Please Note: These minutes are pending Board approval.

Board of Education
Newtown, Connecticut

Minutes of the Board of Education meeting on September 1, 2015 at 7:00 p.m. in the council chambers, 3 Primrose Street, Newtown, CT

K. Alexander, Chair	J. Erardi
L. Roche, Vice Chair (absent)	J. Evans Davila
K. Hamilton, Secretary	R. Bienkowski
D. Leidlein	12 Staff
J. Vouros	30 Public
D. Freedman	2 Press
M. Ku	

Mr. Alexander called the meeting to order at 7:10 p.m.
MOTION: Mrs. Leidlein moved that the Board of Education go into executive session to discuss litigation and a teacher resignation and invited Dr. Erardi, Mrs. Evans Davila, and Attorney Monte Frank. Mr. Freedman seconded. Motion passes unanimously.

Dr. Erardi joined the meeting at 7:17 p.m.

Item 1 – Executive Session
Executive session ended at 7:30 p.m.
Item 2 – Pledge of Allegiance
Item 3 – Celebration of Excellence
Dr. Erardi spoke about the Outstanding Comprehensive Developmental School Counseling Program award received by the high school counseling department. Jenna Pelosi from the Connecticut School Counselor Association spoke about the criteria for receiving this award. Those present from the guidance department were Cathy Oster, Bret Nichols, Jan English, Sara Brant, Lisa Kapitan and Jeff Tolson. Also acknowledged were Peg Ragaini and Kitty Latowicki from the Career Center and Clare Francke support staff in the guidance office.

Mr. Alexander removed the minutes of August 18, 2015 from the consent agenda.

Item 4 – Consent Agenda
MOTION: Mrs. Ku moved that the Board of Education approve the consent agenda which includes the updated roster of fall coaches and the correspondence report. Ms. Hamilton seconded. Motion passes unanimously.

MOTION: Ms. Hamilton moved to approve the minutes of August 18, 2015. Mrs. Ku seconded. Vote: 4 ayes, 2 abstained (Mr. Alexander, Mr. Vouros) Motion passes.

Item 5 – Public Participation
Aaron Cox, 33 Pond Brook Road, wanted the Board to go forward with the Hawley project on the CIP as well as move forward with the Middle Gate project. The Board should put a placeholder for these projects for the Board of Selectman and Board of Finance to consider.

Item 6 – Reports
Chair Report: Mr. Alexander said the Board of Finance wants us to produce a CIP by the end of this month.

Superintendent's Report:
Dr. Erardi spoke about the letter being sent to parents regarding the arrangement with NYA as the location for the schools to take students if there needs to be an evacuation. It would be the primary parent-student reunification site.
He provided an enrollment update which showed as of August 27 we were down 146 students although we were projected to lose 181 students. With out of district and preschool included, we have 166 fewer students this year.

The Head O'Meadow PTA was selected as one of four Connecticut schools to receive national recognition through the PTA Board. He sent a letter to the State regarding the late notification to the districts regarding the school lunch program. Smarter Balanced Assessment data was released to the media before being sent to superintendents.

Ms. Evans Davila spoke about the SBAC results which are just baseline data. She took a comparison of our closest neighbors and the State of Connecticut and Newtown did well placing third among these groups. Sandy Hook grade three ranked first in math and second in ELA between our elementary schools.

Dr. Erardi spoke about convocation, the quiet opening of school and that Newtown High School is ranked as one of the top in the nation. He welcomed back high school student Rilind Abazi and he introduced Kayla Disibio. Kayla is captain of the field hockey team and mentioned some of the events starting the year. Rilind mentioned the NEASC visit with the National Honor Society helping during the visit. There was a petition with 419 names from last year who had concerns regarding the dress code. His thought was for a group of students to meet with the superintendent and principal.

Committee Reports:
Mr. Freedman said the CIP committee met last week and discussed the historical overview of the Hawley project and CIP regulations. He provided handouts to the Board. They also had a discussion with Mr. Bienkowski about the transfers and budget adjustments.
Ms. Hamilton said the policy meetings will start up again September 21.

Mrs. Ku said the Municipal Building Strategic Plan Advisory Committee discussed whether a school will be turned over to the committee. They agreed that this discussion would not occur until the Board of Education made a decision.

Dr. Erardi said the Climate & Culture Committee's first meeting is August 27 with the same membership as last year.

<u>Item 7 – Old Business</u>
Phase 6 of the Sandy Hook School Project:
MOTION: Ms. Hamilton moved that the Board approve Phase 6 of the Sandy Hook School Project. Mr. Freedman seconded.

Geralyn Hoerauf told the Board that Phase 5 approval for furniture will be in November. Phase 6 is playground equipment and and surfacing under the equipment.

Motion passes unanimously.

Action on CIP:
MOTION: Mrs. Ku moved that the Board of Education approve the CIP as recommended by the CIP subcommittee with the addition in year four of the boiler for Hawley School. Mrs. Leidlein seconded.

Ms. Hamilton asked the cost for the boiler.
Mr. Faiella said it would be $1.5M.
Ms. Hamilton asked if he heard back from Bob Mitchell.
Mr. Faiella said Chuck Boos is currently on vacation and Mr. Mitchell wants to discuss it with him. This number is a good placeholder. Phase 1 was completed 2012-13 in the 1948 building. We need a boiler and piping for the 1921 building.

Mrs. Leidlein said we were going to look at the necessity of the air conditioning. Where are we regarding air quality and temperature regulation? Is opening windows interfering with student learning?

Mr. Faiella said carbon dioxide levels are fine but it’s very hot on the second floor. The heating piece is important. The air conditioning is in phase 6. The boiler is crucial and was pushed to the end. We need to look at the phases.

Mrs. Leidlein asked about the Middle Gate project.
Mr. Faiella said that was in for next year. The gas company agreed to give us material to get the lines in and the town will install them. Those boilers are antique from 1964. Also involved is changing all lights to LED. We put the Hawley roof in our CIP last year as a priority.

Mr. Freedman asked if the Hawley School buildings could tie into the air conditioning in the library and office.
Mr. Faiella said that was not possible.
Mr. Freedman asked what effect not having air conditioning has on teaching and learning.
Dr. Erardi said it was a difficult day at Hawley and the Middle School. It was 82 to 87 degrees in some classes. There is no way to move air at Hawley but there are cooling stations in that school.

Ms. Hamilton feels it would be beneficial to have a joint meeting with Pubic Building & Site for their thoughts on moving the project.
Mrs. Ku wished we had more concrete numbers but was comfortable with adding the boiler. She would prefer the larger number from the previous CIP.

Mrs. Leidlein is concerned that we are getting farther and farther behind on the maintenance of our buildings.
Ms. Hamilton said the original goals of the project were to upgrade boilers and put in ventilation.

Mr. Alexander asked Mr. Faiella to get the financial information for the September 15 meeting.
Mrs. Ku agreed to put in the air conditioning.
Mr. Freedman was hesitant on the air conditioning but a ventilation system may solve a lot of the problems. Air conditioning would only be used two months a year.
Mrs. Leidlein said that could be 8 to 10 weeks dealing with the heat.

MOTION: Mrs. Leidlein moved to table the original motion. Mr. Vouros seconded.

Mrs. Ku said the Board of Finance has until October to move on the CIP. Maybe we should request that month be changed. There also needs to be a way for the Board to get feedback from the subcommittee. We could ask our subcommittee to look at how the Board of Education CIP compares to other towns.

Ms. Hamilton said that is a question for the Board of Finance. We give them a piece to have on their CIP.
Motion passes unanimously.

Amended Budget Adjustments:
MOTION: Ms. Hamilton moved to approve the amended 2015-2016 budget adjustments.
Mr. Freedman seconded.
Mr. Bienkowski said this is the same list with some modifications. The finance committee also reviewed it. He removed the additional cost for the health coordinator. Most transfers are related to personnel.

Motion passes unanimously.

Facility Study Committee:
Dr. Erardi asked for direction from the Board at the next meeting on the charge of the facility study committee and what the committee would look like. After the enrollment report was presented the Board wanted the work to continue by looking at our schools. The committee was composed of site level administrators, cabinet members, Ms. Hamilton and Mrs. Ku. He would be comfortable with more members.

Mr. Freedman asked if the facilities committee should be part of that committee.
Dr. Erardi said the Board should consider that for the next meeting.

NEASC Report:
Dr. Lorrie Rodrigue, high school principal and Amy Deeb, NEASC chair and social studies teacher, gave the attached presentation on the NEASC accreditation process.

Ms. Hamilton asked to see the self-study reports.
Dr. Rodrigue stated they would be shared after the visit in October.
Mr. Vouros asked what it would mean if the high school was not accredited.
Dr. Rodrigue said some schools are put on probation which gives the schools time to look at what they need to do to achieve accreditation before the next report. It's important for students applying and getting accepted at colleges.

Mrs. Ku asked how this related to the district as a whole.
Dr. Rodrigue said the self-study fits in with the district standards.

<u>Item 8 – New Business</u>
First Read of High School Science Curricula:
Chris Canfield, science department chair, was available for questions regarding these courses.

Mrs. Leidlein asked the order for students to take these classes.
Mr. Canfield said IPES is for freshman, biology is for sophomores, chemistry is for juniors and physics is for seniors.

Mrs. Leidlein asked if it was a requirement for a student who is in honors math to go into honors science and who decides on the placement.
Mr. Canfield said it was not required and teachers and guidance counselors decide on placement but parents often make requests for upper level courses.

Mrs. Leidlein asked how a student is recommended to take biology instead of IPES.
Mr. Canfield said science placement is linked to the math taken to determine whether a student could be successful in an advanced science course.

Mr. Vouros said we look at math being in sync with science. It is important for students and parents to know this starting in fourth grade. We want everyone to understand how the math and sciences mesh moving to the middle school.

Ms. Hamilton said there is still some difficulty if you want to move off a path. Once in a track in fourth grade you are not encouraged to move from that track.

Mr. Alexander asked how the curriculum was decided.
Mr. Canfield said we follow state standards and what we believe is best.

Ms. Hamilton said the state standards seem pretty old.
Mr. Canfield said even though they were written a number of years ago the material is still relevant.

<u>Item 9 – Public Participation</u>
Mike Brennan, 7 Fallen Leaf Lane, said that in June the board took steps to look at the enrollment report and reevaluating all schools. He looks forward to the boards plans to take the steps addressing facility and enrollment needs in our schools.

MOTION: Ms. Hamilton moved to adjourn. Mr. Vouros seconded. Motion passes unanimously.

<u>Item 10 – Adjournment</u>
The meeting adjourned at 10:02 p.m.

Respectfully Submitted:

____
Kathryn Hamilton
Secretary

NEWTOWN HIGH SCHOOL
FALL COACHES ROSTER 2015
UPDATED 8/27/15

NAME/STEP	SPORT/COACH RETURNING OR NEW HIRE
SUSAN BRIDGES 3	CHEERLEADING--- RETURNING
CHERYL STENZ 3	DANCE TEAM----RETURNING
MARC KENNEY 3	GIRLS SOCCER---- RETURNING
LAURA MCLEAN 3	J.V. GIRLS SOCCER---RETURNING
MARY KATE FAHY 1	FRESHMAN GIRLS SOCCER—NEW COACH
BRIAN NEUMEYER 3	BOYS SOCCER----RETURNING
MIKE DYER 3	J.V.BOYS SOCCER----RETURNING
TOM BRANT 3	FRESHMAN BOYS SOCCER— RETURNING
TOM CZAPLINSKI 3	GIRLS VOLLEYBALL----RETURNING
LISA BURBANK 3	J.V. GIRLS VOLLEYBALL—FRESHMAN COACH LAST YEAR
CHRIS PEARSON 1	FRESHMAN GIRLS VOLLEYBALL-NEW TEACHERAT THE HS
ROBERT GAUVIN 3	GIRLS SWIM----- RETURNING
RYAN CUTLER 3	ASST. GIRLS SWIM---RETURNING
DOUG RUSSELL 3	GIRLS CROSS COUNTRY-- RETURNING
CARL STRAIT 3	BOYS CROSS COUNTRY-- RETURNING
CHARLOTTE MANOS 2	ASSISTANT CROSS COUNTRY-VOLUNTEER LAST YEAR
STEPHANIE PAPROSKI 3	FIELD HOCKEY- RETURNING
KATHY DAVEY 3	J.V. FIELD HOCKEY—RETURNING
JEN HUETTNER 3	FRESHMAN FIELD HOCKEY— RETURNING
STEVE GEORGE 3	FOOTBALL----RETURNING
BOB PATTISON 3	ASST. FOOTBALL----RETURNING
IAN SUTER 2	J.V. FOOTBALL-- RETURNING
CARL PATERNOSTER 3	FRESHMAN FOOTBALL-- RETURNING
COREY FISHER 3	FRESHMAN FOOTBALL---FORMER VOLUNTEER
LISA IRVING	DIVE COACH

VOLUNTEER COACHES

TYLER TARANTINO	FOOTBALL
JOHN MARCUCILI	FOOTBALL
NICK TARANTINO	FOOTBALL
MIKE KEARNS	FOOTBALL
***MATT PELLICONE	FOOTBALL
CAITLIN DELOHERY	CHEERLEADING
LORI ROHRBACHER	CHEERLEADING
HENRYK TERASZKIEWICZ	VOLLEYBALL
KELLY TERASZKIEWICZ	VOLLEYBALL
CHRIS HOAGLAND	BOYS SOCCER
RUSS DAVEY	FIELD HOCKEY
SHANNON PAPROSKI	FIELD HOCKEY

BOE Communications Report, 9/1/2015
Kathy Hamilton, Board of Education Secretary

From	**Date**	**Description**
Melissa Mottola	8/18/2015	Bullying Prevention Enews
Ryan Blakely	8/18/2015	Scholarship Annoucement August 2015
Kinga Walsh	8/19/2015	Last night's Board Meeting
Aaron Cox	8/19/2015	quick note of appology
Wolfgang W Halbig	8/22/2015	Watch your own Governor Malloy lie like a dog
Mary Burnham	8/24/2015	New post How can you defend play to your school administrator
Mary E. Burnham	8/24/2015	From the Gesell Institute
Julia Conlin	8/25/2015	Head OMeadow Named National PTA School of Excellence
Mary Burnham	8/27/2015	New post Madison Convocation Speaker Highlights Need to Personalize Education for Students
Aaron Carlson	8/31/2015	Enrollment projections

Administrative Report

Tuesday, September 1st

1. School Safety (Attachment #1)

2. Back to School (Attachment #2)
    a. Enrollment
    b. Staffing
    c. Opening Day

3. 2014-2015 Head O' Meadow PTA National Recognition

4. SDE School Lunch Program (Attachment #3)

5. Smarter Balanced Assessment Data

6. National Recognition – Newsweek – Newtown High Schol

9/1/15

NEWTOWN PUBLIC SCHOOLS
3 PRIMROSE STREET
NEWTOWN, CT 06470

OFFICE OF THE SUPERINTENDENT
(203) 426-7620
FAX (203) 270-6199

BUSINESS OFFICE
(203) 426-7618
FAX (203) 270-6110

September 1, 2015

Dear Parents and Guardians,

As part of the Newtown Public Schools continuous efforts to evaluate and enhance school security and safety, several months ago the District Security Committee (DSSC), in conjunction with the Superintendent's Office and Director of Security, began identifying potential locations in town that could be used to temporarily accommodate Newtown Public School students, faculty, and staff in the unlikely event of a single or multi-campus evacuation. The location would also serve as the primary student-parent reunification site. After careful consideration, which included site visits and conversations with various property owners and property managers, the DSSC determined that the most viable location was the Newtown Youth Academy (NYA), located 4 Primrose Street, Newtown, Connecticut. The NYA facility is located on the east side of the Fairfield Hills property, and is a short walk from the Municipal Center. The facility can be fully secured when used as a campus evacuation/student-parent reunification center, and contains more than adequate restroom facilities and parking.

Through the cooperation and generosity of the NYA Board of Directors, as well as its management and staff, the Newtown Public Schools has secured the location as our primary evacuation/student-parent reunification site. Our Director of Security, along with the Newtown Police Department and All-Star Transportation, are currently working with representatives of NYA in drafting a plan for transportation, intake, housing, and reunification of our students and staff in the event of an emergency. Students will always be under the care, custody, and responsibility of school personnel familiar to them. The plan will be completed and in place prior to the beginning of the upcoming 2015-2016 school year.

I truly hope the need to use the NYA in this capacity never arises, but I wanted to make parents, guardians, and students aware of the facility and our availability to use it if necessary.

If you have any questions regarding emergency preparedness and response in the Newtown Public Schools, please don't hesitate to contact Mark Pompano, Director of Security, Central Office, at (203) 270-6131.

Respectfully,

Joseph V. Erardi, Jr.

Dr. Joseph V. Erardi, Jr.
Superintendent

Enrollment Update – Newtown Public Schools - Elementary

	June 17, 2015	August 27, 2015	
Head O' Meadow	316	297	-19 (Projected 311)
Hawley	332	324	-8 (Projected 301)
Middle Gate	384	362	-22 (Projected 366)
Sandy Hook	366	340	-26 (Projected 343)
Total	1,398	1,323	-75 (Projected 1,321)

Reed Intermediate School / Middle School / High School

	June 17, 2015	August 27, 2015	
RIS	734	702	-32 (Projected 684)
Middle School	829	814	-15 (Projected 813)
High School	1,713	1,689	-24 (Projected 1,676)
Total	3,276	3,205	-71 (Projected 3,173)

K-12 Actual	(6/17/15)	(8/27/15)	Projection
	4,674	4,528 (146)	4,494

Analysis = Projected loss of 180 students results in actual decline 146 students

Pre – K	53	33	
Out – District	36	36	
Total	4,763	4,597	(-166)

NEWTOWN PUBLIC SCHOOLS
3 PRIMROSE STREET
NEWTOWN, CT 06470

OFFICE OF THE SUPERINTENDENT
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(203) 426-7618
FAX (203) 270-6110

August 27, 2015

Ms. Fionnuala Brown, RD
Associate Education Consultant
Connecticut State Department of Education
Office of Student Supports and Organizational Effectiveness
Bureau of Health/Nutrition, Family Services and Adult Education
25 Industrial Drive
Middletown, CT 06457-1543

Dear Fionnuala:

Thank you for the most recent update to Newtown schools pertaining to the School Lunch Program. On Tuesday, August 18, the Board of Education had a detailed and lengthy conversation about school lunch and struggled with the delayed state notification to the district; thus, the feeling that an eleventh hour decision needed to be made that should have been addressed months earlier.

I write to you hoping to be part of the solution.

I am fortunate to be one of twenty superintendents across the country on the AASA Executive Board that directly looks to influence federal statute pertaining to public schools. It appears that the federal legislation around school lunch is at best challenging in all states.

I offer to you my time and connection if you would like to meet with me so I can fully understand the frustrations that your office must deal with each day.

Respectfully,

Dr. Joseph V. Erardi, Jr.
Superintendent of Schools

STV 100 Years | DPM

CT State Project #097-0114N

8/15/2015

Sandy Hook Elementary School - 12 Dickinson Drive, Newtown

Phase 6 - Playground Equipment

Description	Take-off Qty		Cost/Unit			Total Amount	
ELIGIBLE							
G20 Site Improvement							
G2040 Site Development							
PreK Playground Structure	1	ls	$	31,098	/ls	$	31,098
K-1st Playground Structure	1	ls	$	35,564	/ls	$	35,564
Sand Table	1	ls	$	2,242	/ls	$	2,242
Chatter Noodle	1	ls	$	1,639	/ls	$	1,639
Drop Shot	1	ls	$	1,064	/ls	$	1,064
Caterpillar Tunnel	1	ls	$	5,795	/ls	$	5,795
3-Bay Swing Set	1	ls	$	3,726	/ls	$	3,726
Grade 2-4 Playground Structure	1	ls	$	74,162	/ls	$	74,162
4-Bay Swing Set	1	ls	$	4,152	/ls	$	4,152
Poured in Place Safety Surfacing	11,450	sf	$	16	/sf	$	184,102
Installation Services	1	ls	$	80,378	/ls	$	80,378
G2040 Site Development						$	423,922
ELIGIBLE						**$**	**423,922**
SUBTOTAL						**$**	**423,922**
Contingency				8%		$	33,913.76
TOTAL						**$**	**457,836**

M.E. O'Brien & Sons, Inc.
93 West Street – P.O. Box 650 / Medfield, MA 02052
Phone: 508-359-4200 / Fax: 508-359-2817
SDO CERTIFIED WBE (MA ONLY)

REVISED QUOTE

Date: June 16, 2015

Job: Sandy Hook Elementary School

Location: Newtown, CT

Salesman: Peter C. Wallace, CPSI / Phone: 203-805-4325 / Fax: 203-805-4265
Peter_Wallace@obrienandsons.com

Attention: Cynthia Jensen – Richter Cegan / cjensen@richtercegan.com

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We are pleased to offer our quotation on the following for the above subject job:

CT STATE CONTRACING PRICING – CONTRACT #14PSX0154

QTY	DESCRIPTION	TOTAL
	By Landscape Structures, Inc. – MEO15304 / 06-10-15 (2015 Pricing)	
	PreK-1st Grade Area	
1	PreK Structure	**$31,098.00**
1	#182502 Welcome Sign, 2-5 years	**No Charge**
1	K-1st Grade Structure	**$35,564.00**
1	#182503A Welcome Sign, 2-5 years	**No Charge**
1	#136233A Elevated Sand Table	**$2,242.00**
1	#158106A Chatter Noodle	**$1,639.00**
1	#100042A Drop Shot	**$1,064.00**
1	#769733 Caterpillar Tunnel	**$5,795.00**
1	Single Post Swing Set, 8'-high, 3 bays, 5 belt seats, 1 ADA molded bucket seat with harness	**$3,726.00**
	Grades 2-4 Play Area	
1	PlayBooster Structure	**$74,162.00**
1	5000 Series Swing Set, 8'-high, 4 bays, 7 belt seats, 1 ADA molded bucket seat with harness	**$4,152.00**
1	#182503C Welcome Sign, 5-12 year	**No Charge**
	Total All LSI Equipment Furnished and Delivered	**$159,442.00**

By Surface America
PlayBound Poured-In-Place Safety Surfacing **$184,102.00**

- Materials and installation
- 100% color, aliphatic binder is included
- PreK-1st grade swing area, 1,825 sq/ft @ 3-1/2" thick
- PreK-1st grade structure area, 3,025 sq/ft @ 1-3/4" thick
- 2nd-4th grade structure/swing area, 6,600 sq/ft @ 3-1/2" thick
- Quote includes minor graphic work. If graphics are extensive a re-quote may be required.

Newtown, CT
June 16, 2015

QTY	DESCRIPTION	TOTAL
	Installation Services: • Receive/off-load equipment delivery • Lay out and augur holes • Erect LSI equipment, pour concrete footers • Re-compact stone base in preparation for rubber surfacing • Prevailing wage rates apply • Site excavation, processed stone sub-base/drainage is by others	**$75,595.00**
	2016 pricing:	$4,783
	Total Project Price	~~**$419,139.00**~~ $423,922.00

⇨ ~~**LSI prices are based on 2015. Please expect an annual increase of 3% ($4,783) if product is purchased/delivered in 2016.**~~

****PLEASE READ – IMPORTANT NOTES – PLEASE READ****

POURED-IN-PLACE NOTES:

- **If 100% color or 50% color/50% black is quoted, red will be an additional charge.**
- **Does not include aliphatic binder (yellow inhibitor) necessary with the following colors: dark & light gray, blue, teal and pearl.**
- **If installation is included please note the following:**
  Prevailing wages are included. Installation is to take place over a prepared sub-base by others. Installation lead-time is to be determined and is weather dependent. Site security is the responsibility of the owner/contractor until product is cured. Owner/Contractor is responsible for quantity confirmation. Any changes to quantity may impact price quoted.

ADDITIONAL NOTES:

- **Contractor/Customer is responsible for quantity, color, and product confirmation.**
- **Prices based on quantities listed. Any change to quantities may impact prices quoted.**
- **M.E. O'Brien & Sons is NOT responsible for plan take-offs. All quantities, square footages, thicknesses, etc. are the responsibility of the purchaser. Confirm and double check quantities quoted. It is the responsibility of the purchaser to approve/purchase items "per plan".**
- **Prices are quoted for 2015, are firm for 30 days only and are subject to review thereafter.**
- **Prices are for materials only unless otherwise noted. Prices do NOT include sales tax.**
- **If installation is included, M.E. O'Brien & Sons is NOT responsible for buried underground hazards including, but not limited to: ledge, unsuitable bearing soils, unmarked utilities, boulders, construction debris and any other conditions beyond our control. Additional cost will be required to rectify these situations.**
- **Standard manufacturer's design, colors, specifications, and construction apply.**
- **Retainage does not apply.**
- **Returns must be made within 30 calendar days of receipt of order. Customer is responsible for re-stocking fee plus shipping charges (to and from) for all returned items. Poured-In-Place is NOT returnable.**
- **Our terms are: to be arranged.**
- **Allow 4 to 6 weeks for delivery of materials after receipt of order and architectural approval if required. Installation to take place as soon as possible after receipt of materials and according to installer's schedule.**

If we can be of further assistance please do not hesitate to contact us. Thank you!

3 Primrose Street
Newtown, CT 06470
Tel (203) 270-4201
3) 270-4311

TOWN OF NEWTOWN

PUBLIC BUILDING AND SITE COMMISSION

August 24, 2015

The following motions will be presented to the Public Building and Site Commission for discussion and approval at the scheduled meeting to be held on August 25, 2015.

MOTION TO ACCEPT THE SANDY HOOK ELEMENTARY SCHOOL PHASE 6 PLAYGROUND EQUIPMENT CONSTRUCTION DOCUMENTS FOR SUBMISSION TO THE STATE OF CONNECTICUT OFFICE OF SCHOOL FACILITIES

Resolved that: The Construction Documents for the Town of Newtown, Sandy Hook School, dated August 11, 2015 for the State of Connecticut Project Number 097-0114N, Phase 6 of 6, as prepared by Svigals+Partners be accepted by the Public Building and Site Commission, acting as the School Building Committee for submission to the State of Connecticut Office of School Facilities for review and approval, for the purpose of allowing this phase of the project to be released for procurement.

The construction documents encompass 19 drawings and the associated specifications Volume 1, Phase 6 of 6, all dated August 11, 2015. RDM

MOTION TO ACCEPT THE SANDY HOOK ELEMENTARY SCHOOL PHASE 6 PLAYGROUND EQUIPMENT COST ESTIMATE FOR SUBMISSION TO THE STATE OF CONNECTICUT OFFICE OF SCHOOL FACILITIES

Resolved that: The Cost Estimate for the Town of Newtown, Sandy Hook School, dated August 11, 2015, for the State of Connecticut Project Number 097-0114N, Phase 6 of 6, as prepared by STV|DPM and M. E., O'Brien & Sons, Inc. of Medfield MA, pages 1 through 3 inclusive, be accepted by the Public Building and Site Commission, acting as the School Building Committee for submission to the State of Connecticut Office of School Facilities for their review and approval. RDM

NEWTOWN BOARD OF EDUCATION
SUMMARY - CAPITAL IMPROVEMENT PLAN
2016/17 TO 2020/21

For Board Discussion
Tentative as of 8/4/15

CIP Item #	Location	Description of Project	*underway* 2015/16	Year 1 2016/17	Year 2 2017/18	Year 3 2018/19	Year 4 2019/20	Year 5 2020/21	TOTALS
3	Hawley Elem.	Roof replacement 1948 and 1997 sections			$800,000				
									$800,000
*	Sandy Hook Elem	Design, engineering & construction	($49,250,000)						
6	Middle Gate Elem	Roof replacement 1964 and 1992 sections					$1,500,000		
2	Middle Gate Elem	Replace original 1964 boiler and lighting upgrade		$475,000					
									$1,975,000
4	Middle School	Phase 0 - Professional Services			$100,000				
4	Middle School	Phase I - New boilers and re-piping			$2,100,000				
5	Middle School	Phase II - Ventilation renovations				$4,805,000			
									$7,005,000
**	High School	Auditorium; ADA code, replace duct work, lighting, seating, rigging, fire sprinkler system	$3,600,000						
1	High School	Restoration of roof with replacement of lobby roof		$1,402,500					
7	High School	Replace/restore football turf field						$1,000,000	
									$2,402,500
	TOTAL COSTS OF ALL PROJECTS		$52,850,000	$1,877,500	$3,000,000	$4,805,000	$1,500,000	$1,000,000	$12,182,500
	TOTAL TO BE BONDED			$1,877,500	$3,000,000	$4,805,000	$1,500,000	$1,000,000	$12,182,500
	School Building Grant Eligible		$534,000 **		$272,000		$510,000		$782,000

Shading represents items new to the plan

*Funding provided by the State of Connecticut. This project will not be bonded locally and will not impact Newtown's budget or tax rate.

**Code grant eligibility on total project costs.

Eligibility for project inclusion on the CIP is that the cost must exceed 0.25% of the Town Budget, $111,730,513. For 2015-16 the threshold is $279,326.

DIVERSIFIED
PROJECT MANAGEMENT

Newtown Public School District, Capital Projects
Public Building & Site Commission

March 25, 2014

ANNUAL COMPILATION OF DISTRICT PROJECTS (or periodically, as to be determined)

- Meet with District Director of Facilities (DF), Superintendent and BOE
    - Receive/review list of potential renovation projects
    - Prior to this meeting, DF to have received from each school a list of proposed renovation projects; DF to have conducted site visit to confirm work requested
    - DF and PB&SC to collaborate on determining priority list and integrated timeline
- PB&SC finalizes list of projects for preliminary review and authorization to proceed

PRE-APPROVAL PLANNING FOR EACH PROJECT

- PB&SC establishes Scope of Work for each project
    - Conduct on-site assessment, mtgs with building staff
        - Receive copies of all previous documentation
        - Meet with principal and/or custodial staff
    - Create written narrative and determine all consultants and trades necessary to implement work
- PB&SC establishes preliminary Budget for each project
    - Create high/low budget
    - Create cash flow analysis
- PB&SC establishes Timeline for each project, through close-out
    - Create integrated timeline for all proposed projects

PRELIMINARY APPROVALS

- Review scope and budgets with Director of Facilities, Superintendent and BOE
- Approve scope and budgets
- Present plan and budget to Director of Finance, Superintendent and/or BOE as required

PROJECT BIDDING AND AWARD

- Depending on the type of individual project, PB&SC to
    - For larger, more complex projects that require professional services (architects, engineering, etc.) – Develop RFPs for services and identify short list of potential consultants (Project Type A)
    - For projects requiring only product procurement – Develop RFPs for soliciting product price quotes and identify potential product manufacturers or distributors (Type B)
    - For minor renovation projects with clearly defined scope or for the construction of Project Type A above – Develop RFPs for construction bidding and identify short list of contractors pre-qualified for town projects (Type C)
- PB&SC to issue RFPs
- PB&SC to manage receipt of RFP responses

- Issue any clarifications or addendum
- Conduct pre-bid walk-thrus as needed
- Review responses for compliance with RFP requirements
- Tabulate and level price proposals
- Make recommendation to the Purchasing Agent for contract award

- PB&SC will work with the Purchasing Agent and/or Attorney regarding form of contract award

PROJECT IMPLEMENTATION

Project Type A – Professional Services

- Monitor and coordinate the work of all consultants
  - Establish project schedule and deliverables
  - Facilitate communications with school and district staff
  - Report periodic progress to PB&SC
- Ensure involvement of Director of Facilities in all decisions and reports
- Manage communications and presentations to the Superintendent and/or BOE, as appropriate
- Review and recommend approval of all invoices
- At the conclusion of any design/planning phase, and upon approval by the District, begin Project Type C tasks as outlined below

Project Type B – Product Procurement

- Confirm documentation for products and pricing and make recommendation to the District Purchasing Agent for issuance of Purchase Orders
- Track all costs and review against approved budget
- Manage communications with the Director of Facilities, Superintendent and/or school staff, as appropriate
- Establish delivery and installation schedule and coordinate with District Facilities
- Review and recommend approval of all delivery documentation and invoices
- Report periodic progress

Project Type C – Construction/Renovation

- Perform scope review meetings with District Facilities and awarded contractor
- Establish project timeline with the contractor and monitor critical path and project deadlines
- Track all costs and review against approved budget
- Manage communications with the Director of Facilities, Superintendent and/or school staff, as appropriate
- Participate in project punchlist activities and project close-out together with District Facilities
- Review and recommend approval of all requisitions
- Report periodic progress to the BOE
- Participate in project close-outs as required

All Projects

- Manage integrated project scheduling for all projects during a given period
- Provide continuous budget tracking and analysis for all projects, including cash flow projections

3 Primrose Street
Newtown, CT 06470
Tel (203) 270-4201

TOWN OF NEWTOWN

PUBLIC BUILDING AND SITE COMMISSION

Newtown Public School District, Capital Projects
Public Building & Site Commission

March 25, 2014

PHASE A – PROJECT IDENTIFICATION, SCOPE & COST STRUCTURE

Periodically, the Director of Facilities for the Newtown Public School District will receive (or solicit) from each school, a list of potential capital improvement or renovation projects. To enhance the efficiency with which capital improvement projects are implemented, the Public Building & Site Commission would undertake a coordination role to support School District staff and liaison with the BOE.

The PB&SC would collaborate with the Director of Facilities (DF) and Superintendent of the District in reviewing the list of proposed projects, determining a priority list and developing an integrated timeline for all projects. The PB&SC would conduct a preliminary review of all projects and provide the District with a recommendation to proceed with project planning.

The PB&SC would coordinate the *Pre-Approval Phase* and provide comprehensive planning services in order to best inform the budgeting and approval process. The PB&SC will establish a comprehensive Scope of Work for each project. Project scope may be verified by conducting on-site assessments, including meetings with building staff or may involve review of previously developed written documentation. The PB&SC will create a written narrative for each project scope and determine whether professional consultants and/or construction trades are necessary to plan and/or implement the work.

The PB&SC will establish a preliminary budget for each project utilizing industry standards and proprietary benchmark construction cost data, creating high/low budgets and/or cash flow analyses, as appropriate. The PB&SC will establish a preliminary timeline for each project through implementation and close-out and will develop an integrated timeline for all proposed projects during the proposed period.

The written scope(s) and preliminary budget(s) will be reviewed and adjusted in collaboration with the Director of Facilities. The PB&SC will review and approve project budgets; the integrated project plan and overall budget will be submitted to the Superintendent and Board of Education for review and approval. The completed project plan and budget can then be submitted as part of the CIP process or BOE budget.

The PB&SC will retain a project management consultant (PM) to assist in the development of the tasks listed under Phase A above and to facilitate the work of all subsequent phases.

PHASE B – PROJECT IMPLEMENTATION

Once the project scope and budgets have been approved, the *Design, Bidding and Award, and Construction Phases* will commence. Services during this phase will vary by individual project type and size. For larger, more complex projects that require professional services (architects, engineering, etc.), the PB&SC will develop and issue RFPs for professional services (Project Type A). For projects requiring only product procurement, the PB&SC will assist the District Purchasing Agent by developing RFPs for product price quotes (Project Type B). And for minor renovation projects with clearly defined scope, or for the construction of Project Type A above, the PB&SC will develop RFPs for construction bidding and pre-qualify a short-list of contractors (Project Type C).

For all projects, the PB&SC will approve RFPs for release after review by the Town / District Purchasing Agents. On behalf of the PB&SC, the PM will manage the RFP process by issuing any clarifications or addendum, conducting pre-bid walk-thrus, and reviewing RFP responses for compliance with RFP requirements. The PM will tabulate and level all price proposals and will make a recommendation to PB&SC and Town / District Purchasing Agents as to contract award. Once the PB&SC has approved the award, the PM will work with the Town / District Purchasing Agents and Attorney regarding form of contract award and notification.

During the subsequent *Implementation Phase* for each project, the PB&SC would provide the following oversight:

Project Type A – Professional Services

- Monitor and coordinate the work of all consultants
    - Establish a project schedule and identify deliverables
    - Ensure communications with school and district staff
    - Report periodic progress
- Ensure involvement of the Director of Facilities in all decisions and reports
- Provide reports and presentations to the Superintendent and/or BOE, as appropriate
- Review and recommend approval of all consultant invoices

Project Type B – Product Procurement

- Confirm documentation for product pricing and make recommendation to the District Purchasing Agent for issuance of Purchase Orders
- Track all costs and review against approved budget
- Establish delivery and installation schedule and coordinate with District Facilities
- Review and recommend approval of invoices

Project Type C – Construction/Renovation

- Coordinate scope review meetings with awarded contractor
- Establish project timeline with the contractor and monitor critical path and project deadlines
- Track all costs and review against approved budget
- Participate in project punchlist activities and project close-out together with District Facilities
- Review and recommend approval of all requisitions

During all phase of each project the PB&SC will work closely with the District Director of Facilities to ensure compliance with all District policies and standards. All project documentation will be submitted to and reviewed by district staff as appropriate and all final decisions regarding contractual issues and payment approvals will reside with the District. All services provided to the District by the PB&SC will be completed in a manner that augments District staff efforts and facilitates successful project implementation.

Middle School Roof Update:
Mr. Faiella said there have been no changes. The Public Building and Site Commission will interview and pick the architect.

Mrs. Fetchick said Bob Edwards and Tom Catalina have been invited to attend the combined CIP/Facilities Committee meetings. Mr. Edwards seemed hopeful to work a schedule with a start date of April 1. They will meet with the three architects this Friday and then on the 31st to make a selection. A former middle school teacher and Donna Culbert attended a meeting for information on the middle school roof and thought a letter should be sent to staff and parents to inform them on what we plan to do and the Superintendent has agreed to do so.

Item 5 – Old Business
CIP Discussion and Possible Action:
Mrs. Fetchick went over the CIP.
Mr. Nanavaty said we may get a more favorable price on the HVAC work for Hawley, Middle Gate and Sandy Hook if we bid for all three projects. He asked if the Board would consider amending this in the future if we get a favorable bid price.

Mrs. Fetchick said that would be left up to the business office to decide. Mrs. Raymo recommended bidding the boiler phase 1 and 2 together and phase 3 separately.

Dr. Robinson said the middle school numbers were from Fletcher Thompson. There are upgrades for the cafeteria but old estimates would have to be re-estimated. She would like the science rooms updated and some work done in the media center.

MOTION: Mrs. Bittman moved to accept the CIP dated August 13, 2010 as presented. Mr. Nanavaty seconded. Vote: 7 ayes

MOTION: Mr. Nanavaty moved to approve the year-end financial report dated June 30, 2010. Mrs. Bittman seconded.

Mr. Nanavaty asked if we purchased Enos for the high school for $55,762.
Mr. Bienkowski said the motion at the June meeting was to purchase SmartBoards for Reed and Enos for the high school.

Mr. Nanavaty asked if we returned $100,000 to the Town and kept the rest.
Mr. Bienkowski said we will return $155,762 and will take the $100,000 into a reserve for the Board of Education.
The Board agreed on having a report on this year's budget before work begins on next year's budget which would include each line item.

Mr. Bienkowski said that when we start to work on the 2011-2012 budget we will have all the expenditures from the previous budget. The budget in the book includes transfers made up to Dec. 31st.
Vote: 7 ayes

Item 3 – Reports (continued)
The Strategic Plan Update was postponed until the next meeting.

NEWTOWN BOARD OF EDUCATION
SUMMARY - CAPITAL IMPROVEMENT PLAN
2011/12 TO 2015/16

Approved by
the BOE 8/17/2010

CIP Item #	Location	Description of Project	2011/12	2012/13	2013/14	2014/15	2015/16	TOTALS
1	Hawley Elem.	HVAC Design Fees for proposed three phase project	$350,000					
2	Hawley Elem.	HVAC Phase I Boiler/Electrical replacement and upgrade		$3,000,000				
3	Hawley Elem.	HVAC Phase II Ventilation system installed			$2,200,000			
4	Hawley Elem.	HVAC Phase III Split/Systems Limited Air Conditioning				$1,600,000		$7,150,000
5	Middle School	Design Fees - All Phases climate control renovate and comply with code			$630,000			
6	Middle School	Phase I Three new boilers & re-piping				$2,070,000		
7	Middle School	Phase II - HVAC recommendations & code compliance					$4,805,000	$7,505,000
8	High School	Engineering Fees - Renovate auditorium		$100,000				
9	High School	Auditorium ADA code, replace duct work, lighting, seating and fire sprinkler system			$1,339,338			$1,439,338
	TOTAL COSTS OF ALL PROJECTS		$350,000	$3,100,000	$4,169,338	$3,670,000	$4,805,000	
	TOTAL TO BE BONDED		$350,000	$3,100,000	$4,169,338	$3,670,000	$4,805,000	

Town of Newtown
Department CIP Summary Worksheet
For the Five Fiscal Years 2011/2012 to 2015/2016

DEPARTMENT: **Board of Education**

Item #	Capital Item	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
		PROJECT COST - TOTAL / BONDED				
Item # 1	Hawley HVAC Renovations - Design	350,000 350,000	- -	- -	- -	- -
Item # 2	Hawley HVAC Renovations - Phase I	- -	3,000,000 3,000,000	- -	- -	- -
Item # 3	Hawley HVAC Renovations - Phase II	- -	- -	2,200,000 2,200,000	- -	- -
Item # 4	Hawley HVAC Renovations - Phase III	- -	- -	- -	1,600,000 1,600,000	- -
Item # 5	Middle School Improvements Project-Design	- -	- -	630,000 630,000	- -	- -
Item # 6	Middle School Improvements Project-Phase I	- -	- -	- -	2,070,000 2,070,000	- -
Item # 7	Middle School Improvements Project-Phase II	- -	- -	- -	- -	4,805,000 4,805,000
Item # 8	High School Auditorium Improvement Project	- -	100,000 100,000	- -	- -	- -
Item # 9	High School Auditorium Improvement Project	- -	- -	1,339,338 1,339,338	- -	- -
Item # 10	0	- -	- -	- -	- -	- -
Item # 11	0	- -	- -	- -	- -	- -
Item # 12	0	- -	- -	- -	- -	- -
Item # 13	0	- -	- -	- -	- -	- -
Item # 14	0	- -	- -	- -	- -	- -
Item # 15	0	- -	- -	- -	- -	- -
Item # 16	0	- -	- -	- -	- -	- -
Item # 17	0	- -	- -	- -	- -	- -
Item # 18	0	- -	- -	- -	- -	- -
	TOTAL COST OF ALL PROJECTS	350,000	3,100,000	4,169,338	3,670,000	4,805,000
	TOTAL TO BE BONDED	**350,000**	**3,100,000**	**4,169,338**	**3,670,000**	**4,805,000**

Town of Newtown
Department CIP Detail Worksheet
Item # 1

NEW REQUEST	.
PRIOR YEAR PROJECT	X
PRIOR YR REJECTED	.

DEPARTMENT: Board of Education

PROJECT TITLE: Hawley HVAC Renovations - Design

PRIORITY: URGENT

LOCATION: Hawley Elementary School

ITEM/PROJECT DESCRIPTION: Engineering Fees - 1948 Building and 1921 Boiler - Install ducted ventilation systems with individual thermostats for heating and cooling. Provide for energy efficiency with minimum noise, sized for AC fully compatible with an energy management system including boiler replacement. Fees for architectural, engineering, mechanical, electrical,structural and civil trades.

PROJECT FISCAL YEAR START: 2011 - 2012

MONTHS TO COMPLETE: 7 to 9 months

USEFUL LIFE: 26 to 30 years

PURPOSE & JUSTIFICATION: To improve ventilation for fresh air described in both the Climate Control Committee Report (8/12/2003) and testing done by Brooks Environmental Consulting in 2010. To replace aging equipment at the end of its useful life with with energy efficient technology controlled systems, including certain air conditioning components for recommended comfort levels.

ALTERNATIVES TO REQUEST: Use existing passive system and continue to make repairs.

APPROVAL OR REVIEW OF OTHER GOVERNMENTAL AGENCIES REQUIRED? YES (X) X NO (X) .

AGENCY NAME(S): Building Department

ESTIMATED COST:

	AMOUNT
ARCHITECTURAL & ENGINEERING	350,000
CONSTRUCTION MANAGER	
GENERAL CONSTRUCTION	
EQUIPMENT & FURNITURE	
INFRASTRUCTURE	
OTHER	
TOTAL ESTIMATED COST	350,000 (A)

Note: As your project gets closer to the start date; more attention will be necessary when estimating project costs.

BASIS FOR OR SOURCE OF ESTIMATE: Brian Wetzel, CES 12/18/2009

ESTIMATED EFFECT OF PROJECT ON OPERATING BUDGET:

	AMOUNT	COMMENT
NEW STAFF REQUIREMENTS		
OPERATING AND MAINT COSTS	9,500	Increased ventilation requires more heat; new equipment will reduce oper. costs.
OTHER COSTS		

FINANCING PLAN:

	AMOUNT
BONDING	350,000
GRANTS	
OTHER	
	350,000 (A)

TOTALS PROVE

DEPT HEAD/MANAGER NAME: Ron Bienkowski **DATE:**____________

TITLE: Director of Business **SIGNATURE:**____________

Town of Newtown
Department CIP Detail Worksheet
Item # 1

ITEM/PROJECT DESCRIPTION:
-------CONTINUED-------

Hawley Elementary School HVAC Renovations

This project includes:

Replace one boiler in the 1948 building and convert 1921 boilers from steam to hot water.
Installation of a ducted ventilation system to provide fresh air using an energy management system
Ducting will be appropriately sized to meet all heating and cooling requirements
Replace steam heating systems with hot water heating systems
Provide individual temperature control in classrooms
Provide air conditioning throughout the building as needed
Install energy efficient direct digital control (DDC) temperature control systems. DDC system also aids in reducing maintenance.
Improve indoor air quality
Provide mechanical ventilation via air handling units versus natural ventilation through open windows. The 1921 section of the building is particularly subject to noise and dust from Church Hill Road when windows are open.

In order to accommodate the HVAC renovations there are extensive renovations to the electrical systems, including lighting, power and fire alarms.

PURPOSE & JUSTIFICATION:
-------CONTINUED------

Hawley Elementary School

The purpose of this project is to comply with current building recommendations for fresh air exchange and ventilation in classrooms and to replace aging equipment which exceeds its useful life.
Built in three sections, 1921, 1948 and 1997, this facility is currently heated by two boiler plants. The 1921 section is served by two steam boiler and the 1997 section is served by one hot water boiler which is located in the 1948 boiler room. The 1948 section has old cast iron radiators, while the 1921 section has been largely upgraded to fin-tube heaters. Problems with poor temperature control capabilities and long system-response time for temperature regulation create many rooms that are either too cold or too hot during the winter season. The steam boilers in the 1921 section are relatively new (1993), but the 1948 section is operating with the original equipment and is coming to the end of its useful life. The hot water boiler was installed in 1997. Mechanical ventilation exists in all rooms, but requires windows to be opened to provide "make-up" or fresh air. This is a particular problem in the 1921 portion, where road noise and auto/truck emissions are introduced to the classrooms when windows are opened. The 1997 section has some air-conditioned spaces, but the addition has six classrooms that are not air-conditioned. The computer room, nurse's room, library, gym and office are air-conditioned.

Town of Newtown Department CIP Detail Worksheet Item # 2		
	NEW REQUEST	.
	PRIOR YEAR PROJECT	X
	PRIOR YR REJECTED	.

DEPARTMENT: Board of Education **PROJECT TITLE:** Hawley HVAC Renovations - Phase I

PRIORITY: URGENT **LOCATION:** Hawley Elementary School

ITEM/PROJECT DESCRIPTION: Install new hot water system including consolidating boiler rooms. Remove existing steam boilers and piping distribution. Provide new high efficiency condensing boiler, pumps, pipe distribution, heating elements, etc. New temperature controls including head end equipment, new electrical service 208 volt, 3 phase, new gas service, site work, ceilings remain open.

PROJECT FISCAL YEAR START: 2012 - 2013 **MONTHS TO COMPLETE:** 13 to 18 months **USEFUL LIFE:** 26 to 30 years

PURPOSE & JUSTIFICATION: To replace aging equipment at the end of its useful life with energy efficient technology controlled systems
at the end of its useful life with energy efficient technology controlled systems

Phase I = Boiler / Electrical

ALTERNATIVES TO REQUEST: Use existing passive system and continue to make repairs.

APPROVAL OR REVIEW OF OTHER GOVERNMENTAL AGENCIES REQUIRED? YES (X) X NO (X) .

AGENCY NAME(S): Building Department

ESTIMATED COST:

	AMOUNT
ARCHITECTURAL & ENGINEERING	
CONSTRUCTION MANAGER	
GENERAL CONSTRUCTION	3,000,000
EQUIPMENT & FURNITURE	
INFRASTRUCTURE	
OTHER	
TOTAL ESTIMATED COST	3,000,000 (A)

Note: As your project gets closer to the start date; more attention will be necessary when estimating project costs.

BASIS FOR OR SOURCE OF ESTIMATE: Brian Wetzel, CES 12/18/2009

ESTIMATED EFFECT OF PROJECT ON OPERATING BUDGET:

	AMOUNT	COMMENT
NEW STAFF REQUIREMENTS		
OPERATING AND MAINT COSTS	9,500	Increased ventilation requires more heat; new equipment will reduce oper. costs.
OTHER COSTS		

FINANCING PLAN:

	AMOUNT
BONDING	3,000,000
GRANTS	
OTHER	
	3,000,000 (A)

TOTALS PROVE

DEPT HEAD/MANAGER NAME: Ron Bienkowski **DATE:** ____________

TITLE: Director of Business **SIGNATURE:** ____________

Town of Newtown
Department CIP Detail Worksheet
Item # 2

ITEM/PROJECT DESCRIPTION:
------CONTINUED------

Hawley Elementary School HVAC Renovations
This project includes:
Replace one boiler in the 1948 building and convert 1921 boilers from steam to hot water.
Installation of a ducted ventilation system to provide both heating and cooling to be thermostatically controlled using an energy management system
Ducting will be appropriately sized to meet all heating and cooling requirements
Replace steam heating systems with hot water heating systems
Provide individual temperature control in classrooms
Provide air conditioning throughout the building
Install energy efficient direct digital control (DDC) temperature control systems. DDC system also aids in reducing maintenance.
Improve indoor air quality
Provide mechanical ventilation via air handling units versus natural ventilation through open windows. The 1921 section of the building is particularly subject to noise and dust from Church Street when windows are open.

In order to accommodate the HVAC renovations there are extensive renovations to the electrical systems, including lighting, power and fire alarms.

PURPOSE & JUSTIFICATION:
------CONTINUED------

Hawley Elementary School
The purpose of this project is to comply with current building code requirements for fresh air exchange and ventilation in classrooms and to replace aging equipment which exceeds its useful life.

Built in three sections, 1921, 1948 and 1997, this facility is currently heated by two boiler plants. The 1921 section is served by two steam boiler and the 1997 section is served by one hot water boiler which is located in the 1948 boiler room. The 1948 section has old cast iron radiators, while the 1921 section has been largely upgraded to fin-tube heaters. Problems with poor temperature control capabilities and long system-response time for temperature regulation create many rooms that are either too cold or too hot during the winter season. The steam boilers in the 1921 section are relatively new (1993), but the 1948 section is operating with the original equipment and is coming to the end of its useful life. The hot water boiler was installed in 1997. Mechanical ventilation exists in all rooms, but requires windows to be opened to provide "make-up" or fresh air. This is a particular problem in the 1921 portion, where road noise and auto/truck emissions are introduced to the classrooms when windows are opened. The 1997 section has some air-conditioned spaces, but the addition has six classrooms that are not air-conditioned. The computer room, nurse's room, library, gym and office are air-conditioned.

Town of Newtown
Department CIP Detail Worksheet
Item # 3

NEW REQUEST	.
PRIOR YEAR PROJECT	X
PRIOR YR REJECTED	.

DEPARTMENT: Board of Education

PROJECT TITLE: Hawley HVAC Renovations - Phase II

PRIORITY: URGENT

LOCATION: Hawley Elementary School

ITEM/PROJECT DESCRIPTION: Install dedicated outside air ventilation systems including equipment, ductwork, piping, electrical power and controls. Install ceilings, permanent light fixtures, fire alarm devices and other ceiling mounted devices. Create conditioned space at attic of 1921 section of building for new equipment.

PROJECT FISCAL YEAR START: 2013 - 2014

MONTHS TO COMPLETE: 13 to 18 months

USEFUL LIFE: 26 to 30 years

PURPOSE & JUSTIFICATION: Phase II = Ventilation System - To provide ventilation which will improve air quality conditions as described in both the Climate Control Committee Report (8/12/2003) and testing done by Brooks Environmental Consulting in 2010 for recommended comfort levels.

ALTERNATIVES TO REQUEST: Use existing passive system and continue to make repairs.

APPROVAL OR REVIEW OF OTHER GOVERNMENTAL AGENCIES REQUIRED? YES (X) X NO (X) .

AGENCY NAME(S): Building Department

ESTIMATED COST:

	AMOUNT
ARCHITECTURAL & ENGINEERING	
CONSTRUCTION MANAGER	
GENERAL CONSTRUCTION	2,200,000
EQUIPMENT & FURNITURE	.
INFRASTRUCTURE	
OTHER	
TOTAL ESTIMATED COST	2,200,000 (A)

Note: As your project gets closer to the start date; more attention will be necessary when estimating project costs.

BASIS FOR OR SOURCE OF ESTIMATE: Brian Wetzel, CES 12/18/2009

ESTIMATED EFFECT OF PROJECT ON OPERATING BUDGET:

	AMOUNT	COMMENT
NEW STAFF REQUIREMENTS		
OPERATING AND MAINT COSTS	9,500	Increased ventilation requires more heat; new equipment will reduce oper. costs.
OTHER COSTS		

FINANCING PLAN:

	AMOUNT
BONDING	2,200,000
GRANTS	
OTHER	
	2,200,000 (A)

TOTALS PROVE

DEPT HEAD/MANAGER NAME: Ron Bienkowski **DATE:**__________

TITLE: Director of Business **SIGNATURE:**__________

Town of Newtown
Department CIP Detail Worksheet
Item # 3

ITEM/PROJECT DESCRIPTION:
-----CONTINUED-----

Hawley Elementary School HVAC Renovations

This project includes:

Replace one boiler in the 1948 building and convert 1921 boilers from steam to hot water.
Installation of a ducted ventilation system to provide both heating and cooling to be thermostatically controlled using an energy management system
Ducting will be appropriately sized to meet all heating and cooling requirements
Replace steam heating systems with hot water heating systems
Provide individual temperature control in classrooms
Provide air conditioning throughout the building
Install energy efficient direct digital control (DDC) temperature control systems. DDC system also aids in reducing maintenance.
Improve indoor air quality
Provide mechanical ventilation via air handling units versus natural ventilation through open windows. The 1921 section of the building is particularly subject to noise and dust from Church Street when windows are open.

In order to accommodate the HVAC renovations there are extensive renovations to the electrical systems, including lighting, power and fire alarms.

PURPOSE & JUSTIFICATION:
-----CONTINUED-----

Hawley Elementary School

The purpose of this project is to comply with current building code requirements for fresh air exchange and ventilation in classrooms and to replace aging equipment which exceeds its useful life.

Built in three sections, 1921, 1948 and 1997, this facility is currently heated by two boiler plants. The 1921 section is served by two steam boiler and the 1997 section is served by one hot water boiler which is located in the 1948 boiler room. The 1948 section has old cast iron radiators, while the 1921 section has been largely upgraded to fin-tube heaters. Problems with poor temperature control capabilities and long system-response time for temperature regulation create many rooms that are either too cold or too hot during the winter season. The steam boilers in the 1921 section are relatively new (1993), but the 1948 section is operating with the original equipment and is coming to the end of its useful life. The hot water boiler was installed in 1997. Mechanical ventilation exists in all rooms, but requires windows to be opened to provide "make-up" or fresh air. This is a particular problem in the 1921 portion, where road noise and auto/truck emissions are introduced to the class-rooms when windows are opened. The 1997 section has some air-conditioned spaces, but the addition has six classrooms that are not air-conditioned. The computer room, nurse's room, library, gym and office are air-conditioned.

Town of Newtown
Department CIP Detail Worksheet
Item # 4

NEW REQUEST	.
PRIOR YEAR PROJECT	X
PRIOR YR REJECTED	.

DEPARTMENT: Board of Education
PROJECT TITLE: Hawley HVAC Renovations - Phase III

PRIORITY: URGENT
LOCATION: Hawley Elementary School

ITEM/PROJECT DESCRIPTION: Install "ductless split" VRF type units including combined condensing units outside and refrigerant piping as needed. Provide electrical power to equipment.

PROJECT FISCAL YEAR START: 2014 - 2015
MONTHS TO COMPLETE: 13 to 18 months
USEFUL LIFE: 26 to 30 years

PURPOSE & JUSTIFICATION: Phase III = Split Systems Air Conditioning - provide air-conditioning as needed due to road noise levels and classroom comfort levels.

ALTERNATIVES TO REQUEST: Use existing passive system and continue to make repairs.

APPROVAL OR REVIEW OF OTHER GOVERNMENTAL AGENCIES REQUIRED? YES (X) X NO (X) .

AGENCY NAME(S): Building Department

ESTIMATED COST:

	AMOUNT
ARCHITECTURAL & ENGINEERING CONSTRUCTION MANAGER GENERAL CONSTRUCTION EQUIPMENT & FURNITURE INFRASTRUCTURE OTHER	1,600,000
TOTAL ESTIMATED COST	1,600,000 (A)

Note: As your project gets closer to the start date; more attention will be necessary when estimating project costs.

BASIS FOR OR SOURCE OF ESTIMATE: Brian Wetzel, CES 12/18/2009

ESTIMATED EFFECT OF PROJECT ON OPERATING BUDGET:

	AMOUNT	COMMENT
NEW STAFF REQUIREMENTS		
OPERATING AND MAINT COSTS	9,500	Increased ventilation requires more heat; new equipment will reduce oper. costs.
OTHER COSTS		

FINANCING PLAN:

BONDING	1,600,000
GRANTS	
OTHER	
	1,600,000 (A)

TOTALS PROVE

DEPT HEAD/MANAGER NAME: Ron Bienkowski **DATE:**__________

TITLE: Director of Business **SIGNATURE:**__________

Town of Newtown
Department CIP Detail Worksheet
Item # 4

ITEM/PROJECT DESCRIPTION:
------CONTINUED------

Hawley Elementary School HVAC Renovations
This project includes:
- Replace one boiler in the 1948 building and convert 1921 boilers from steam to hot water.
- Installation of a ducted ventilation system to provide both heating and cooling to be thermostatically controlled using an energy management system
- Ducting will be appropriately sized to meet all heating and cooling requirements
- Replace steam heating systems with hot water heating systems
- Provide individual temperature control in classrooms
- Provide air conditioning throughout the building
- Install energy efficient direct digital control (DDC) temperature control systems. DDC system also aids in reducing maintenance.
- Improve indoor air quality
- Provide mechanical ventilation via air handling units versus natural ventilation through open windows. The 1921 section of the building is particularly subject to noise and dust from Church Street when windows are open.

In order to accommodate the HVAC renovations there are extensive renovations to the electrical systems, including lighting, power and fire alarms.

PURPOSE & JUSTIFICATION:
------CONTINUED------

Hawley Elementary School
The purpose of this project is to comply with current building code requirements for fresh air exchange and ventilation in classrooms and to replace aging equipment which exceeds its useful life.

Built in three sections, 1921, 1948 and 1997, this facility is currently heated by two boiler plants. The 1921 section is served by two steam boiler and the 1997 section is served by one hot water boiler which is located in the 1948 boiler room. The 1948 section has old cast iron radiators, while the 1921 section has been largely upgraded to fin-tube heaters. Problems with poor temperature control capabilities and long system-response time for temperature regulation create many rooms that are either too cold or too hot during the winter season. The steam boilers in the 1921 section are relatively new (1993), but the 1948 section is operating with the original equipment and is coming to the end of its useful life. The hot water boiler was installed in 1997. Mechanical ventilation exists in all rooms, but requires windows to be opened to provide "make-up" or fresh air. This is a particular problem in the 1921 portion, where road noise and auto/truck emissions are introduced to the class-rooms when windows are opened. The 1997 section has some air-conditioned spaces, but the addition has six classrooms that are not air-conditioned. The computer room, nurse's room, library, gym and office are air-conditioned.

BOARD OF EDUCATION – FACILITIES/CIP SUBCOMMITTEE
June 30, 2011
9:00 AM
BOE Offices 3 Primrose St. Newtown, CT

Minutes

CALL TO ORDER – 9:15

Present – Debbie Leidlein, Bill Hart, Dr. Janet Robinson, Gino Faiella

PUBLIC PARTICIPATION - None

NEW BUSINESS

1. DISCUSSION REGARDING BUDGET REDUCTION OF BUILDING AND GROUND'S BUDGET

A list was distributed regarding Building and Ground's projects that will be accomplished this year, along with their cost. At the next meeting we will prioritize the list and look to determine which items will be moved to next year.

2. DISCUSSION AND POSSIBLE ACTION REGARDING 2011-2016 CIP

More information will be needed regarding CIP. Debbie will contact Pat to set up a meeting to collaborate town and school side CIP amounts for the coming year. Debbie will also contact Bob Mitchell with Public Building and Site to update him as to our projects. At our next meeting we will have Brian from CES along with Public Building and Site to discuss the upcoming Hawley school project. We will also discuss the projects in years 13/14 through 16/17. Our next meeting will be July 18th at 11:30.

PUBLIC PARTICIPATION - None

ADJOURNMENT – 10:40

Respectfully submitted by
Debbie Leidlein, Chairman

BOARD OF EDUCATION – FACILITIES/CIP SUBCOMMITTEE
July 20, 2011
1:00 PM
BOE Offices 3 Primrose St. Newtown, CT

Minutes

CALL TO ORDER – 1:15

Present – Debbie Leidlein, Bill Hart, Dr. Janet Robinson, Richard Gaines, 1 member of the press

PUBLIC PARTICIPATION - None

NEW BUSINESS

1. DISCUSSION REGARDING BUDGET REDUCTION OF BUILDING AND GROUND'S BUDGET

Gino was unable to attend and so the discussion regarding prioritizing projects will happen at our next meeting.

2. DISCUSSION AND POSSIBLE ACTION REGARDING 2011-2016 CIP

More information will be needed regarding CIP.

Hawley School HVAC Renovations Project -Debbie will be meeting with Pat and members of the Public Building and Site to discuss the upcoming Hawley School project and to begin the design phase. This information will help us to solidify numbers for the three phases of the project and will give us more information for years 2012-2013, 2012-2014, and 2014-2015.

High School Auditorium Improvement Project – Mrs. Leidlein will let Mrs. Llodra know that this project is set to begin with the design phase in 12/13 and the project to be implemented in 13/14 and will ask Mrs. Llodra to alert PB&S of this project.

Middle School Improvements Project - Mr. Hart recommended pushing the Middle School Project back on year. This will enable us to make the best decision with regard to the possible closing of the Middle School as identified by the Ad

Hoc Facilities Committee and will enable us to keep the CIP amounts below the town debt cap. Pushing this project back a year will enable to BOE to reduce their capital projects by $630,000 in 13/14, $1,000,000 in 14/15, and $2,200,000 in 15/16. We will ask Mr. Faiella for his input regarding this proposal at our next meeting.
Sandy Hook window replacement would be added to year 15/16 and MG windows will be added to year 14/15.

PUBLIC PARTICIPATION - None

ADJOURNMENT – 2:00
Next meeting - TBA

Respectfully submitted by
Debbie Leidlein, Chairman

Dr. Robinson reviewed the strategic plan process since it began in 2008. In April another meeting was held. The mission statement remained the same but the objectives adopted in 2009 were revised. She asked the Board to approve the revised objectives so we could move forward with the plan. The old strategies will change to align with the new objectives.
Mr. Alexander asked the schedule for updating the action plans.
Dr. Robinson stated the teams are developing now and will take five or six months to work with the revised strategies.

Discussion and Vote on CIP:
Mrs. Leidlein spoke about the meeting regarding the CIP. They discussed changing Hawley to leave the 21 section as is with the newer boiler and changing the boilers in the 48 section.
Mr. Faiella said they decided to do a redesign to upgrade the boilers and install a tempered air system with a cost savings. Brian Wetzel came up with this newer technology which will make these boilers more efficient. The boilers in the 48 section would be sized to take care of the entire building.
Mrs. Leidlein stated that we have to look at possibly breaking the high school auditorium work down. They moved the middle school design fees out to year 2014-2015 because we don't know the future of the building.
Mr. Nanavaty asked how this plan reconciled with the one approved by the Legislative Council in April of this year.
Mrs. Leidlein responded that some adjustments had to be made based on the budget.
Mr. Nanavaty feels there is no guarantee they will agree when this gets to Legislative Council because they approved it in April.

MOTION: Mrs. Bittman moved that the Board of Education approve the Capital Improvement Plan dated August 16, 2011. Mr. Alexander seconded. Vote: 7 ayes

MOTION: Mr. Nanavaty moved to go into executive session to discuss the Superintendent's evaluation, potential litigation and a personnel leave request and invited Dr. Robinson. Mrs. Leidlein seconded. Vote: 7 ayes

MOTION: Mr. Gaines moved that the Board of Education deny the leave for Evelyn Pancaldo. Mr. Alexander seconded. Vote: 7 ayes

Item 7 – Executive Session Motion
MOTION: Mrs. Leidlein moved to adjourn. Mr. Nanavaty seconded. Vote: 7 ayes

Item 8 – Adjournment
The meeting adjourned at 11:47 p.m.

Respectfully submitted:

Andrew Buzzi, Jr.
Secretary

NEWTOWN BOARD OF EDUCATION
SUMMARY - CAPITAL IMPROVEMENT PLAN
2012/13 TO 2016/17

Approved by the BOE 8/16/2011

CIP Item #	Location	Description of Project	2012/13	2013/14	2014/15	2015/16	2016/17	TOTALS
1	Hawley Elem.	HVAC Design Fees for proposed three phase project						
2	Hawley Elem.	HVAC Phase I Boiler/Electrical replacement and upgrade	$2,300,000					
3	Hawley Elem.	HVAC Phase II Ventilation system installed		$2,200,000				
4	Hawley Elem.	HVAC Phase III Split/Systems Limited Air Conditioning			$1,600,000			$6,100,000
5	Sandy Hook Elem	Window Replacement Projects			$600,000			$600,000
6	Middle Gate Elem	Window Replacement Projects				$400,000		$400,000
7	Middle School	Design Fees - All Phases climate control renovate and comply with code			$630,000			
8	Middle School	Phase I Three new boilers & re-piping				$2,070,000		
9	Middle School	Phase II - HVAC recommendations & code compliance					$4,805,000	$7,505,000
10	High School	Engineering Fees - Renovate auditoriur	$100,000					
11	High School	Auditorium ADA code, replace duct work, lighting, seating and fire sprinkler system		$1,339,338				$1,439,338
	TOTAL COSTS OF ALL PROJECTS		$2,400,000	$3,539,338	$2,830,000	$2,470,000	$4,805,000	$16,044,338
	TOTAL TO BE BONDED		$2,400,000	$3,539,338	$2,830,000	$2,470,000	$4,805,000	$16,044,338

Dr. Salvatore said this policy allows us to streamline our K-12 system for consistency to focus on language that is consistent tying in the strategic plan.
Mrs. Roche asked for a timeline.
Dr. Salvatore said the committee was developing a presentation to cover the training needed in February. We are also going to work with the PTAs.

MOTION: Mr. Gaines moved to amend the motion to correct the typographical errors and on page 4. #9 change the wording to "both sets of parents." Mr. Alexander seconded. Vote: 7 ayes

* CIP Re-approval:
MOTION: Mr. Gaines moved that the Board of Education re-approve the CIP.
Mr. McCubbin seconded.
Mrs. Leidlein went over each item. Vote: 7 ayes

Mrs. Leidlein spoke about the building and site projects and asked Mr. Faiella what were critical to address.
Mr. Faiella said the $150,000 was going to reduce the cost for the middle school parking lot paving which will be done as soon as school is out in June.

Mr. Gaines asked if the money would be there until the project was completed.
Mr. Faiella said the money would come out of the 2012-13 budget.

Mr. Bienkowski said the $150,000 are the unexpected funds from the 2010 fiscal year that the Town was going to set this aside for Board of Education purposes. The projects listed will be in the Superintendent's budget but, if we can have the money, they will be taken out. The projects Mr. Faiella listed are all in the 2012-13 year. We have to bid the middle school parking lot pavement in April for it to be done over the summer.

Mrs. Leidlein wanted clarification as to if the money could be carried over.
Mr. Bienkowski said it has been carried over. They were available June 2010.
Mrs. Leidlein asked Mr. Faiella to prioritize his list with the most critical items.

Item 5 – Old Business (continued)
Revisions to Graduation Policy 7-302:
Dr. Gejda said the revision reflects the addition of the personal financial literacy course. The graduation date was changed from 2017 to 2016.

MOTION: Mr. Hart moved to amend the personal financial literacy course effective for students graduating in 2016. Mr. Alexander seconded. Vote: 7 ayes.

Common Core State Standards:
Dr. Gejda presented an overview of the Common Core State Standards and how they will be implemented. For English/Language Arts there will be a 50/50 balance between literature and information text. There will be more literacy education in content areas and students should be reading appropriately complex text. Reading instruction will be more text-based with students being able to answer questions from what they read. Students should be writing to inform and be able to make an argument using evidence from the text. There will also be more emphasis on academic vocabulary.

CAPITAL IMPROVEMENT PLAN REGULATION

1. GOAL

The goal of the Board of Finance in adopting this regulation is to:

A]

- a) Prioritize, on a town-wide basis, proposed major capital projects
- b) Establish a consistent level of spending for such capital projects
- c) Integrate financial planning, budgeting and debt issuance for the Town
- d) Encourage careful project design

This Capital Improvement Plan (CIP) Regulation hereby:

B]

- a) Creates a process by which the Board of Finance adopts a proactive position regarding the capital expenditures of the Town of Newtown;
- b) Creates a process by which the Board of Finance identifies, prioritizes, evaluates, justifies, monitors, postpones or eliminates proposed capital expenditures;
- c) Creates a process by which the Board of Finance and the Legislative Council work compatibly in enacting Sections 1(B)a and 1(B)b.

2. DEFINITION

The Capital Improvement Plan is Newtown's five year program of Major Capital Purchases of a non-recurring nature. The CIP is based on assigned priorities which consider Town needs, desires, and mandates for various improvements and coincides with Newtown's current and anticipated financial capability to finance such improvements. The CIP shall be reviewed at least annually by the Board of Finance. The Board of Finance shall amend the CIP as required to address changing priorities and maintain the CIP at a five year projection time frame.

3. COMPOSITION

The Board of Finance is hereby charged with the responsibility of implementing the goals expressed above in Section 1A and 1B and all changes, additions and deletions to the CIP. In addition, among others, the Town Financial Director, First Selectman, Chairman of the Board of Education, Superintendent of Schools and Legislative Council members may advise the Board of Finance, but do not have voting privileges.

4. TIMING

Proposed purchases may be brought to the Board of Finance at any time, however, except for exigent circumstances, purchases not presented in the Board of Selectmen or Board of Education yearly five year CIP projection shall not be considered by the Board of Finance until the next June through October period. The Board of Selectmen shall submit its five year projected CIP proposal at the first regularly scheduled Board of Finance meeting in August. The Board of Education shall submit its five year projected CIP proposal at the first regularly scheduled Board of Finance meeting in June. The Board of Finance shall hold its review period from June through October.

5. ELIGIBILITY

To be eligible for inclusion in the CIP, a proposed purchase shall have an estimated cost that is at least twenty-five hundredths of one percent (.25%) of the Town budget for the year in which the request is made(excluding projects funded with loCIP money). Listed below are some of the guidelines which would make a request eligible for inclusion in the CIP assuming the proposed purchase meets the .25% requirement set above:

a) Purchases requiring debt obligation;
b) Acquisition of lease or land;
c) Purchase of major equipment and vehicles with life expectancy of five years or more;
d) Construction of new building facilities, including engineering, design and other preconstruction costs;
e) Major building improvements that are not routine expenses including those that substantially enhance the safety of the occupants of the building and/or the longevity of the building itself;
f) Major equipment or furnishing required for a new building or other projects;
g) Major studies requiring the employment of outside professional consultants.

6. PROCESS OVERVIEW

All requests for inclusion in the CIP will adhere to the following process and shall be submitted on a form as prescribed by the Town Financial Director.

a) Each Town Department shall submit to the Board of Selectmen, a prioritized list of proposed capital purchases.

b) The Board of Selectmen will identify, prioritize and approve, on a town-wide basis purchases it proposes to include in the CIP, excluding items requested by the Board of Education.

The Board of Education will likewise identify, prioritize and approve purchases it proposes to be considered for placement on the CIP.

c) The Board of Selectmen and the Board of Education shall also include in the request(s):

- the identification of any revenues or reimbursements anticipated each year
- financial impact statement as provided by the Town Financial Director
- indication whether the item/project requested is eligible for LoCIP funds

d) The Town Financial Director will review and compile the two lists to be presented to the Board of Finance.

e) The Board of Selectmen and the Board of Education will then present their prioritized purchase request to the Board of Finance.

f) The Board of Finance will consider all requests made through this process and determine those that will be recommended for inclusion in the CIP and those that are to be rejected or postponed. If rejected, the proposed purchase can be resubmitted to the appropriate Board at the first step of the process. If postponed, the request shall be reviewed by the Board of Finance with respect to its new priority level.

g) The Board of Finance will prioritize, on a town-wide basis, all requests it approves for inclusion into the CIP, establish a time frame for proceeding with each purchase in view of the financial implications of such a purchase.

h) The Board of Finance will forward its recommendation to the Legislative Council by November 30th. The Legislative Council may accept the plan in its entirety, reject any item or reduce any item in capital costs, or reduce any item in priority. Any new item addition, or increase in proposed capital expenditure for an item by the Legislative Council shall be referred back to the Board of Finance for further review and recommendation with written comment by the Legislative Council as to its reasoning. Within a reasonable time thereafter, the Board of Finance will resubmit its recommended CIP plan noting any changes it has made.

i) The CIP plan approved by the Legislative Council shall be the single and final adopted CIP plan for the Town of Newtown, except should the Legislative Council not return a proposed plan by the Board of Finance to the Board of Finance for further review within sixty days of its submission, and not pass the final CIP plan presented by the Board of Finance within sixty days of submission to the Legislative Council, the proposed CIP plan presented by the Board of Finance shall be the single and final adopted CIP plan for the Town of Newtown.

7. PRIORITIZATION

The Board of Finance shall consider the following criteria during its prioritization:

a) The cost of the purchase
b) The impact of the purchase versus the benefit to the Town
c) The year it will be implemented
d) The source of financing
e) The impact on future operating budgets
f) The benefit of risk to the Town should the purchase not be made

8. TOWN BUDGET

All purchases which are proposed for the ensuing fiscal year and included in the final CIP by the Legislative Council shall be included as proposed expenditures in the budget presented to the Board of Finance. Except for exigent circumstances, any capital improvement expenditure that falls within Section Five of this Plan Regulation and is not contained in the CIP shall not be considered for implementation.

APPROVED:

BOARD OF FINANCE SEPTEMBER 9, 2002

LEGISLATIVE COUNCIL SEPTEMBER 18, 2002

Historical Outline of Hawley Project

- 2010 – Hawley HVAC project proposed and approved by the BOE on 8/17/2010 as a three phase project:

  Phase 1: Boiler/Electrical Upgrade
  Phase 2: Ventilation
  Phase 3: Limited Air-conditioning – specifically for the 1921 section

- 2011 – Hawley HVAC project modified but still three phases and is approved by the BOE on 8/16/2011

- 2012 –
  - 6/26/2012, PBSC accepts the new project scope from Kaestle Boos which modifies the order of the project and adds a possible ADA enhancement component.

  - 9/4/2012, BOE approves the revised Hawley School project
    9/5/2012, BOE CIP Committee discusses the Hawley project and the minutes indicate that the business director will forward the CIP documentation to the town's finance director

  - 9/10/2012, PB&SC move forward with the re-phased Hawley project

- 2013 –
  - 9/30/2013, CIP meeting held (no discussion about the Hawley project)

  - 10/1/2013, BOE approves CIP (Phase 1 underway, but no other changes to Hawley project)

- 2014 –
  - 5/7/2014 & 8/14/2014 – BOE CIP Meetings discussing the various parts of the CIP. Recommendation to move Phase II Hawley project to 2019-20 but extract the Hawley roof project out of Phase II and to 2017-18.

  - 8/19/2014, BOE approves revised CIP which includes the change in timing to the project. (This discussion is recorded on the town's website at the 1 hour, 40 minute mark.)

  - 10/23/2014, BOF removes the Hawley HVAC project from the CIP

NEWTOWN PUBLIC SCHOOLS
BUSINESS OFFICE

MEMORANDUM

DATE: August 27, 2015

TO: Dr. Joseph V. Erardi, Jr., Superintendent

FROM: Ron Bienkowski, Director of Business

SUBJECT: 2015-16 Budget Adjustments (Amended)

The attached schedule represents the revised budget adjustment that were reviewed at the August 27th Finance Committee meeting. The change in the recommendation is highlighted, a deletion of the Health Specialist's adjustment due to a late resignation.

The schedule includes the same recommendations for budget modifications with the above noted, as they were presented at the August 18th meeting. Taking into account the changes as detailed in the 'Reason' column, with this updated recommendations' the remaining amount needed for turnover has dropped to $96,354, which we are confident will be covered by three positions which will go unfilled.

Salary adjustments for the Paraeducators are included along with all independently contracted personnel. There is a remaining balance of $114,036 for all outstanding negotiations.

We have created five summer program accounts to track program expenses for such that were previously embedded in other accounts. This will help add further clarity to these needs.

Below the dashed line are fourteen non-salary adjustments required for the reasons listed.

The balance amount has been added to Out-of-District tuition which will have additional needs for the year.

All future adjustments that become necessary will be handled by transfers.

Account Number	Account Description	Board Approved Budget	Recommended Adjustments	Final Recommended Budget	Reason
1-001-82-082-1111-0000	ADMIN. SALARIES - SUPER.	$450,690.00	$2,214.00	$452,904.00	Salary adjustments, super. + 5 paid unused vac, days, late start for new assist. Superintendent
1-001-84-086-1111-0000	ADMIN. SALARIES - BUS. SERV.	$150,121.00	$1,952.00	$152,073.00	Salary adjustment - independent contract
1-001-10-001-1115-0000	LEAD TEACHERS - ADMIN.	$90,871.00	$2,885.00	$93,756.00	Advance degree
1-001-30-001-1115-0000	LEAD TEACHERS - ADMIN.	$92,886.00	($6,023.00)	$86,863.00	Change in Lead Teacher
1-001-75-050-1112-0000	DIRECTOR - PUPIL SERV.	$320,343.00	$89,582.00	$409,925.00	Special Ed. department chair to supervisor, reduce summer days 30 to 25
1-001-10-002-1121-0000	TEACHERS - ART	$54,880.00	($9,335.00)	$45,545.00	.3 of elementary art reduction under salary adjustment
1-001-10-022-1121-0000	TEACHERS - MUSIC	$63,113.00	($10,503.00)	$52,610.00	.2 position reduction not budgeted
1-001-10-038-1121-0000	TEACHERS - CLASSROOM	$1,292,211.00	$56,594.00	$1,348,805.00	Added new kindergarten teacher
1-001-10-038-1131-0000	SPECIALISTS - CLASSROOM	$6,284.00	$0.00	$6,284.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-20-002-1121-0000	TEACHERS - ART	$54,555.00	($6,184.00)	$48,371.00	.2 of elementary art reduction under salary adj., .8 filled from within
1-001-20-009-1131-0000	SPECIALISTS - EARLY INTERVENTION	$0.00	$45,173.00	$45,173.00	Open .75 reading position filled as early intervention
1-001-20-024-1121-0000	TEACHERS - P.E.	$128,074.00	$6,728.00	$134,802.00	.5 of the.7 open pos. filled at higher step
1-001-20-026-1121-0000	TEACHERS - READING	$196,047.00	($37,381.00)	$158,666.00	Teacher moved to kindergarten, .75 open pos. moved to early intervention
1-001-20-034-1131-0000	SPECIALISTS - LIBRARY	$57,502.00	$4,454.00	$61,956.00	Cost of replacement
1-001-20-038-1121-0000	TEACHERS - CLASSROOM	$1,439,239.00	($45,931.00)	$1,393,308.00	3 moved & replaced by 2 transfers & 1 new
1-001-20-038-1131-0000	SPECIALISTS - CLASSROOM	$6,284.00	$0.00	$6,284.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-30-002-1121-0000	TEACHERS - ART	$53,028.00	($11,784.00)	$41,244.00	.2 of elementary art reduction under salary adjustment
1-001-30-009-1131-0000	SPECIALISTS - EARLY INTERVENTION	$50,178.00	$6,142.00	$56,320.00	.75 open filled .5 new at M-8 & .25 transferred
1-001-30-022-1121-0000	TEACHERS - MUSIC	$79,497.00	($16,401.00)	$63,096.00	Unpaid leave, sub for beginning of year
1-001-30-026-1121-0000	TEACHERS - READING	$158,145.00	$2,732.00	$160,877.00	Advance degree
1-001-30-038-1121-0000	TEACHERS - CLASSROOM	$1,455,519.00	($57,936.00)	$1,397,583.00	2 teachers didn't return, 1 open position due to transfer
1-001-30-038-1131-0000	SPECIALISTS - CLASSROOM	$6,284.00	$0.00	$6,284.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-40-002-1121-0000	TEACHERS - ART	$90,841.00	($27,252.00)	$63,589.00	.3 of elementary art reduction under salary adjustment
1-001-40-009-1131-0000	SPECIALISTS - EARLY INTERVENTION	$36,915.00	$4,501.00	$41,416.00	.5 teacher resigned, rehired a senior teacher
1-001-40-020-1131-0000	SPECIALISTS - MATH/SCI	$56,014.00	$14,727.00	$70,741.00	More senior teacher transferred to position
1-001-40-024-1121-0000	TEACHERS - P.E.	$101,344.00	$816.00	$102,160.00	.2 pos. open teacher did not return
1-001-40-038-1121-0000	TEACHERS - CLASSROOM	$1,313,762.00	$20,868.00	$1,334,630.00	1 senior teacher transfer into new position, 1 transferred out to Math/Sci.
1-001-40-038-1131-0000	SPECIALISTS - CLASSROOM	$6,284.00	$0.00	$6,284.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-45-014-1131-0000	SPECIALISTS - HEALTH ED.	$6,284.00	$0.00	$6,284.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-45-022-1121-0000	TEACHERS - MUSIC	$408,133.00	$2,660.00	$410,793.00	Advanced degree
1-001-45-024-1121-0000	TEACHERS - P.E.	$170,986.00	($19,266.00)	$151,720.00	More senior teacher resigned (position cut)
1-001-45-026-1121-0000	TEACHERS - READING	$294,754.00	($1,184.00)	$293,570.00	.78 teacher resigned replaced by .75
1-001-45-038-1121-0000	TEACHERS - CLASSROOM	$2,393,386.00	$19,527.00	$2,412,913.00	Advance degree, 1 new hire & 2 senior teachers transferred in
1-001-50-002-1121-0000	TEACHERS - ART	$128,072.00	($32,931.00)	$95,141.00	Senior teacher retired
1-001-50-010-1121-0000	TEACHERS - ENGLISH	$693,278.00	$2,662.00	$695,940.00	Advance degree
1-001-50-014-1121-0000	TEACHERS - HEALTH ED	$60,232.00	($11,319.00)	$48,913.00	Health coord. no longer teaching any classes
1-001-50-014-1131-0000	SPECIALISTS - HEALTH ED	$9,427.00	$0.00	$9,427.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-50-020-1121-0000	TEACHERS - MATH	$606,019.00	($27,751.00)	$578,268.00	A resigned & retiree replaced with starting teachers
1-001-50-024-1121-0000	TEACHERS - P.E.	$282,968.00	($3,872.00)	$279,096.00	.5 of a more senior teacher transferred to Sandy Hook (.5 eliminated)
1-001-50-026-1121-0000	TEACHERS - READING	$138,790.00	$2,661.00	$141,451.00	Title I grant not increasing with salaries
1-001-50-028-1121-0000	TEACHERS - SCIENCE	$632,757.00	($23,476.00)	$609,281.00	Savings from turnover
1-001-50-040-1131-0000	SPECIALISTS - GUIDANCE	$291,194.00	($2,106.00)	$289,088.00	Savings from turnover
1-001-60-004-1121-0000	TEACHERS - BUSINESS ED	$189,555.00	$9,637.00	$199,192.00	New teacher only business ed., .2 moved from tech. ed.
1-001-60-008-1121-0000	TEACHERS - C.W.E.	$11,739.00	$6,354.00	$18,093.00	Transfer senior teacher to fill opening
1-001-60-010-1121-0000	TEACHERS - ENGLISH	$1,216,518.00	($14,732.00)	$1,201,786.00	+15 credits, savings from turnover (1 resigned & .2 transferred)
1-001-60-012-1121-0000	TEACHERS - WORLD LANG.	$870,242.00	($28,265.00)	$841,977.00	2 replacements at bottom of guide, HANBAN to pay $13,000 of Chinese teacher

Account Number	Account Description	Board Approved Budget	Recommended Adjustments	Final Recommended Budget	Reason
1-001-60-014-1131-0000	SPECIALISTS - HEALTH ED	$9,427.00	$0.00	$9,427.00	~~Senior teacher transfer to coord., + stipend not budgeted, no classes~~
1-001-60-018-1121-0000	TEACHERS - TECH ED.	$462,515.00	($8,178.00)	$454,337.00	.2 unified theater pos. moved from classroom, .2 pos. moved to business ed.
1-001-60-020-1121-0000	TEACHERS - MATH	$1,098,536.00	($6,423.00)	$1,092,113.00	Turnover savings from resignation
1-001-60-028-1121-0000	TEACHERS - SCIENCE	$1,795,495.00	($18,566.00)	$1,776,929.00	+15 credits, a senior teacher resigned position is open
1-001-60-030-1121-0000	TEACHERS - SOC. STUDIES	$1,348,847.00	($13,383.00)	$1,335,464.00	Savings from turnover and change in dept. head
1-001-60-034-1131-0000	SPECIALISTS - LIBRARY	$172,322.00	($6,704.00)	$165,618.00	Savings from turnover
1-001-60-038-1121-0000	TEACHERS - CLASSROOM	$58,624.00	($1,337.00)	$57,287.00	Two .2 academic officer pos. filled with senior teachers, .2 unified theater moved to tech.ed.
1-001-60-039-1121-0000	TEACHERS - T.A.P./FLEX	$292,877.00	($4,892.00)	$287,985.00	.14 senior teacher retired, pos. open
1-001-60-040-1131-0000	SPECIALISTS - GUIDANCE	$773,066.00	($844.00)	$772,222.00	Change in director
1-001-75-060-1121-0000	TEACHERS - GATES	$212,552.00	$14,952.00	$227,504.00	Senior teacher to new pos., senior teacher replaced by lower paid teacher, .4 pos. fill by returning senior teacher
1-001-75-061-1121-0000	TEACHERS - SP. ED. PREK-8	$1,704,327.00	($100,110.00)	$1,604,217.00	Pos. moved to IDEA grant, teacher resigned pos. open
1-001-75-063-1121-0000	TEACHERS - SP. ED. H.S.	$339,301.00	($11,898.00)	$327,403.00	Department head pos. moved to admin., pos. moved from IDEA grant
1-001-84-088-1151-0000	CERTIFIED SALARY ADJ.	($344,500.00)	$248,146.00	($96,354.00)	Distribute elementary art position cut, turnover savings & salary increases
1-001-94-084-1143-0000	CONTINUING ED. DIRECTOR	$44,378.00	$888.00	$45,266.00	Salary adjustment - independent contract
1-001-60-026-1313-0000	TUTORS - READING	$81,305.00	$1,628.00	$82,933.00	Salary adjustment - independent contracts
1-001-84-088-1312-0000	CERT. SUBS. - CONTRACTED	$247,050.00	($45,000.00)	$202,050.00	Reduction of budget based on last years' experience
1-001-77-041-1210-0000	SUPERVISOR - HEALTH ADMIN.	$16,512.00	$330.00	$16,842.00	Salary adjustment - independent contract
1-001-81-085-1210-0000	STAFF SALARIES - INFO. TECH.	$437,374.00	$2,458.00	$439,832.00	Salary adjustment - independent contract
1-001-84-086-1210-0000	SUPERVISORS - BUS. SERV.	$73,850.00	$1,477.00	$75,327.00	Salary adjustment - independent contract
1-001-90-092-1210-0000	SUPERVISORS - B&G ADMIN.	$204,164.00	($7,591.00)	$196,573.00	Salary adjustment - independent contract, filled new pos. at lower rate
1-001-20-001-1221-0000	CLERICAL - ADMIN.	$84,381.00	$772.00	$85,153.00	Turnover savings and vacation payout for retiring secretary
1-001-45-040-1221-0000	CLERICAL - GUIDANCE	$32,591.00	($1,001.00)	$31,590.00	Turnover savings
1-001-75-050-1221-0000	CLERICAL - PUPIL SERV.	$153,065.00	$4,750.00	$157,815.00	Position expansion
1-001-82-082-1222-0000	SECRETARIAL - SUPER.	$203,711.00	$6,327.00	$210,038.00	Salary adjustment - independent contract
1-001-84-086-1221-0000	CLERICAL - BUS. SERV.	$255,421.00	$1,155.00	$256,576.00	Salary adjustment - independent contract
1-001-10-034-1232-0000	ED ASSISTANTS - LIBRARY	$12,120.00	$211.00	$12,331.00	Salary adjustment - union contract
1-001-10-038-1232-0000	ED ASSISTANTS - CLASSROOM	$92,599.00	$1,764.00	$94,363.00	Salary adjustment - union contract
1-001-20-034-1232-0000	ED ASSISTANTS - LIBRARY	$11,945.00	$211.00	$12,156.00	Salary adjustment - union contract
1-001-20-038-1232-0000	ED ASSISTANTS - CLASSROOM	$96,603.00	$1,870.00	$98,473.00	Salary adjustment - union contract
1-001-30-034-1232-0000	ED ASSISTANTS - LIBRARY	$12,045.00	$211.00	$12,256.00	Salary adjustment - union contract
1-001-30-038-1232-0000	ED ASSISTANTS - CLASSROOM	$108,083.00	$2,165.00	$110,248.00	Salary adjustment - union contract
1-001-40-034-1232-0000	ED ASSISTANTS - LIBRARY	$8,959.00	$158.00	$9,117.00	Salary adjustment - union contract
1-001-40-038-1232-0000	ED ASSISTANTS - CLASSROOM	$93,036.00	$1,751.00	$94,787.00	Salary adjustment - union contract
1-001-45-038-1232-0000	ED ASSISTANTS - CLASSROOM	$83,529.00	$1,703.00	$85,232.00	Salary adjustment - union contract
1-001-50-001-1232-0000	ED ASSISTANTS - ADMIN.	$12,400.00	$245.00	$12,645.00	Salary adjustment - union contract
1-001-50-006-1232-0000	ED ASSISTANTS - COMPUTER ED.	$15,799.00	$285.00	$16,084.00	Salary adjustment - union contract
1-001-50-025-1232-0000	ED ASSISTANTS - PROJ. ADV.	$16,325.00	$335.00	$16,660.00	Salary adjustment - union contract
1-001-50-038-1232-0000	ED ASSISTANTS - CLASSROOM	$7,535.00	$154.00	$7,689.00	Salary adjustment - union contract
1-001-60-028-1232-0000	ED ASSISTANTS - SCIENCE	$16,325.00	$335.00	$16,660.00	Salary adjustment - union contract
1-001-75-061-1231-0000	ED. ASSISTANTS - HAW. SP. ED.	$93,901.00	$1,787.00	$95,688.00	Salary adjustment - union contract
1-001-75-061-1232-0000	ED ASSISTANTS - SP. ED. PREK-8	$164,014.00	$3,181.00	$167,195.00	Salary adjustment - union contract
1-001-75-061-1233-0000	ED. ASSISTANTS - M.G. SP. ED.	$117,816.00	$2,369.00	$120,185.00	Salary adjustment - union contract

Account Number	Account Description	Board Approved Budget	Recommended Adjustments	Final Recommended Budget	Reason
1-001-75-061-1234-0000	ED. ASSISTANTS - HOM. SP. ED.	$166,945.00	$3,128.00	$170,073.00	Salary adjustment - union contract
1-001-75-061-1235-0000	ED. ASSISTANTS - RIS. SP. ED.	$308,173.00	$6,360.00	$314,533.00	Salary adjustment - union contract
1-001-75-061-1236-0000	ED. ASSISTANTS - M.S. SP. ED.	$218,006.00	$4,291.00	$222,297.00	Salary adjustment - union contract
1-001-75-063-1232-0000	ED ASSISTANTS - H.S. SP. ED.	$230,688.00	$4,663.00	$235,351.00	Salary adjustment - union contract
1-001-75-079-1232-0000	ED ASSISTANTS - SUMMER PROGRAM	$14,411.00	$24,474.00	$38,885.00	Under budgeted for summer programs
1-001-77-049-1240-0000	NURSES SALARIES - H.S.	$94,964.00	$990.00	$95,954.00	Salary adjustment - independent contract
1-001-90-094-1259-0000	COURIER SALARY	$37,393.00	$754.00	$38,147.00	Salary adjustment - independent contract
1-001-84-088-1271-0000	NON-CERT SALARY ADJ.	$189,217.00	($75,181.00)	$114,036.00	Allocation for approved salary increases and staffing changes
1-001-60-008-1263-0000	SCHOOL-TO-CAREER COORDINATOR	$60,315.00	$1,206.00	$61,521.00	Salary adjustment - independent contract
1-001-60-032-1261-0000	ATHLETIC TRAINER - SPORTS	$43,483.00	$870.00	$44,353.00	Salary adjustment - independent contract
1-001-60-039-1262-0000	JOB COACH - T.A.P./FLEX	$4,329.00	$164.00	$4,493.00	Salary adjustment - independent contract
1-001-75-066-1262-0000	JOB COACHES - TRANSITIONAL	$77,764.00	$885.00	$78,649.00	Salary adjustment - independent contracts and staff turnover savings
1-001-75-079-1262-0000	JOB COACHES - SUMMER	$0.00	$7,542.00	$7,542.00	New account to segregate cost for summer programs
1-001-75-051-1263-0000	THERAPISTS - OT/PT	$345,430.00	($3,555.00)	$341,875.00	Salary adjustment - independent contracts, segregate summer work
1-001-75-061-1263-0000	BEHAVIORAL ANAL. - SP. ED. PREK-8	$152,540.00	($657.00)	$151,883.00	Salary adjustment - independent contracts, segregate summer work
1-001-75-061-1266-0000	BEHAVIORAL THERAP. - SP. ED. PREK-I	$454,069.00	($26,519.00)	$427,550.00	Salary adjustment - independent contract, segregate summer work
1-001-75-079-1261-0000	BEHAVIORAL ANAL. - SUMMER	$0.00	$4,200.00	$4,200.00	New account to segregate cost for summer programs
1-001-75-079-1263-0000	THERAPISTS - OT/PT SUMMER	$0.00	$12,500.00	$12,500.00	New account to segregate cost for summer programs
1-001-75-079-1266-0000	BEHAVIORAL THERAP. - SUMMER	$0.00	$27,000.00	$27,000.00	New account to segregate cost for summer programs
1-001-84-088-1261-0000	ATTENDANCE - SUB. CALLING	$11,193.00	$224.00	$11,417.00	Salary adjustment - independent contract
1-001-85-088-1264-0000	SECURITY SALARIES	$216,830.00	$3,207.00	$220,037.00	Salary adjustment - independent contracts
1-001-75-079-1423-0000	EXTRA WORK - NON-CERT. SUMMER	$0.00	$2,000.00	$2,000.00	New account to segregate cost for summer programs
1-001-90-096-1750-0000	CUST. PARK & REC - DISTRICT	$40,000.00	($4,000.00)	$36,000.00	Excess budgeted
	Non-Salary accounts				
1-001-86-090-2030-0000	ADMINISTRATION FEES	$44,130.00	($36,130.00)	$8,000.00	Administration fee paid from town insurance fund
1-001-86-090-2700-0000	WORKERS COMP.	$502,017.00	$904.00	$502,921.00	Actual Invoice cost slightly over estimate
1-001-90-096-3220-0000	WATER - MAINT.	$1,000.00	($1,000.00)	$0.00	Warehouse - water included in rental fee
1-001-85-088-3300-0000	REPAIRS - SECURITY	$0.00	$25,000.00	$25,000.00	Need to have a repair budget for all technological security equipment
1-001-90-094-3508-0000	B. & G. IMPROVE - C.O.	$28,000.00	($28,000.00)	$0.00	Project completed with remaining encumbrance from 2013-14
1-001-60-032-4120-0000	ATHLETIC ACTIVITIES INS.	$32,000.00	$5,950.00	$37,950.00	Increases premium due to higher claims
1-001-84-083-4120-0000	LIABILITY/UMBRELLA INS.	$189,875.00	$4,997.00	$194,872.00	Late increase estimate of 3% to 5% by CIRMA
1-001-90-096-4120-0000	PROPERTY INSURANCE	$121,118.00	$3,001.00	$124,119.00	Late increase estimate of 3% to 5% by CIRMA

Account Number	Account Description	Board Approved Budget	Recommended Adjustments	Final Recommended Budget	Reason
1-001-60-037-4160-0000	TUITION - OUT-OF-DISTRICT REG. ED.	$128,445.00	$27,291.00	$155,736.00	4 additional vocational agriculture students
1-001-75-052-4160-0000	TUITION - OUT-OF-DISTRICT	$2,213,032.00	$52,285.00	$2,265,317.00	Special education needs
1-001-82-082-4200-0000	STAFF TRAVEL - SUPER.	$8,950.00	$920.00	$9,870.00	Adjust travel allowances
1-001-50-002-5100-0000	INSTR. SUPPLIES - ART	$4,800.00	($1,211.00)	$3,589.00	Reallocated to technology equipment
1-001-81-085-7200-0000	EQUIPMENT - INFO. TECH.	$547,933.00	$1,211.00	$549,144.00	Reallocated supplies for MacBook for MS Art program
1-001-85-088-7200-0000	EQUIPMENT - SECURITY	$34,692.00	($34,692.00)	$0.00	Purchased equipment through DOJ grant
	GRAND TOTAL		-	**check**	

Newtown Board of Education Presentation: NEASC

Sunday, October 4-
Wednesday, October 7th

Amy Deeb
NEASC Chair

Dr. Lorrie Rodrigue
Principal

September 1, 2015

Accreditation

Regional accreditation relies on a voluntary, peer review process, engaging some 3,400 educators in the region on hundreds of reviews in any year. A self-study process of 12-18 months is undertaken by schools and colleges in regular review cycles. The goals are effectiveness, improvement and public assurance. Unlike popular magazines, this does not involve ranking institutions, but rather establishes a level of acceptable quality for all accredited institutions.

Why Regional Accreditation is Important?

- Fosters self-reflection and self-evaluation for high school staff
- Based on standards and indicators associated with quality schools and post-secondary institutions
- Solicits feedback from all stakeholders throughout the process
- Provides both a sense of accomplishment and pride
- Expresses to the community-at-large that our high school is a quality institution
- Allows us to develop future improvements aligned with our needs

NEASC

NEASC accreditation is structured in a ten-year cycle of:

- **Self-study** which engages the entire educational community in structured analysis, self-reflection, and planning in response to the standards.
- **Peer review** which brings discipline and perspective to the process through the observations and judgments of a visiting committee of peers from other schools and colleges, informed by the self-study and based on the standards.
- **Follow-up** which is monitored by a commission of elected peers and overseen by a professional staff to ensure that planned and prescribed institutional change is accomplished and which provides for intervention, as necessary, to respond to information gathered in regular reports from the institution or through complaints from the public concerning a failure to comply with the standards.

Staff:

Student:

Parent/Community:

Created November 2012

Academic Responsibility

Taguls

Staff:

Student:

Parent/Community:

Social Responsibility Taguls

Created November 2012

Staff:

Student:

Parent/Community:

Created November 2012

Civic Responsibility

Taguls

Core Values and Beliefs:

The Newtown High School community is committed to cultivating the growth of *productive* and *innovative* citizens who demonstrate *integrity* and *empathy* in our local and global communities.

We believe that a *rigorous* curriculum, *collaborative* environment, and *supportive* community will foster *intellectually curious*, *resilient*, and *kind* individuals who continuously strive to meet their full potential.

Newtown High School

Core Values and Beliefs

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Academic

21st Century Learning Expectations:

Newtown High School students will:

Information Literacy:

- Demonstrate strategies to identify, locate, and interpret information.
- Relate and apply new knowledge using a variety of resources including technology.

Problem Solving:

- Demonstrate use of the scientific method and apply appropriate procedures to solve and communicate an authentic problem or situation.

Spoken Communication:

- Convey information and ideas to others in a presentation using spoken language, nonverbal language and, when appropriate, multimedia.

Written Performance:

- Take and support a position on information and ideas.
- Convey information and ideas in a given written format.

Civic

- Demonstrate civic responsibility through community service and the understanding of governmental processes.

Social

- Demonstrate social responsibility by respecting yourself and others, working with honesty and integrity, keeping high expectations, and supporting the community.

	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5	Standard 6	Standard 7	
	Core Values, Beliefs, L.E.	Curriculum	Instruction	Assessment	School Culture and Leadership	School Resources	Community Resources	
Steering Committee	**Eugene Hall**	**Abi Marks +**	Gary Franklin+	**Laura Battisti**	**Kristin English**	**Maggie Conway**	**Tim DeJulio**	
Steering Committee						**Dave Defeo**	**Peg Ragaini**	
						Colleen Kimball	Sayward Parsons	
Chair	Bob Gendreau	Kathy Swift	Jen Huettner	Kim Lowell	Carol Skolas	Jen Hoag	Jill Gonski	
Chair	Chris Lee	Marty Swanhall	Martha Parvis	Brian Tenney	Cate Brainard	Cathy Ostar	Cheryl Lombardo	
		Ana Mendes	Candi Dietter		Lori Hoagland	Melissa Cacioppo	Rick Lye	
	Jason Edwards	Jessica Metz	Katherine Dimoulas	Lisa Meyer	Jacqui Kaplan		Ali Boa	
	Sarah Chow	Joanna Barry	Ellie Hanna	Tammy Zukowski	Marc Kenney	Jolene Swann	Shawn Tierney	

NEASC- Standards for Accreditation

Teaching and Learning Standards

Standard 1: *Core Values, Beliefs and Learning Expectations- adopted 10/6/14*

Standard 2: *Curriculum - adopted 4/4/15*

Standard 3: *Instruction-adopted 3/2/15*

Standard 4: *Assessment of and for Student Learning- adopted 4/4/15*

Standards for Accreditation continued

Support Standards:

Standard 5: *School Culture and Leadership-adopted 10/6/14*

Standard 6: *School Resources for Learning-adopted 2/2/15*

Standard 7: *Community Resources for Learning-adopted11/3/14*

What to expect...

Sunday, October 4th

Panel Presentation at NHS-1:00-2:00 pm

BOE and Parent Interview- 2:15-3:00 pm

Teacher Interviews: 3:10-4:10 (TBD on 9/21 by Visiting Chair)

Welcoming Reception: 4:15-5:15 pm-Cafetorium

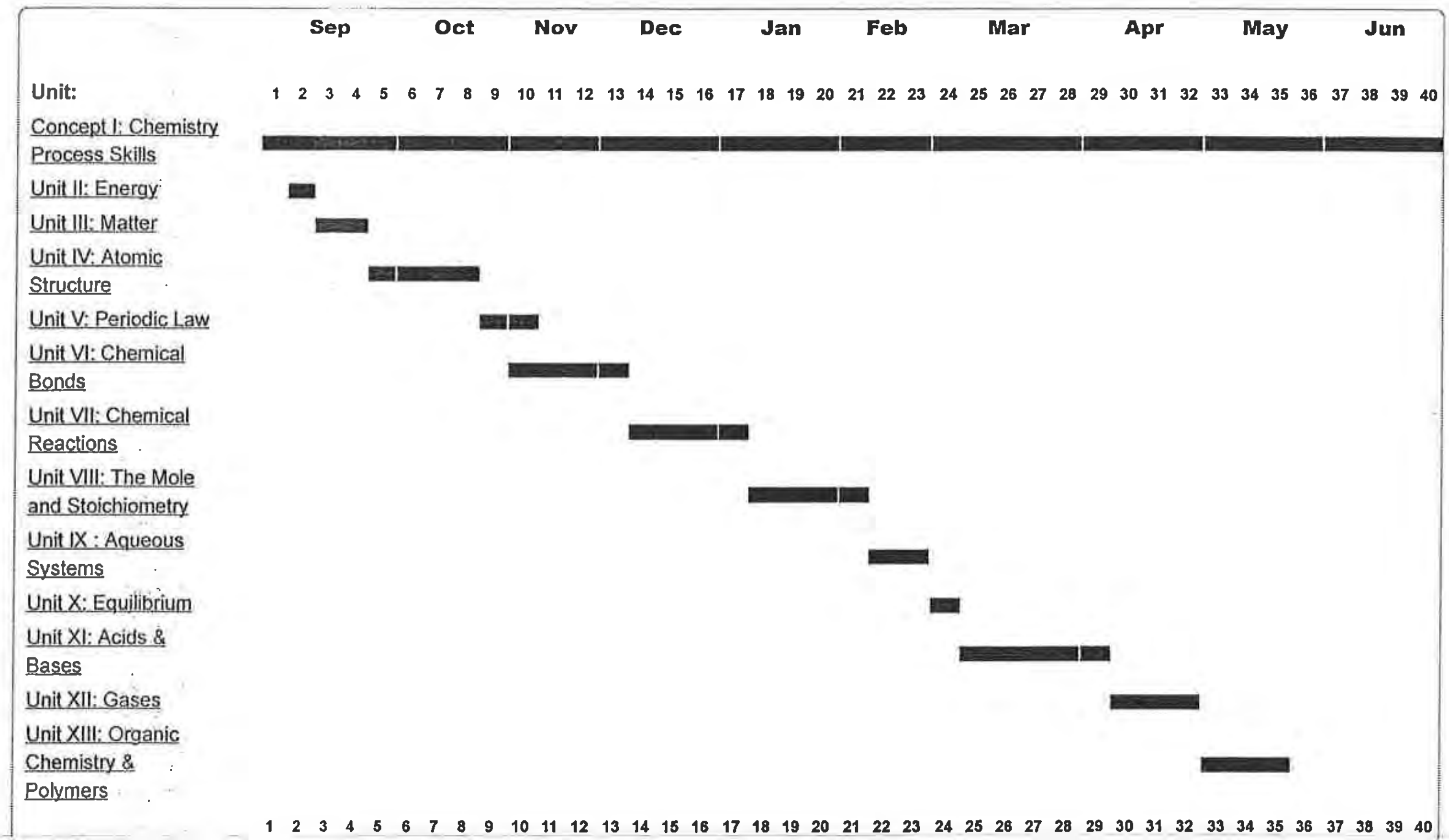
Newtown Public Schools

Chemistry

Newtown High School > High School > Science > Chemistry

Last Updated: Friday, April 10, 2015 by Doreen Merritt

Collaboration



Atlas Version 8.1.1

Unit Planner: Concept I: Chemistry Process Skills
Chemistry
Friday, May 22, 2015, 9:56AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 1 - Week 40

Last Updated: Monday, March 23, 2015 by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

Scientific knowledge must be created and communicated in a logical, common language in order for scientists to globally understand each other and continue developing new discoveries for our world.

Scientific discovery must use safe techniques in the laboratory to not only protect the individual but the environment as well.

Essential Question(s)

- How is scientific knowledge created and communicated?
- How is the safety of the individual and environment protected while obtaining this knowledge?

Guiding Questions

Factual, Conceptual, Provocative

- What logical methods do chemist use to observe and explain natural phenomena?
- How do chemists use previous research to formulate experiments?
- How do chemists record qualitative data?
- How do chemists record quantitative data?
- What equipment is used to measure mass, volume, and temperature?
- Which metric units are common to the above mentioned quantities?
- What are the most important safety considerations while performing chemical experiments?
- What techniques do chemists use to protect their immediate environment and laboratory partners as well as the outdoor environment?
- How do scientists report their findings to their colleagues for critical review?

Standard(s)

Content and CCSS

CT: Science Framework (2005)

CT: Grade 10

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

See STANDARD section. INQ 1- D INQ 10 from CT: Scientific Framework (2005), CT: Grade 10, I. Inquiry

In addition:

D INQ.11 List common metric prefixes and convert between different metric units.

D INQ.12 Explain how to determine which digits in measurements are significant.

findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ1. Identify questions that can be answered through scientific investigation. D INQ2. Read, interpret and examine the credibility and validity of scientific claims in different sources of information. D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions. D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls. D INQ6. Use appropriate tools and techniques to make observations and gather data. D INQ7. Assess the reliability of the data that was generated in the investigation. D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms. D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation. D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic. 	**D INQ.13** Determine the proper laboratory equipment to use for a given task. **D INQ.14** Convert measurements into scientific notation. **D INQ.15** Distinguish between qualitative and quantitative data. **D INQ.16** Explain the difference between accuracy and precision. **D INQ.17** Demonstrate responsible laboratory behavior. **D INQ.18** Wear proper clothing in the laboratory. **D INQ.19** Report any accident or inquiry. **D INQ.20** Handle all chemicals in the appropriate manner. **D INQ.21** Handle glassware and equipment carefully. **D INQ.22** Exercise extreme caution when heating substances. **D INQ.23** Demonstrate proper use of a Bunsen burner.
Content/Topics *Critical content that students must **KNOW*** • Proper design, execution, and reporting	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals.

of a scientific experiment • Metric units and the use of dimensional analysis to convert them • Identification and use of laboratory equipment • Basic laboratory safety rules	• 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving. • 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.
Core Learning Activities • Lab Hazard Poster • Create a hazard video • Skit of Lab Hazards • Reading Instruments Activity • Density Lab	Resources *Professional & Student* **General Teacher Resources:** • Review of Introductory Science Skills • DiStasio,J., Chemistry, Frank Schaffer Publications,. • Teacher's Edition of Text: T.Buthelezi, L. Dingrando, N. Hainen, C. Wistrom, Chemistry. McGraw Hill, Glencoe, 2008. • K. Trivedi, General Chemistry 3.3: An Interactive Multimedia Course on DVD-ROM, 2006 • K. Packard, D. Jacobs, R. Marshall. Chemistry. Pearson AGS Globe, 2007. • K. Packard, D. Jacobs, R. Marshall. Chemistry: Lab Manual. Pearson AGS Globe, 2007. • K. Packard, D. Jacobs, R. Marshall. Chemistry: Student Workbook. Pearson AGS Globe, 2007. ChemWiki:The Dynamic Chemistry E-textbook: http://chemwiki.ucdavis.edu/ **General Student Resources:** • StudentsText: T.Buthelezi, L. Dingrando, N. Hainen, C. Wistrom, Chemistry. McGraw Hill, Glencoe, 2008. • http://phet.colorado.edu/en/simulations/category/chemistry (Interactive Simulations) • K. Packard, D. Jacobs, R. Marshall. Chemistry. Pearson AGS Globe, 2007. ChemWiki:The Dynamic Chemistry E-textbook :

	http://chemwiki.ucdavis.edu/ Specific to Unit • Safety Video – "The Accident at Jefferson High" , https://www.youtube.com/watch?v=PxyDImUYo14(see links) • Flinn's Student Safety Contract • Equipment List https://www.youtube.com/watch?v=PxyDImUYo14

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
CSA_Math_and_Measurement_Quiz_1314 Summative: Written Test Scientific Method, Reading Measurements, Percent Error, Density, Scientific Notation and Metric Conversions are assessed using problem solving. Lab Safety Skit and Video Summative: Dramatization Lab Safety Poster Formative: Visual Arts Project Density of Metals Summative: Lab Assignment Introduction to Chemistry Formative: Written Test A multiple choice formative assessment is given to students so that teachers can determine their students' background knowledge.	Information Literacy Problem Solving Spoken Communication Written Performance	

Unit Planner: Unit II: Energy
Chemistry
Friday, May 22, 2015, 9:57AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 2

Last Updated: Friday, April 10, 2015 by Doreen Merritt

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Energy exists in many forms, and when these forms change energy is conserved.</td></tr>
<tr><td>Essential Question(s)

What is the role of energy in chemical and physical processes?</td><td>Guiding Questions
Factual, Conceptual, Provocative

What is the difference between temperature and heat?

What are the different forms of energy?

How is a quantity of energy determined?

How do exothermic and endothermic processes differ?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grade 9
III. Energy Transfer&Transformation
Strand I: Energy Transformations 9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.
Show details

D 1. Describe the effects of adding energy</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language
Differentiate between the concepts of temperature and heat.
Discriminate between exothermic and endothermic physical and chemical changes.
Interpret the heating and cooling curve of a substance in terms of kinetic and potential energy.
Calculate the specific heat of a substance as a physical property of that substance.
Apply the Law of Conservation of Energy.</td></tr>
</table>

to matter in terms of the motion of atoms and molecules, and the resulting phase changes. D 2. Explain how energy is transferred by conduction, convection and radiation. D 3. Describe energy transformations among heat, light, electricity and motion. 	
Content/Topics *Critical content that students must **KNOW*** • Chemical and physical changes can be exothermic or endothermic. • Energy released or absorbed during a chemical reaction can be represented by a potential energy diagram. • Energy	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

released or absorbed during a chemical reaction (heat of reaction) is equal to the differenc e between the potential energy of the products and the potential energy of the products. • Temperat ure is a measure ment of the average kinetic energy of the particles in a sample of material. Temperat ure is not a form of energy. • The concepts of kinetic and potential energy can be used to explain physical	

processes that include: fusion (melting), solidification (freezing), vaporization (boiling/evaporation), condensation, sublimation, and deposition • Entropy is a measurement of randomness or disorder of a system. A system with greater disorder has greater entropy • Systems in nature tend to undergo changes towards lower energy and higher entropy	
Core Learning Activities	Resources *Professional & Student*

Calorimetry lab Heat vs. Temperature Lab Heating curve Lab Heating curve poster project	**Teacher Resources** • Bill Nye Video: Heat **Students Resources:** • Textbook • American Chemical Society: Science for Kids (http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_TRANSITIONMAIN&node_id=878&use_sec=false&sec_url_var=region1&__uuid=d17eb59e-0e21-4b41-8988-aa2adb549506)

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
CFA Energy Formative: Written Test Energy Test Summative: Written Test Heat vs. Temperature Lab Summative: Lab Assignment Calorimetry Lab Summative: Lab Assignment	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

Unit Planner: Unit III: Matter
Chemistry
Friday, May 22, 2015, 9:57AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 3 - Week 4

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

Matter is categorized by chemists in order to understand and manipulate it in a predictable manner for the use of mankind.

All objects in our world are composed of matter, which have distinct chemical and physical properties.

All matter can be classified as gases, liquids, solids, and plasmas.

Essential Question(s)

- How can categorizing matter be useful?
- When massing the total matter before and after a chemical or physical change, how do these quantities compare?

Guiding Questions

Factual, Conceptual, Provocative

- How is matter categorized based on chemical and physical properties?
- How can different types of matter be changed physically and chemically?
- What are the indicators of a chemical change?
- What are the four phases of matter and their properties on the macro level verses the atomic/molecular level?
- What are the categories of matter on the macro level: elements, compounds, and mixtures?

Standard(s)

Content and CCSS

CT: Science Framework (2005)

CT: Grades 9-12

High School Chemistry

Atomic and Molecular Structure The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure

The position of an element in the periodic table is related to its atomic number.

The periodic table can be

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Compare and contrast the properties of the four phases(states) of matter.
- Distinguish the chemical and physical differences between pure substances and mixtures.
- Differentiate real world items as elements, compounds, homogeneous or heterogeneous mixtures.
- Determine the whether a change is physical or a chemical reaction.
- Identify indicators of chemical reactions.
- Describe several techniques to separate mixtures.
- Explain and apply the Law of Conservation of Mass to an example of a chemical reaction.
- Identify the chemical symbols of the first twenty elements and ten others.
- Distinguish an element as a metal, non-metal, metalloid or noble gas based upon its chemical and physical properties.
- Categorize elements based upon their location on the periodic table and their group names.

Unit Planner: Unit IV: Atomic Structure
Chemistry
Friday, May 22, 2015, 10:01AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 5 - Week 8

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

All matter is composed of fundamental particles called atoms.

Every atom is a fundamental particle of a specific element.

Atoms are further composed of subatomic particles.

An atom's structure determines its physical and chemical properties.

Essential Question(s)

- Who contributed to the development of the atomic model and what were those contributions?
- What is the basic structure of an atom?
- How does an atom's structure determine its location on the periodic table?
- How does an atom's structure determine the physical and chemical properties of the element composed of that atom?

Guiding Questions

Factual, Conceptual, Provocative

- How and during what time periods did Democritus, John Dalton, JJ Thomson, Rutherford, Bohr, and Schrodinger contribute to the current Atomic Model?
- What analogy can you generate to explain these models?
- Where is the nucleus of an atom located and what it's overall charge?
- What are the charges, relative masses, and locations of the major subatomic particles: protons, neutrons and electrons?
- Which subatomic particle determines the atomic number of an element and therefore its identity?
- Which subatomic particles are used to calculate the mass number of an atom?
- How do isotopes of the same element compare to each other?
- How is the average atomic mass of an element determined?
- What is an electron configuration and how is it written?
- How can the electrons in an atom be excited and what happens when they return to ground state?
- How is the knowledge of this quantized energy used in the applied sciences?
- What are possible future implications of this knowledge?
- What are valence electrons and what is their overall importance in chemistry?
- How is an ion formed?

Standard(s)

Content and CCSS

CT: Science Framework (2005)

CT: Grades 9-12

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Identify the contributions of scientists such as: Dalton, Thomson, Bohr, Rutherford and Einstein to Atomic Theory

High School Chemistry Atomic and Molecular Structure The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure The nucleus of the atom is much smaller than the atom yet contains most of its mass. The quantum model of the atom is based on experiments and analyses by many scientists, including Dalton, Thomson, Bohr, Rutherford, Millikan, and Einstein. The electronic configuration of elements and their reactivity can be identified based on their position in the periodic table. Copyright © 2002-2014 State of Connecticut.	• Explain the differences between subatomic particles in terms of location, mass, and charge. • Discriminate the mass number and atomic number of an element based on the number of protons and neutrons in an atom • Calculate the average atomic mass of an element given the masses and ratios of naturally occurring isotopes. • Formulate an element's electron configuration based solely on its atomic number. • Identify an element given its electron configuration. • Predict the subsequent charge of an ion based on the valence configuration of an atom
Content/Topics *Critical content that students must* ***KNOW*** • The atomic theory and its models have evolved throughout history due to the work of many scientists. • Every atom has a nucleus, with an overall positive charge, surrounded by a cloud of negatively charged electrons. • The nucleus consists of protons and neutrons. • The proton is positively charged, the electron is negatively	Skills *Transferable skills that students must be able to* ***DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.

charged and the neutron has no charge.

- The number of protons equals the number of electrons in an electrically neutral atom.
- The number of protons determines the atomic number and the identity of an element.
- The mass of each proton and each neutron is approximately one atomic mass unit. An electron's mass is almost negligible compared to their masses.
- The mass number is the sum of the number of protons and neutrons in an atom.
- Atoms of an element that contain the same number of protons but different number of neutrons are called isotopes of that element.
- The average atomic mass of an element is the weighted average of the masses of its naturally occurring isotopes.
- Bohr diagrams are simplistic models for the location of electrons around the nucleus of an atom.
- When an electron in an atom gains a specific amount of energy the electron is at a higher energy or excited state.
- When an electron returns from an

excited state to a lower energy state or ground state, a specific amount of energy or quantum is emitted. • When the electrons of an element are excited, the quanta they emit upon returning to ground state may be used to identify the element. • These quanta are in the form of EMR and are known as photons • An electron's energy in an atom is identified by four quantum numbers that refer to its Principal Energy, sub-level, orbital and spin. • Electron configurations depict the location of electrons in an atom. • An element's electron configuration correlates to its location on the periodic table. • Elements are arranged into s, p, d, and f blocks representing the atom's sublevel of energy being filled with valence electrons. • The formation of an ion occurs when an atom gains or loses valence electrons.	
Core Learning Activities • Development of the Atomic Model: A Children's Book • Isotope Lab: Pennium or Candium	Resources *Professional & Student* **Teacher Resources:** • PBS Nova: Fire Works • PBS Nova: Kaboom!

- Illustrate Electron Arrangements of Various Elements using Bohr Models
- Atomic Model Web Quest: Electron Arrangement
- Flame test Lab
- Spectroscopy Lab
- Mystery Element Project

- Fireworks: Webquest--Kaboom! www.pbs.org/wgbh/nova/kaboom
- PBS Nova: Fabric of the Cosmos: Quantum Leap, http://www.pbs.org/wgbh/nova/physics/fabric-of-cosmos.html
- Bill Nye: Atoms and Molecules
- Bill Nye: Light and Color
- http://www.chem1.com/acad/webtext/intro/AT.html (Atom)
- http://www.discoveryeducation.com/, Video: Atom: Clash of the Titans
- http://www.cabrillo.edu/~jmccullough/Physics/Particles_Waves.html

Students Resources:

- ChemWiki: Atomic Theory: http://chemwiki.ucdavis.edu/Physical_Chemistry/Atomic_Theory
- ChemWiki: Electron Configurations: http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Electronic_Configurations
- http://www.falstad.com/qmatom/(Orbital)
- http://www.chemguide.co.uk/atoms/properties/elstructs.html#top
- http://elements.wlonk.com/Orbitals.pdf (Atomic Orbitals)
- Chemical Bonding (http://www.visionlearning.com/library/module_viewer.php?mid=55)
- For Atomic Structure Web Quest: Electron Arrangement
- http://www.chemguide.co.uk/atoms/properties/orbitsorbitals.html
- http://www.chemguide.co.uk/atoms/properties/atomorbs.html#top
- http://ucatbraucht.wordpress.com/chemistry/the-periodic-table
- http://www.learner.org/interactives/periodic/elementary3.html
- http://www.learner.org/interactives/periodic/elementary2.html
- http://www.hobart.k12.in.us/ksms/PeriodicTable/energy%20levels.htm
- http://www.learner.org/interactives/periodic/periodic_table.html
- http://web.gccaz.edu/~ksmith8/rev130_files/workch5.pdf

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Development of the Atomic Model: A Children's Book Formative: Other written assessments **Performance Assessment:** Students will research the work of different scientists	Information Literacy Problem Solving Spoken Communication Written Performance	

and construct a children's book that traces the development of the atomic model. This book's target audience is middle-school aged students and its goal is to inform and interest students in science. Using both words and illustrations the book will describe the experiments conducted and models proposed by key scientists. Students will demonstrate their understanding of each model by creating an original analogy that compares the model to something familiar to the reader. Atomic Structure Formative: Written Test Mulitiple choice assessment with one short answer question. Isotope Lab Formative: Lab Assignment Pennies from before and after 1982 are counted and massed in the manner of finding a weighted average to: 1. Demonstrate the mathematics for both		

typical averaging and weighted averaging produce the same results. 2. Demonstrate that weighted averaging is used because atoms of isotopes for an element are too small to mass and count individually. Atomic Structure Summative: Written Test Flame Test Lab Formative: Lab Assignment Flame tests of metallic ions are performed as standards in order to determine metallic ions in unidentified solutions. Electron Structure CFA Formative: Written Test Mulitiple choice assessment with one short answer question. Spectroscopy Lab Formative: Lab Assignment Spectroscopes are used to view quantized visible light energy emitted from ionized gas tubes. Fluorescent lighting is a practical application using quantized light		

energy. Electron Structure Summative: Written Test		

Unit Planner: Unit VI: Chemical Bonds
Chemistry
Friday, May 22, 2015, 10:05AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 10 - Week 13

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

Atoms join together to form compounds or elemental molecules through chemical bonding.

Chemical bonding occurs between the valence electrons of one atom and the nuclei of another atom OR between positive and negative atoms to form a stable electron configuration.

Forming chemical bonds releases energy into the environment and breaking bonds requires energy.

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
• How are compounds and molecules named and represented by chemical formulas? • How do atoms join together to form compounds, elemental molecules . or metals? • Why do atoms join together to form compounds, elemental molecules or	• How are ionic compounds named and how are their formulas written? • How are binary molecules named and their formulas written? • What are the seven common elemental diatomic molecules? • What are the names and formulas of common molecules? • How many electrons will a metal lose to form a positive ion? • How many electrons will a non-metal gain to form a negative ion? • How do metals and non-metals combine to form an ionic bond that result in ionic compound? • How do non-metals share electrons to form covalent bonds and resulting covalent compounds or elemental molecules? • How do metal atoms bond to form metallic bond and resulting metal solids?

metals? • How do bond types predict the physical and chemical properties of their resulting solid type? • What causes individual molecules to interact with each other to form liquids and solids?	
Standard(s) *Content and CCSS* **CT: Science Framework (2005)** **CT: Grades 9-12** **High School Chemistry** Chemical Bonds Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms	Objective(s) Bloom/ Anderson Taxonomy / DOK Language • Name ionic and covalent compounds given formulas. • Write formulas given ionic and covalent compounds' names. • Classify a bond as ionic, covalent, or metallic based upon the presence of metals or nonmetals. • Apply the octet rule in order to predict bonding types. • Demonstrate ionic and covalent bonding using Lewis/Electron dot structures representing valence electrons. • Distinguish between non polar covalent and polar covalent bonds in molecules. • Predict the polarity of a molecule. • Categorize solids as metallic,ionic, molecular, or molecular network solids based on physical and chemical properties. • Infer the strength of Intermolecular forces of various covalent compounds based upon their physical and chemical properties.

and molecules Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds. Chemical bonds between atoms in molecules such as H2, CH4, NH3, H2CCH2, N2, Cl2, and many large biological molecules are covalent. Salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction. The atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form. Lewis dot structures can provide models of atoms and molecules.	

The shape of simple molecules and their polarity can be predicted from Lewis dot structures. Electronegativity and ionization energy are related to bond formation. Solids and liquids held together by van der Waals forces or hydrogen bonds that affect their volatility and boiling/melting point temperatures. Organic Chemistry and Biochemistry The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life. The bonding characteristics of carbon result in the formation of a large variety of structures, ranging from simple hydrocarbons to	

complex biological molecules and synthetic polymers. 	
Content/Topics *Critical content that students must **KNOW*** • Naming and formula writing of ionic compounds, binary covalent compounds, and common molecular names. • The seven most common diatomic molecules are: hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine, and iodine. • Atoms bond with each other to obtain a stable noble gas valence electron configura	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

tion. • Since Noble gases have stable valence configurations they generally do not bond with other atoms. • Metals often bond with non-metals that form ionic compounds. Nonmetals react with other nonmetals to form covalent compounds. Ionic compounds containing polyatomic ions have both ionic and covalent bonding. • Chemical bonds are formed when valence electrons are: transferred from one atom	

to another (ionic), shared between atoms (covalent), or are mobile within a metal (metallic). • Lewis dot or Electron dot diagrams can represent the valence electron arrangement in elements, compounds, and ions. • The electronegativity difference between two bonded atoms is used to determine bond type and its polarity if covalent. • Molecular polarity is determined by the shape of the molecule and	

distribution of unshared pairs of electrons. • Intermolecular forces, created by the unequal distribution of electrons, result in varying strengths of attraction between molecules. • The strength of intermolecular forces determine physical properties of molecules such as: boiling point, melting point, and aqueous solubility.	
Core Learning Activities • Paper Ionic Formula Writing Activity • Heat Treatmen	Resources *Professional & Student* **Teacher Resources:** PBS NOVA: Secrets of the Viking Sword: http://www.pbs.org/wgbh/nova/ancient/secrets-viking-sword.html PBS NOVA: Secrets of the Samaurai Sword:

t of Steel in Bobby Pins Experiment • Alloys: The "Golden" Penny Lab • Comparing the Physical Properties of Various Pure Substances (computer research) • Comparing Ionic and Molecular Compounds Lab • Molecular Model Building	http://www.pbs.org/wgbh/nova/ancient/secrets-samurai-sword.html **Student Resources:** ChemWiki: Nomenclature of Inorganic Compounds: http://chemwiki.ucdavis.edu /Physical_Chemistry/Quantum_Mechanics/Atomic_Theory/Chemical_Compounds /Nomenclature_of_Inorganic_Compounds ChemWiki: Introduction to Chemical Bonding: http://chemwiki.ucdavis.edu/Physical_Chemistry/Quantum_Mechanics/Atomic_Theory/Chemical_Compounds/Introduction_to_Chemical_Bonding Handbook of Chemistry and Physics **Link to Physical Constants of Inorganic Compounds:** http://www.slac.stanford.edu/BFROOT/www/Detector/Backgrounds/BkG4Sim/Planning/Validations/neutronCounters/04_02_85.pdf **Link to Physical Constants of Organic Compounds:** http://orgchem.colorado.edu/Technique/Cheminfo/Physdata.pdf ChemWiki: Molecular Geometry: http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Molecular_Geometry Lewis Structures: http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/lewis.html

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Comparing the Physical Properties of Various Pure Substances Formative: Technology Project Students, as individuals or in teams	Information Literacy Problem Solving Spoken Communication Written Performance	History and technology: Viking steel and Japanese Samaurai steel are studied in the context of their time period.

of two, research the physical properties of pure substances with various bond types using research websites. The physical properties compared are density, boiling and melting points, & dissolving abilities. Elements: metals, and molecules Ionic compounds Covalent compounds Heat treatment of Steel Formative: Lab Assignment After hardening, annealing and		

tempering steel bobby pins, students compare their springiness and ability to bend. They then connect these properties to the steel's crystalline structure on the atomic/molecular level. Paper Ionic Formula Writing Activity Formative: Other written assessments Students use anion and cation cut-outs sized proportionally to their charges and match them to form electronically neutral ionic compounds. Students		

then write the compounds formula and name. Bonding Test Summative: Written Test Naming and Formula Writing of Ionic Compounds Summative: Written Test After initial instruction in ionic compound nomenclature, students will be given a series of quizzes, of comparable difficulty, each comprising ten ionic formulas to be named, at least two of which will contain multivalent metals (e.g. iron (II), iron		

(III), copper (I), copper (II)). and ten ionic compound names for which students **will** write **formulas.** Again at least two of which will contain multivalent metals. All chemistry teachers administer ten common summative assessments from this point on in the year.The quizzes will be differentiated by level in terms of number of multivalent ions included and resources used (ex, Periodic tables with or without names, ionic charges and polyatomic		

ions).		

Atlas Version 8.1.1

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Unit Planner: Unit VII: Chemical Reactions
Chemistry
Friday, May 22, 2015, 10:06AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 14 - Week 17

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

The bonds in matter are broken during a chemical reaction and new bonds are formed to produce new substances.

The mass of matter before and after a chemical reaction is the same.

Energy is required to break bonds and released when bonds are formed; therefore, every chemical reaction has a net change in energy though the energy of the system is conserved.

Balanced chemical equations are used to represent chemical reactions.

The rate of a chemical reaction can be affected by different factors that effect the number of effective collisions between reactants.

Essential Question(s)

- How does matter chemically react to form new substances?
- In order to be useful, how can these reactions be predicted?
- How do chemists write out these reactions in order to have a universal means of

Guiding Questions

Factual, Conceptual, Provocative

- Review: What are the indicators of a chemical change or reaction?
- What do the coefficients in a balanced equation represent?
- What occurs during a synthesis reaction and how can it be recognized?
- What occurs during a decomposition reaction and how can it be recognized?
- What occurs during a single replacement reaction and how can it be recognized?
- Given a possible single replacement reaction, how can you predict if it will occur?
- What occurs during a double replacement reaction and how can it be recognized?
- Why must the reactants in a double replacement reaction be aqueous?
- Given a possible double replacement reaction, how can you predict if it will occur?
- During the complete combustion of a hydrocarbon, what is the other reactant and what are the products?
- How does collision theory explain why the rate of a reaction can vary?
- How do increasing the amount of a reactant, the surface area of a reactant, and the temperature of a system affect the rate of effective collisions and the subsequent rate of a chemical reaction?
- What is the enthalpy of a reaction?
- How can the Energy changes of a reaction's progress be graphically represented?

communicating their research and applications of these reactions? • What happens on the molecular level during a chemical reaction? • How can chemical reactions be sped up or slowed down?	
Standard(s) *Content and CCSS* **CT: Science Framework (2005)** **CT: Grades 9-12** **High School Chemistry** Conservation of Matter and Stoichiometry The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and	Objective(s) Bloom/ Anderson Taxonomy / DOK Language • Given the formulas of reactants and products, balance chemical equations. • Write a balanced equation from a word equation. • Create and use models of representative particles to demonstrate balanced equations. • Compare and differentiate between types of chemical reactions. • Predict the products of a chemical reaction based on the reactants. • Apply collision theory to explain how various factors, such as temperature, surface area, and concentration influence the rate of reaction. • Interpret potential energy diagrams: Potential Energy of reactants and products, activation energy (with or without catalyst), heat of reaction. • Analyze the effect of a catalyst/inhibitor on a reaction.

reactants. Chemical reactions can be described by writing balanced equations. Reaction Rates Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. The rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time. Reaction rates depend on such factors as concentration, temperature and pressure. Copyright © 2002-2014 State of Connecticut.	
Content/Topics *Critical content that students must KNOW* • In all chemical reactions mass and energy are conserved . • A balanced	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

chemical equation represents the conservation of matter and its atoms. • The coefficients in a balanced chemical equation represent the number of representative particles of a pure substance or the moles of that substance. • Types of chemical reactions included synthesis, decomposition, single replacement, double replacement, and combustion. • The Activity Series of Elements is used to predict single replaceme	

nt reactions. • A solubility table for ionic compounds in water is used to predict double replacement reactions. • During the complete combustion reaction of a hydrocarbon, oxygen is a reactant while carbon dioxide and water are products. Energy is released. • The rate of a reaction is measured in terms of the quantity of a product formed or the quantity of a reactant used up per unit	

of time. • For reactions to occur the reactants must have the correct orientation and sufficient energy to collide in order to form an activated complex. • To increase the rate of a reaction, the number of effective collisions must increase. • The rate of a reaction depends on the nature of the reactants, the concentration of the reactants, the surface area of the reactants, the temperature, and whether a	

catalyst or inhibitor is present. • A catalyst increases the rate of a reaction by lowering its activation energy by changing the reaction's pathway. • The enthalpy of a reaction is the Energy difference between the enthalpy of the reactants and the enthalpy of the products. • If the potential energy of the reactants is less than the potential energy of the products, the reaction is endothermic and the sign of the	

<table>
<tr>
<td>enthalpy value is positive.
• If the potential energy of the reactants is greater than the potential energy of the products, the reaction is exothermic and the sign of the enthalpy value is negative.</td>
<td></td>
</tr>
<tr>
<td>Core Learning Activities

• Activity Series of Metals Lab
• Creating a Solubility Table using double replacement reactions
• Obtaining Copper from a copper ore: copper (II) carbonate or copper (II) oxide</td>
<td>Resources
Professional & Student

Teacher Resources:

• http://seattlecentral.edu/faculty/mvillarba/CHEM121/Chapter05.pdf (Chemical Reaction Overview)
• Bill Nye Chemical Reactions Movie
• PBS NOVA: Kaboom!
• Demonstrations:

-sacrificing a Gummy Bear(decomposition)

-burning magnesium ribbon (synthesis/combustion)

-whoosh bottle(combustion)

-decomposition of hydrogen peroxide with/with-out a catalyst(rate)

-surface area & Burning steel wool(rate)

Hyperphysics Heat and Thermodynamics: http://hyperphysics.phy-astr.gsu.edu/hbase/heacon.html#heacon

Enthalpy:</td>
</tr>
</table>

• Classification of Chemical Reactions Experiment • Factors that Affect the Rate of a Chemical Reaction Lab	http://chemwiki.ucdavis.edu/Physical_Chemistry/Thermodynamics/State_Functions/Enthalpy **Student Resources:** • http://www.hccsc.k12.in.us/huntingtonnorth/perkins/Website%20Update/Gen%20Chem/Chemical%20Reactions.ppt#256,1,Chemical Reactions (PowerPoint - Chemical Reactions)

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Activity Series of Metals Formative: Lab Assignment Using deductive reasoning, students derive their own Activity Series for copper, zinc, magnesium, silver, and sodium. They place the first four metals listed above in six aqueous solutions containing all of the respective	Information Literacy Problem Solving Spoken Communication Written Performance	

metal ions. Students write chemical equations for the single replacement reactions. Creating a Solubility Table Formative: Lab Assignment Students w mix together different aqueous ionic compounds, predict the products and determine whether or not a double displacement reaction occurred. Based on their results, they create a solubility table. Balancing Equation Quiz Summative: Written		

Test Chemical Reaction Test Summative: Written Test Students must be able to identify all major reaction types. Students use the Activity Series and Solubility Tables to predict, write, and balance Single and Double Replacement reactions. Students must also predict and balance hydrocarbon combustion reactions. Students write and balance a word equation. Classifying Chemical Reactions Lab Summativ		

e: Lab Assignment Students perform eight chemical reactions, recording detailed observations. For certain reactions students use standard tests to help them to identify products of that reaction. Students identify the type of each reaction, then proceed to write a word equation for each. Students write final balanced equations for the chemical reactions they observed.		

Unit Planner: Unit VIII: The Mole and Stoichiometry
Chemistry
Friday, May 22, 2015, 10:55AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 18 - Week 21

Last Updated: Friday, April 10, 2015 by Christopher Carley

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

The amounts of reactants and products in a chemical reaction can be determined quantitatively.</td></tr>
<tr><td>Essential Question(s)

How does matter chemically react to form predictable amounts of new substances?</td><td>Guiding Questions
Factual, Conceptual, Provocative
Why are chemical equations balanced?
What is the molar mass of a substance?
How is the mass, quantity, or volume of a substance in a reaction calculated based upon the mass, quantity, or volume of another substance?
How do relative amounts of reactants determine which are limiting the process and which are in excess?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grades 9-12
High School Chemistry
Conservation of Matter and Stoichiometry The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants.
Chemical reactions can be described by writing balanced equations.
The quantity one mole is set by defining one mole of carbon-12 atoms to have a mass of exactly 12 grams.
One mole equals 6.02.x 1023 particles (atoms or molecules).
The molar mass of a molecule can be determined from its chemical formula and a table of atomic masses
The mass of a molecular substance can be converted to moles, number of particles, or volume of gas at standard temperature and pressure.
Copyright © 2002-2014 State of Connecticut.</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language
Construct balanced equations by applying the law of conservation of matter.
Calculate the molar mass of a substance based on its formula.
Calculate the mass, quantity, or volume of a substance in a reaction based upon the mass, quantity, or volume of another substance.
Compare relative amounts of reactants to determine which are limiting the process and which are in excess.</td></tr>
<tr><td>Content/Topics</td><td>Skills</td></tr>
</table>

*Critical content that students must **KNOW***

- The mole is 6.022×10^{23} representative particles of a substance: atoms, molecules, formula units.
- The mass of one mole of a substance is the molar mass of that substance.
- Stoichiometry is the calculations of quantities in chemical reactions.

*Transferable skills that students must be able to **DO***

- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
- 7. Other.

Write and balance chemical reaction equations

Core Learning Activities

- Calculating the Percent Mass of Water in a Hydrate Lab
- Decomposition of Baking Soda(Stoichiometry Lab)
- Production of Calcium Carbonate(Stoichiometry Lab)
- Percent Mass of Water in Popcorn(Inquiry: Problems)

Resources

Professional & Student

Teacher Resources:

- http://phet.colorado.edu/en/simulation/reactions-and-rates

Students Resources:

- http://www.moleday.org/ (MOLE DAY)

Assessments (Titles)

CFA -Stoichiometry
Formative: Written Test

Pretest to assess student content knowledge.

Lab -Calculating the percent mass of copper in copper(II) oxide
Summative: Lab Assignment

Students experimentally determine the percentage of an element found in a compound sample.

Unit test
Summative: Written Test

Summative test to conclude the unit

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Problem Solving

Interdisciplinary Connections

Unit Planner: Unit IX : Aqueous Systems
Chemistry
Friday, May 22, 2015, 10:56AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 22 - Week 23

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

The shape and polarity of the water molecule contribute to its remarkable properties.

Water can dissolve a wide variety of solutes to form solutions.

Essential Question(s)

How does the solution process occur and what factors influence it?

Guiding Questions
Factual, Conceptual, Provocative

- What attributes of the water molecule give it its unique chemical and physical properties?
- How do substances dissolve other substances?
- What determines the solubility of a substance?

Standard(s)
Content and CCSS

CT: Science Framework (2005)
CT: Grades 9-12
High School Chemistry

Chemical Bonds Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules

The shape of simple molecules and their polarity can be predicted from Lewis dot structures.

Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

- Illustrate a Lewis Diagram of a water molecule.
- Evaluate the polarity of the hydrogen – oxygen bonds in water.
- Compare the unique properties of water to substances such as alcohols, oils, and other nonpolar substances.
- Prepare a solution with a specific concentration.
- Prepare dilutions from a stock solution.
- Calculate the concentration of a solution.
- Compare, quantitatively and qualitatively, the degree to which different solutes affect solubility.
- Predict the amount of a solute that will dissolve in water at a given temperature through the use of a solubility curve.

Content/Topics
Critical content that students must ***KNOW***

- Unequal charge distribution makes water a polar molecule.
- Water molecules are attracted and held together

Skills
Transferable skills that students must be able to ***DO***

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

by strong intermolecular forces called hydrogen bonds. • The capacity of water molecules to form hydrogen bonds results in such properties as high surface tension, high heat capacity, low vapor pressure, and low density as a solid. • A solution is a homogenous mixture of a solute and water. • The solubility of a solute in water is dependant on their temperature and pressure, and the chemical nature of the solute. • Properties of water (colligative properties), such as boiling point, freezing point, and vapor pressure can be affected by the presence of solutes. • Aqueous solutions can be electrolytes or nonelectrolytes depending on the nature of the solute. • The concentration of a solution can be expressed as molarity (M), percent by volume, percent by mass, and parts per million (ppm).	
Core Learning Activities • Factors that Affect Solublity (Rates of Solubility) Experiment • Cold Pack Experiment(Inquiry Lab) • Dilution Experiment (using the Spec-20)	Resources *Professional & Student* **Teacher Resources:** • http://phet.colorado.edu/en/simulation/soluble-salts (Interactive Simulations - Solutions) • http://phet.colorado.edu/en/simulation/reversible-reactions **Students Resources:** • http://webclass.lakeland.cc.il.us/iali/CHM151Folder/Tro12Solutions

	.pdf (Aqueous Solutions) http://www.chemistry.nmsu.edu/studntres/chem116/notes/solutions.html

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
CFA -Aqueous systems Formative: Written Test Pretest to assess student knowledge. Lab -Cold Pack Summative: Lab Assignment Students experimentally determine which of a selection of different salts makes the most ideal cold pack when dissolved in water. Unit test Summative: Written Test End of unit test for aqueous systems.	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

Unit Planner: Unit X: Equilibrium Chemistry
Friday, May 22, 2015, 10:57AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 24

Last Updated: Friday, April 10, 2015 by Christopher Carley

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

The rate of a chemical reaction is altered by changes in concentrations, temperature, and pressure.

In an aqueous system at chemical equilibrium, the rates of the forward and reverse reactions are equal.

Essential Question(s)

How does the solution process occur and what factors influence it?

What factors influence the rate of a process?

Guiding Questions
Factual, Conceptual, Provocative

- What factors cause a dynamic equilibrium to occur?
- How do external factors influence and change a dynamic equilibrium?

Standard(s)
Content and CCSS

CT: Science Framework (2005)
CT: Grades 9-12
High School Chemistry

Reaction Rates Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules.

The rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

Reaction rates depend on such factors as concentration, temperature and pressure.

Equilibrium is established when forward and reverse reaction rates are equal.

Catalyst plays a role in increasing the reaction rate by changing the activation energy in a chemical reaction.

Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

- Predict the change in equilibrium due to changes in temperature, pressure, and concentration.
- Contrast the concentration of particles and rates of opposing reactions in an equilibrium system.
- Propose equilibrium shifts for reversible reactions based upon Le Chateliers' principle.

<table>
<tr>
<td>Content/Topics
Critical content that students must KNOW

• In many chemical reactions in closed systems, products also act as reactants. These are called reversible reactions.
• Some chemical reactions can reach equilibrium.
• At equilibrium the rate of the forward reaction equals the rate of the reverse reaction. The measureable quantitites of reactants and products remain constant at equilibrium.
• The position of a chemical equilibrium can be expressed as a ratio of product concentration to reactant concentration. This is the K_{eq} value.
• Le Chatelier's Principle predicts how a change to temperature, pressure, and concentration for a chemical system in equilibrium will affect the position of the equilibrium.</td>
<td>Skills
Transferable skills that students must be able to DO
• 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
• 2. Work independently and collaboratively to solve problems and accomplish goals.
• 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.</td>
</tr>
<tr>
<td>Core Learning Activities

• Reaction Rate Factors Lab
• Potential Energy Diagrams Analysis
• Penny Equilibrium
• Le Chatelier's Principle Experiment</td>
<td>Resources
Professional & Student

Teacher Resources:

• http://phet.colorado.edu/en/simulation/soluble-salts (Interactive Simulations - Solutions)
• http://phet.colorado.edu/en/simulation/reversible-reactions

Students Resources:

• http://webclass.lakeland.cc.il.us/iali/CHM151Folder/Tro12Solutions.pdf (Aqueous Solutions)
• http://www.chemistry.nmsu.edu/studntres/chem116/notes/solutions.html (Solutions)</td>
</tr>
</table>

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
CFA -Equilibrium Formative: Written Test Pretest to determine students' content knowledge. Unit test Summative: Written Test Summative test on equilibrium content Lab -Le Chatelier's Principle Summative: Lab Assignment Laboratory write-up for the conceptual relationship of Le Chatelier's principle in chemical equilibria. Lab -Reaction Rate Factors Summative: Lab Assignment Laboratory experiment where students test how various factor affect the rate at which a reaction occurs. Quiz -Reaction rates Summative: Written Test Quiz on reaction rates and catalysts.	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

Unit Planner: Unit XI: Acids & Bases
Chemistry
Friday, May 22, 2015, 10:58AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 25 - Week 29

Last Updated: Monday, March 23, 2015
by Linda aGejda

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Acids and bases are defined by their ability to change concentrations of hydrogen and hydroxide ions.

Acids and bases react with each other in neutralization reactions.</td></tr>
<tr><td>Essential Question(s)

What is the chemical behavior of acids and bases?</td><td>Guiding Questions
Factual, Conceptual, Provocative

• How are acids and bases structurally and chemically different?
• How do acids and bases interact with eachother in a neutralization process?
• How is the pH of a solution determined?
• What impacts result from changing the pH of a solution?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grades 9-12
High School Chemistry
Conservation of Matter and Stoichiometry The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants.
Chemical reactions can be described by writing balanced equations.
The mass of a molecular substance can be converted to moles, number of particles, or volume of gas at standard temperature and pressure.
Copyright © 2002-2014 State of Connecticut.</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

• Identify acids and bases based on properties and chemical formulas
• Write reactions for Arrhenius and Bronsted-Lowry acids and bases.
• Calculate pH, pOH, $[OH^-]$, and $[H^+]$ for a variety of acid – base values.
• Differentiate between a conjugate acid and base in a Bronsted Lowry reaction.
• Write equations and predict products for neutralization (acid-base) reaction.
• Calculate the unknown concentration of an acid or base by performing a titration in the laboratory.</td></tr>
</table>

Content/Topics *Critical content that students must **KNOW***	Skills *Transferable skills that students must be able to **DO***
• The Arrhenius theory of acids and bases explains many behaviors of acids and bases. • In the Brønsted-Lowry theory of acids and bases, acids are proton donors and bases are proton acceptors. • Increasing H^+ concentrations decreases OH^- concentrations and vice-versa. • pH is an inverse measure of hydrogen ion concentration. Acids have a lower pH because they increase H^+ concentrations, while bases have a higher pH because they increase OH^- concentrations. • The products of a neutralization reaction are water and a salt. • The salt is formed from the anion of an acid and the cation of a base. • Titration is a laboratory process in which a volume of solution of known concentration is used to determine the concentration of another solution.	• 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

• An indicator is a chemical that changes color in response to changes in pH.	

Core Learning Activities	Resources *Professional & Student*
• Titration / Neutralization Reaction Experiment(oxalic acid) • pH Calculations of Various Household Items Experiment • Indicators Experiment • Dilutions and pH Calculations • Percentage of Acetic Acid in Vinegar	**Teacher Resources:** • http://www.chem1.com/acad/webtext/abcon/index.html (Acids and Bases) • http://phet.colorado.edu/en/simulation/ph-scale (Interactive Simulations - pH) **Students Resources:** • http://www.files.chem.vt.edu/RVGS/ACT/notes/Notes_on_acids_and_bases.html (Acids and Bases) • http://pa016.k12.sd.us/Chapter%2020.ppt#284,1,Chapter 20 Acids and Bases (Power Point - Acids and Bases)

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
CFA -Acids and Bases Formative: Written Test Pretest to determine students' content knowledge. Lab -Titration of vinegar Summative: Lab Assignment Students use an acid-base titration to experimentally determine the percentage of acetic acid in store-bought	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

vinegar. Unit test Summative: Written Test End of unit test on acids and bases.		

Unit Planner: Unit XII: Gases
Chemistry
Friday, May 22, 2015, 11:01AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 30 - Week 32

Last Updated: Friday, April 10, 2015 by Doreen Merritt

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)

Gas is a state of matter that can expand, be compressed, diffuse, and exert pressure because its particles ideally have negligible volume compared to the space between them and

because these particles are constantly moving in random directions, colliding elastically.

Equal volumes of different ideal gases at the same constant temperature and pressure, contain the same number of particles.

The behavior of any ideal gas may be described algebraically:

-rates of diffusion/effusion between gases may be compared

-a gas mixture's total pressure predicted

-the new pressure, volume or temperature (Kelvin) of an amount of gas predicted

-the product of the volume and pressure is a constant for a given amount of an ideal gas at a constant temperature.

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
How does an ideal gas behave according to the kinetic-molecular theory? How do different gaseous substances respond similarly to changes in pressure, temperature, volume, and number of particles? How are the relationships between the	• Understand the Kinetic-molecular theory as applied to the gaseous state of matter • Apply the kinetic-molecular theory to explain the changes in pressure, volume, and temperature of a gas in terms of the molecules themselves. • Under what conditions does a real gas behave like an ideal gas? • How is gas pressure measured and applied to gas mixtures? • How is the rate of effusion or diffusion affected by a gas's mass? • How can a gas mixture's pressure be determined given the partial pressures of the mixture's components? • For a given amount of gas; how does changing one variable: pressure, temperature, or volume affect the other two? • Can the number of gas particles be related to the pressure, temperature, and volume of an idea gas?

number of particles, pressure, volume and temperature of a gas be expressed algebraically?	
Standard(s) *Content and CCSS* **CT: Science Framework (2005)** **CT: Grades 9-12** **I. Inquiry** SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the	Objective(s) Bloom/ Anderson Taxonomy / DOK Language • Understand the kinetic-molecular theory as applied to a gas and its pressure, volume and temperature. • Explain what causes gas pressure and how it is measured. • Convert temperatures in degrees Celsius to Kelvin in order to solve gas law problems. • For a given amount of an ideal gas,understand the relationships between pressure, temperature, and volume when one is held constant and the other two are manipulated. • Algebraically apply Boyle's Law, Charles's Law, and the Combined Gas Law with regards to changing the pressure, temperature and/or volume of a given amount of gas. • Explain the Ideal gas Law. • Solve problems using the Ideal gas law. • Explain Dalton's Law of Partial Pressure and give an example. • Solve problems using Dalton's Law of Partial Pressure. • Predict the diffusion rate of gases using Graham's Law.

ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls. D INQ6. Use appropriate tools and techniques to make observations and gather data.	

High School Chemistry Conservation of Matter and Stoichiometry The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. One mole equals 6.02.x 1023 particles (atoms or molecules). Copyright © 2002-2014 State of Connecticut.	
Content/Topics *Critical content that students must* ***KNOW*** • Ideal gases behave according to the Kinetic-molecular theory which states that all gas particles: -are in constant, random, straight-line motion. -are so small that the empty space that separates them is measured as the gas's	Skills *Transferable skills that students must be able to* ***DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

volume -have no attractive forces between them -have elastic collisions with each other • The Kinetic-molecular theory explains the relationships of the pressure, volume, and temperature of a gas with the velocity, and frequency and force of collisions among its molecules. • A real gas is most like an ideal gas at low pressures and high temperatures. • Avogadro's Principle states that equal volumes of gases at the same temperature and pressure contain an	

equal number of particles. • Boyle's law states that at a constant temperature and amount, the volume of a gas is inversely proportional to its pressure. • Charles's Law states that at a constant pressure and amount, the volume of a gas is directly proportional to it's temperature. • Gay-Lussac's Law states that at a constant volume and amount, the pressure of a gas is directly proportional to its Kelvin temperature. • The Combined Gas Law is an algebraic statement	

combining Boyle's, Charles's, and Gay-Lussac's Laws • The Ideal Gas Law relates the number of moles of a gas with its pressure, temperature, and volume using a constant. For a given amount of gas at a constant temperature, the product of its pressure and volume is a constant. • Graham's Law states that the rate of diffusion of a gas is inversely proportional to the square root of its molar mass. • Dalton's Law of partial pressure states that the total pressure of a gas mixture is equal to the sum of the	

partial pressures of the gases in the mixture.	

Core Learning Activities	Resources *Professional & Student*
Boyle's Law Lab Charles's Law Lab Ideal Gas Law Lab Graham's Law Lab	**Teacher Resources:** • Virtual Chemistry Experiments (http://www.chm.davidson.edu/vce/index.html) • Demonstrations: crush the can balloon falls into beaker bell jar blows up "peeps" and balloons gas diffusion: Graham's Law with HCl and NH_4Cl **Students Resources:** • Gas Laws (http://legacyweb.chemistry.ohio-state.edu/betha/nealGasLaw/) • Virtual Gas Law Experiments (http://www.chm.davidson.edu/vce/gaslaws/index.html) • ChemWiki: Gases: http://chemwiki.ucdavis.edu/Physical_Chemistry/Physical_Properties_of_Matter/Phases_of_Matter/Gases

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Gas Laws CFAs Formative: Written Test Multiple choice questions. Gas Laws Summative: Written Test Boyle's Law	Information Literacy Problem Solving Spoken Communication Written Performance	

Formative: Lab Assignment Students graph the relationship between pressure and volume by measuring the volume of air in a syringe as books are added.		

Unit Planner: Unit XIII: Organic Chemistry & Polymers
Chemistry
Friday, May 22, 2015, 11:03AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 33 - Week 35

Last Updated: Friday, April 10, 2015 by Doreen Merritt

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Organic compounds differ from inorganic compounds.

Hydrocarbons are compounds that only contain carbon and hydrogen.

Functional groups impart distinctive physical and chemical properties to organic compounds.</td></tr>
<tr><td>Essential Question(s)

What are organic compounds?

What are the chemical structure of organic compounds?

How do organic compounds affect our bodies?</td><td>Guiding Questions
Factual, Conceptual, Provocative

How do you differentiate an organic compound from an inorganic compound?

What are the different types of organic structures?

What do the different functional groups do?

What role do organic molecules play in biological systems?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grades 9-12
High School Chemistry
Organic Chemistry and Biochemistry The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.
Large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of organic monomers.</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language
Distinguish an organic compound based on its structure or condensed structural formula.
Appraise the molecular formula, given the empirical formula and the molecular mass of a compound.
Compare the structural formulas for alkanes, alkenes, and alkynes containing a maximum of 10 carbon atoms.
Formulate all possible structural formulas of isomers when given the molecular formula of a compound.
Classify an organic compound based on it functional group
Construct a structural formula with the functional group(s) on a straight chain hydrocarbon backbone, when given the correct IUPAC name for the compound.
Categorize the various types of organic reactions</td></tr>
</table>

The bonding characteristics of carbon result in the formation of a large variety of structures, ranging from simple hydrocarbons to complex biological molecules and synthetic polymers. Amino acids are the building blocks of proteins. 	
Content/Topics *Critical content that students must **KNOW*** • Organic compounds can be named using the IUPAC System. • Hydrocarbons are compounds that contain only carbon and hydrogen. Saturated hydrocarbons contain only single carbon-carbon bonds. Unsaturated hydrocarbons contain at least one multiple bond between Carbon atoms. • Organic acids, alcohols, esters, aldehydes, ketones, ethers, halides, amines, amides, and amino acids are types of organic compounds that differ in their structures. Functional groups impart distinctive physical and chemical properties to organic compounds. • Isomers of organic compounds have the	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

<table>
<tr>
<td>same molecular formula, but different structures and properties.
Types of organic reactions include: addition, substitution, polymerization, esterification, fermentation, saponification, and combustion.
The empirical formula of a compound is the simplest whole number ratio of atoms of the elements in a compound. It may be different from the molecular formula, which is the actual ratio of atoms in a molecule of that compound.</td>
<td></td>
</tr>
<tr>
<td>Core Learning Activities
Esters Production
Making soap
Thermoplastics
Comparing Natural Polymer to Synthetic Compounds</td>
<td>Resources
Professional & Student

Teacher Resources:
Virtual Textbook of Organic Chemistry (http://www2.chemistry.msu.edu/~reusch/VirtTxtJml/intro1.htm)
Students Resources:
Chemical Bonding (http://bcs.whfreeman.com/thelifewire/content/chp02/02020.html)
Chemical Bonding (http://www.visionlearning.com/library/module_viewer.php?mid=55)
Animated Chemical Bonding (http://www.kentchemistry.com/links/bonding/bondingflashes/bond_types.swf)
Hydrocarbons (http://www.visionlearning.com/library/module_viewer.php?mid=60)
Organic Chemistry (http://library.thinkquest.org/3659/orgchem/)</td>
</tr>
</table>

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Unit test Summative: Written Test Test on the cumulative concepts of the unit. CFA -Pretest Formative: Written Test Pretest to assess prior knowledge in organic chemistry.	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

Unit Planner: Unit XIII: Organic Chemistry & Polymers
Chemistry
Friday, May 22, 2015, 11:03AM

Newtown High School > 2014-2015 > High School > Science > Chemistry > Week 33 - Week 35

Last Updated: Friday, April 10, 2015 by Doreen Merritt

Berechid, Bridget; Canfield, Christian; Carley, Christopher; Merritt, Doreen; Ramsey, Stephanie; Swanhall, Marty; Tallcouch, Tim; Torrance, Melissa

Enduring Understanding(s)/ Generalization(s)	
Organic compounds differ from inorganic compounds. **Hydrocarbons are compounds that only contain carbon and hydrogen.** **Functional groups impart distinctive physical and chemical properties to organic compounds.**	
Essential Question(s) **What are organic compounds?** **What are the chemical structure of organic compounds?** **How do organic compounds affect our bodies?**	Guiding Questions *Factual, Conceptual, Provocative* How do you differentiate an organic compound from an inorganic compound? What are the different types of organic structures? What do the different functional groups do? What role do organic molecules play in biological systems?
Standard(s) *Content and CCSS* **CT: Science Framework (2005)** **CT: Grades 9-12** **High School Chemistry** Organic Chemistry and Biochemistry The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life. Large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of organic monomers.	Objective(s) Bloom/ Anderson Taxonomy / DOK Language • Distinguish an organic compound based on its structure or condensed structural formula. • Appraise the molecular formula, given the empirical formula and the molecular mass of a compound. • Compare the structural formulas for alkanes, alkenes, and alkynes containing a maximum of 10 carbon atoms. • Formulate all possible structural formulas of isomers when given the molecular formula of a compound. • Classify an organic compound based on it functional group • Construct a structural formula with the functional group(s) on a straight chain hydrocarbon backbone, when given the correct IUPAC name for the compound. • Categorize the various types of organic reactions

The bonding characteristics of carbon result in the formation of a large variety of structures, ranging from simple hydrocarbons to complex biological molecules and synthetic polymers. Amino acids are the building blocks of proteins. 	
Content/Topics *Critical content that students must **KNOW*** • Organic compounds can be named using the IUPAC System. • Hydrocarbons are compounds that contain only carbon and hydrogen. Saturated hydrocarbons contain only single carbon-carbon bonds. Unsaturated hydrocarbons contain at least one multiple bond between Carbon atoms. • Organic acids, alcohols, esters, aldehydes, ketones, ethers, halides, amines, amides, and amino acids are types of organic compounds that differ in their structures. Functional groups impart distinctive physical and chemical properties to organic compounds. • Isomers of organic compounds have the	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

<table>
<tr>
<td>same molecular formula, but different structures and properties.
• Types of organic reactions include: addition, substitution, polymerization, esterification, fermentation, saponification, and combustion.
• The empirical formula of a compound is the simplest whole number ratio of atoms of the elements in a compound. It may be different from the molecular formula, which is the actual ratio of atoms in a molecule of that compound.</td>
<td></td>
</tr>
<tr>
<td>Core Learning Activities

• Esters Production
• Making soap
• Thermoplastics
• Comparing Natural Polymer to Synthetic Compounds</td>
<td>Resources
Professional & Student

Teacher Resources:

• Virtual Textbook of Organic Chemistry (http://www2.chemistry.msu.edu/~reusch/VirtTxtJml/intro1.htm)

Students Resources:

• Chemical Bonding (http://bcs.whfreeman.com/thelifewire/content/chp02/02020.html)
• Chemical Bonding (http://www.visionlearning.com/library/module_viewer.php?mid=55)
• Animated Chemical Bonding (http://www.kentchemistry.com/links/bonding/bondingflashes/bond_types.swf)
• Hydrocarbons (http://www.visionlearning.com/library/module_viewer.php?mid=60)
• Organic Chemistry (http://library.thinkquest.org/3659/orgchem/)</td>
</tr>
</table>

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Unit test Summative: Written Test Test on the cumulative concepts of the unit. CFA -Pretest Formative: Written Test Pretest to assess prior knowledge in organic chemistry.	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving	

Atlas Version 8.1.1

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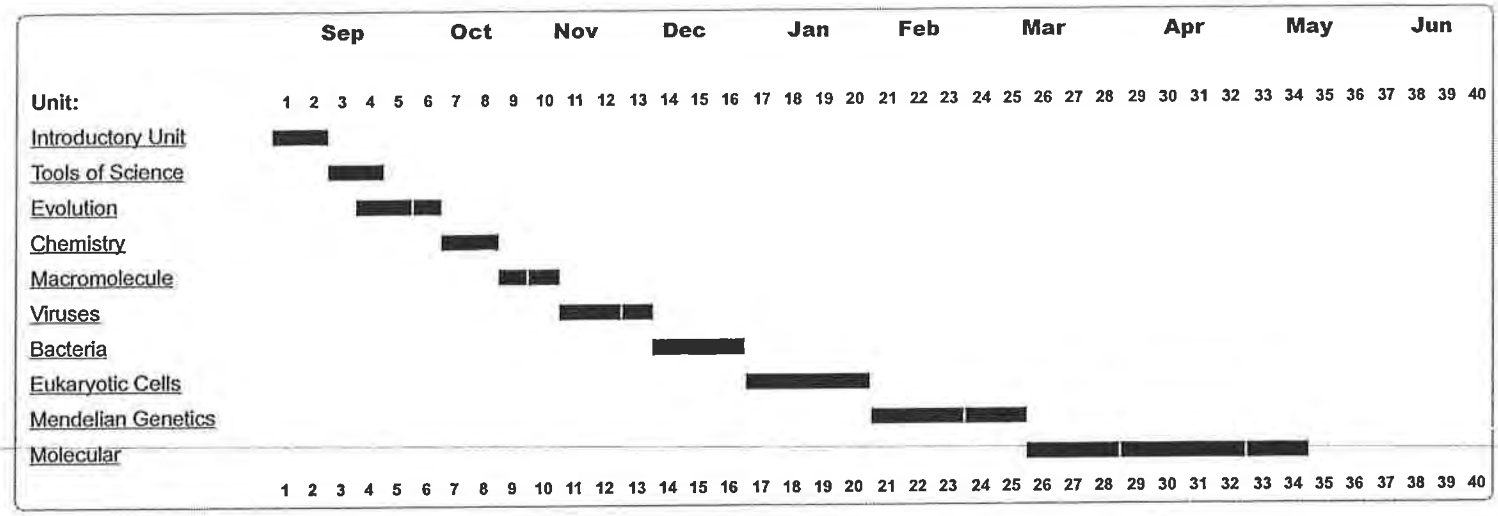
Newtown Public Schools

Biology

Newtown High School > Grade 10 > Science > Biology

Last Updated: Monday, June 22, 2015 by Susan McConnell

Collaboration



Atlas Version 8.1.1

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 1 - Week 2

Last Updated: Monday, June 22, 2015 by Susan McConnell

Introductory Unit

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

Scientific literacy is essential for personal decision-making, participation in civic and cultural affairs and economic productivity.

Unit EU's

There are essential themes that repeat throughout the whole year in Biology.

Topical Generalization

There are essential themes that repeat throughout the whole year in Biology.

Introductory Unit Planner

Essential Question(s)

Topical Generalization

What are essential themes that repeat throughout the whole year in Biology?

Guiding Questions

Factual, Conceptual, Provocative

Essential/Guiding Questions

- Why must new developments in science be examined from an ethical standpoint?
- Why does evolution permeate most topics in Biology?
- How do different careers in science fit into the various units of Biology?
- Are the needs of consumers different from the needs of producers?
- What defines life?
- How can life defined as sharing fundamental characteristics be highly variable at the same time (continuity/diversity)?
- Does structure always dictate function?
- How does the hierarchy of life/ levels of organization demonstrate interdependence?
- What are essential tools that will be used throughout the year?
- Is it necessary to have themes spiral throughout a course?
- Why is there controversy over the classification of organisms?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Recognize the essential themes that repeat throughout Biology.

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They use technology and digital media strategically and capably.

Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.9-10.2a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Biology

Cell Biology The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

- Cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.

Content/Topics

Critical content that students must KNOW

Bioethics, Characteristics of Life, Evolution, Natural Selection, Structure, Function, Energy, Domains, Kingdom, Species, Consumers, Producers, Autotrophs, Heterotrophs, Prokaryotes, Eukaryotes, Archaea, Cellular Respiration, Homeostasis, Adapt, Development, Metabolism, Stimuli, Genetic Information, Reproduction, Cell, Environment, atom, molecule, macromolecule, organelle, tissue, organ, organ system, organism, population, community, ecosystem, biosphere

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.
- 7. Other.

Microscope Skills

Core Learning Activities
See assessments.

Resources
Professional & Student

Attached to assessments.

Assessments (Titles)

Diagnostic
Formative: Other written assessments
What is Biology?

What do all living things share?

CFA
Formative: Other written assessments
Why must new developments in science be examined from an ethical standpoint?

How do different careers in science fit into the various units of Biology?

Are the needs of consumers different from the needs of producers?

Is Sammy Alive?
Formative: Dramatization
Classroom debate

Is Sammy Alive.doc

Levels of Organization Activity
Formative: Other Visual Assessments

Career Poster
Formative: Other written assessments
Students choose a career in the field of Biology and design a poster selling the career.

Biology Career Poster 2013.doc

Characteristics of Life Lab
Summative: Lab Assignment

Characteristics of Life Lab directions.doc

Unit Test
Summative: Standardized Test

TEST (Sci. Meth, Micro, Safety, Characteristics).doc

Graduation Standards
Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Atlas Version 8.1.1

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 3 - Week 4

Last Updated: Monday, June 22, 2015 by Susan McConnell

Tools of Science

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

1. Scientific Inquiry inspires Independent and collaborative critical evaluation and communication of information that can be used for further application, decision making, product design and solutions to problems.

Unit EU's

Science speaks a universal language and shares common methodologies.

Topic Generalization

A. There are common tools that scientists use to collect data

B. Scientists use common language so that communication may be global

Tools_of_Science_.pdf

Essential Question(s)

Essential Question(s)

What are the common tools that scientists use to collect data?

How do scientists use common language to communicate globally?

Guiding Questions

Factual, Conceptual, Provocative

A1. What are essential safety practices/ guidelines that must be followed in the laboratory?

A2. How is bias eliminated in data collection?

A3. Is the scientific method only used by scientists?

A4. What are essential components of a good hypothesis?

A5. How do controls differ from constants?

A6. What is the difference between the independent variable and the dependent variable?

A7. Is it more important that laboratory data be precise or accurate?

A8. Do scientists really use universal procedures/ tools when conducting investigations?

A9. What are some of the common tools biologists use to study life?

A10. What is the difference between qualitative and quantitative data?

A11.What is more acceptable to the scientific community subjective observations or objective observations?

A12.Is there a critical minimum number of data points needed to draw conclusions?

B1. Why is it important to include units with measurements?

B2. How is a graph/data table properly labeled?

B3.On which axis does the independent and dependent variable belong?

B4. Why must conclusions include all data?

B5. What types of data/evidence can be used to support conclusions?

B6. Is it important to use content taught in class to support conclusions?

B7. Is there a correct type of graph to use for all situations?

B8. Are numbers an essential component of data?

B9. What skills are essential for an effective oral presentation?

B10. What are effective strategies to call attention to key points?

B11. What are effective strategies for scientific persuasion?

B12. How do scientists use abstracts?

B13. Why do scientists set out to disprove a point instead of proving it?

B14. Can anything be proven in science?

B15. Why is it essential that procedures be reproducible?

B16. Is it acceptable to include erroneous data in a lab report?

B17. What is validity?

B18. Is there a difference between conversational vocabulary and scientific vocabulary?

B19. Why are personal pronouns avoided in science?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Reading: History/Social Studies

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RH.9-10.7. Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.9-10.1. Write arguments focused on discipline-specific content.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ2. Read, interpret and examine the credibility and validity of scientific claims in different sources of information.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Explain how scientists use common tools to collect data.

Analyze common language scientists use to communicate globally.

Content/Topics

Critical content that students must KNOW

Essential Unit Vocabulary: Safety, Scientific Method, accuracy, precision, qualitative, quantitative, subjective, objective, bias, blind studies, double blind studies, placebo effect, problem statement, hypothesis, experiment, independent variable, dependent variable, data, observation, control, constants, variables, conclusion, units, table, graph, abstract, validity, personal

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and

pronoun,

accomplish goals.

- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
- 7. Other.

Properly use a microscope.
Correctly apply the scientific method.
Properly identify laboratory equipment.

Core Learning Activities

Equipment scavenger hunt

Interactive Scientific Method Internet Activity

Microscope Lab

Resources

Professional & Student

Contained within the assessment section.

Assessments (Titles)

Pre-Assessment
Formative: Other written assessments
Diagnostic

What are some of the tools biologists use to study life?
What types of data/evidence can be used to support conclusions?
What are the important elements in a scientific investigation?
Can anything be proven in science?

Formative
Formative: Other written assessments
How is bias eliminated in data collection?
What is the difference between the independent variable and the dependent variable?
What is the difference between qualitative and quantitative data?
What is more acceptable to the scientific community subjective observations or objective observations?

Tool Matching Activity
Formative: Lab Assignment
Tool scavenger hunt.

Microscope Lab
Formative: Lab Assignment
Microscope Lab.doc
Microscope prelab.doc
Microscope background reading.docx

Name that Tool
Formative: Lab Assignment
Name That Tool!.doc
Name That Tool.ppt

Scientific Method Internet Activity
Formative: Technology Project
ScientificMethod.doc

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Math

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 4 - Week 6

Evolution

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's
Systems, in order to survive, must balance against competing influences that cause change over time.

Unit EU's
Without evolution life would cease to exist.

Topical Generalization
A. Evolution is the result of natural selection
B. Survival of populations depend on variation which can arise through different processes.
C. There is scientific evidence to support evolution.

Evolution Unit

Essential Question(s)

A. How is evolution the result of natural selection?

B. How does survival of populations depend on variation?

C. What scientific evidence supports evolution?

Guiding Questions

Factual, Conceptual, Provocative

A1.What are selective forces?

A2. Why is natural selection the m

A3.How have humans contributed

A4. What is an adaptation?

A5. How do behavioral, physiologi

A6. How does evolutionary adapta adaptation?

A7. In terms of evolution, can an ir

A8. Can evolution be controlled?

A9. Should evolution be controlled

A10. Why do some organisms bec

A11. What defines a species?

A12. How do selective forces guid

A13. What is genetic fitness?

B1. What built in mechanisms do (

B2. What mechanisms exist that p

B3. What are sources of variation?

B4. Is there such a thing as geneti

B5. Are mutations always bad?

B6. What is a mutation?

B7. What is a mutagen?

B8. Why should closely related inc reproduce?

B9. What is hybrid vigor?

B10. Would humans be better off i asexually?

C1. What evidence do scientists u

C2. How has evidence for evolutio

C3. Who were the initial key contri

C4. Why can't pieces of evidence

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies,

Objective(s)

Bloom/ Anderson Taxonomy / D

Explain how natural selection is th

Describe how variation results in tl

Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They respond to the varying demands of audience, task, purpose, and discipline.

Reading: Science & Technical Subjects

2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

- RST.9-10.2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

CT: Science Framework (2005)

CT: Grades 9-12

High School Biology

Evolution The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time.

pressures.

Analyze the scientific evidence tha

- Natural selection acts on the phenotype rather than the genotype of an organism.
- New mutations are constantly being generated in a gene pool.
- Variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

Evolution is the result of genetic changes that occur in constantly changing environments.

- Natural selection determines the differential survival of groups of organisms.
- A great diversity of species increases the chance that at least some organisms survive major changes in the environment.
- Fossil evidence contributes to our understanding of biological diversity, episodic speciation, and mass extinction.
- Several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.

Content/Topics

Critical content that students must KNOW

Essential Unit Vocabulary:
Charles Darwin, Jean Baptiste Lamarck, Thomas Malthus, Charles Lyell, Galapagos Island, Macroevolution, Microevolution, fossil, embryology, homologous, vestigial, analogous structures, molecular evidence, phylogenetic trees, selective forces, "adaptation", behavioral adaptation, physiological adaptation, structural adaptation, species, genetic fitness, extinction, natural selection, variation, hybrid vigor, inbreeding, mutation, mutagen, crossing over, independent assortment, sexual, asexual

Skills

Transferable skills that students

- 2. Work independently and co accomplish goals.
- 3. Communicate information tools/media in varied contexts
- 4. Demonstrate innovation, fle work habits, and working/lear

Core Learning Activities

See assessments.

Resources

Professional & Student

Attached to assessments.

Assessments (Titles)

Diagnostic Evolution
Formative: Other written assessments

1. What is natural selection?
2. What is evolution?
3. What evidence supports the theory of evolution?
4. What is a mutation?

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Information Literacy
- Spoken Communication

Inte Con

Math

5. Why is variation within a population important?
6. How have humans impacted the evolution of life?

Evolution Unit
Formative: Other written assessments

1. What are selective forces?
2. Why is natural selection the mechanism for evolution?
3. How have humans impacted the evolution of life?
4. How do behavioral, physiological, and structural adaptations differ?
5. How does evolutionary adaptation differ from the common reference to adaptation?
6. In terms of evolution, can an individual organism adapt?
7. Why do some organisms become extinct?
8. What defines a species?
9. What is genetic fitness?
10. What evidence do scientists use to support the theory of evolution?
11. What is hybrid vigor?

Stick Worm Toothpick Lab
Formative: Lab Assignment
Student stick worm.docx

Beaks of Finches
Formative: Lab Assignment
Beaks Finches.doc

Classification Cladistic Diagram
Formative: Other Visual Assessments
Making a Cladogram.pdf

Evolution Quiz
Formative: Other written assessments

Evolution Unit
Summative: Other written assessments

1. Why is natural selection the mechanism for evolution?
2. Can evolution be controlled?
3. Should evolution be controlled?
4. How do selective forces guide evolution?
5. What built in mechanisms do organisms have to ensure variation occurs?
6. Is there such a thing as genetic immortality?
7. Why should closely related individuals of the same species not reproduce?
8. What are the benefits of being able reproduce both sexually and asexually?

Natural Selection Cartoon
Summative: Visual Arts Project
Evolution cartoon aasignment.pptx

Evolution Unit Exam
Summative: Written Test

Animal Project
Other oral assessments

Artificial Selection
Formative: Other written assessments
Honors Artificial Selection Extension Questions.docx
dogbreeds.pdf
ownership copy.pdf
puppytraits.pdf

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 7 - Week 8

Last Updated: Monday, June 22, 2015 by Tim Dejulio

Chemistry

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

The relationship between structure and function determines the efficiency and survival of all things.

Unit EU's

The structure of atoms allows them to interact in predictable ways.

Topical Generalization

A. The structure of atoms allows them to interact in predictable ways.

B. Solutions can be classified by pH.

C. The structure of water determines its unique properties.

Chemistry Unit Planner

Essential Question(s)

A. What about the structure of atoms allow them to interact in predictable ways?

B. How are solutions classified by pH?

C. How does the structure of water determine its unique properties?

Guiding Questions

Factual, Conceptual, Provocative

A1. How do subatomic particles influence interactions of the atom?

A2. What are defining properties of subatomic particles?

A3. What influences whether an atom can engage in chemical bonding?

A4. What types of chemical interactions do atoms engage in?

A5. How are isotopes useful?

A6. Does knowledge of chemical interactions influence the medical field?

B1. Why do molecules ionize in water?

B2. What distinguishes an acid from a base?

B3. What color does litmus paper turn when exposed to an acid or base?

B4. How is pH measured?

B6. How do organisms resist changes in pH?

B7. What are the implications of changes in pH?

B8. Why does a variety of environments with different pH exist within organisms?

C1. What is the structure of water?

C2. Why are the properties of water essential for life?

C3. Could "life" exist without the presence of water?

C4. How can the properties of water be both beneficial and harmful to organisms?

C5. What are the products of the ionization of water?

Standard(s)

Content and CCSS

CT: Science Framework (2005)

CT: Grades 9-12

High School Chemistry

Chemical Bonds Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules

- Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.
- Chemical bonds between atoms in molecules such as H2, CH4, NH3, H2CCH2, N2, Cl2, and many large biological molecules are covalent.
- Salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Explain how the structure of atoms allows them to interact in predictable ways.

Describe how solutions are classified in terms of pH.

Analyze and describe how the structure and chemical composition of water determine its unique properties.

Content/Topics

Critical content that students must KNOW

Essential Unit Vocabulary: atom, nucleus, orbital, proton, neutron electron, atomic number, atomic mass, mass number, isotopes, valence shell, ion, covalent bond, polar covalent bond, nonpolar covalent bond, ionic bond, hydrogen bonding, capillary action, cohesion, adhesion, heat capacity, solvent, hydrophobic, hydrophilic, ionization, hydrogen ion, hydroxide ion, acidic, basic, neutral, acid, base, buffer, pH scale, litmus paper, 10 fold, neutralize

Skills

Transferable skills that students must be able to DO

- 7. Other.

Measuring pH
Analyzing and interpreting data
Constructing explanations (evidenced based)

Core Learning Activities

See assessments.

Resources

Professional & Student

See assessments.

Assessments (Titles)

Pre Assessment Chemistry
Formative: Written Test
Chem pretest 2012.doc

Diagnostic Chemistry
Formative: Other written assessments

1. What are the 3 subatomic particles?
2. What is their arrangement and charge?
3. Distinguish between covalent bond and ionic bond.
4. What are isotopes?
5. What is the difference between a polar covalent and a non polar covalent bond?
6. What is an ion?
7. What does the pH scale measure?
8. Distinguish between an acid and a base.
9. List several properties of water.

Basic Chemistry for the Biologist
Formative: Other written assessments

1. The formation of an ionic bond always involves the
A) Transfer of electrons
B) Transfer of protons
C) Sharing of neutrons
D) Sharing of electrons

2. The formation of a covalent bond always involves the
A) Transfer of electrons
B) Transfer of protons
C) Sharing of neutrons
D) Sharing of electrons

3. The electrons that play an important part of an element's chemical properties are in:
A) The outermost energy level
B) The middle energy levels
C) An incomplete lowest energy level
D) An incomplete middle energy level

4. When sodium goes through a chemical reaction the atom becomes a sodium ion (Na^+) because:
A) It takes on an extra proton, becoming more positive.
B) It loses an electron becoming more positive.
C) It becomes just an electron shell, and electron shells are positively charged.
D) It gives away the positively

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Math

charged part of the atom.

5. Which of the following statements helps explain why there are millions of carbon compounds?
A) Carbon has 4 valence electrons
B) Carbon atoms form bonds with other carbon atoms
C) Carbon atoms can form single, double and triple bonds
D) All of the above

6. Which of the following statements is true?
A) All organic compounds contain carbon
B) All organic compounds contain only carbon and hydrogen
C) All organic compounds are produced only in organisms
D) All known compounds include about 10% which are organic compounds

7. HCl (hydrochloric acid) is an acid because
A) it is an enzyme and can eat through other materials
B) it can produce hydrogen ions
C) the chlorine atom separates and reacts with other substances
D) it can take on extra hydrogen ions

pH/Buffer Lab
Summative: Lab Assignment
- pH Lab Write Up MODIFIED[1]-1.doc
- LAB pH (formal).doc
- LAB WRITE UP FORM PH LAB.doc
- ph lab write up GUIDELINES.docx

Properties of Water Lab
Summative: Lab Assignment
- Poperties of Water.ppt
- Water lab student sheet.docx

Chemistry Unit Exam
Summative: Written Test

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 9 - Week 10

Last Updated: Monday, June 22, 2015 by Susan McConnell

Macromolecule

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

The relationship between structure and function determines the efficiency and survival of all things

Unit EU's

Even though carbon atoms are uniquely bonded to one another to form a variety of macromolecules there is consistency in structure and function.

Topical Generalization

A. Carbohydrates serve a multitude of functions due to the arrangement of monosaccharides.

B. The functions of nucleotide monomers differ vastly from the polymer form.

C. Protein structure and function is determined by the order of amino acids.

D. Polarity distinguishes lipids from other macromolecules.

Macromolecule Unit Planner

Essential Question(s)

A. What functions do carbohydrates serve due to the various arrangement of monosaccharides?

B. How do the functions of nucleotide monomers differ from the polymer form?

C. How do the order of amino acids determine protein structure and function?

D. How does polarity distinguish lipids from other macromolecules?

Guiding Questions

Factual, Conceptual, Provocative

A1. Which carbohydrate is preferred for the process of cellular respiration?

A2. Why do cells utilize carbohydrates before other macromolecules for energy?

A3. Why is cellulose essential in our diet if we can't digest it?

A4. How can different configurations of the same monomer be responsible for so many different properties?

A5. Other than providing energy, what functions do carbohydrates serve in the body?

B1. What 3 common components does every nucleotide have?

B2. How can different forms of the same nucleotide be both stable and unstable?

B3. What are the two types of nucleic acids and how do they differ?

C1. Do protein supplements enhance the body building process?

C2. Why should silk products be washed in shampoo and not regular laundry detergent?

C3. How does the sequence of amino acids determine protein function?

C4. Why does temperature and pH influence protein structure?

C5. How have enzymes been commercialized?

C6. How do enzymes serve as catalysts?

C7. What does the body use consumed proteins for?

C8. Where do organisms get essential amino acids from?

C9. How are proteins denatured?

C10. What can cause a protein to form incorrectly?

C11. Are there large differences in the structure of critical proteins between different species?

C12. What are the different functions of proteins?

C13. What are the 4 critical elements found in proteins?

C14. What are the 4 levels of protein structure and how do they influence each other?

C15. How are proteins detected in the laboratory?

C16. By what processes are proteins synthesized and digested?

C17. How can R groups contribute to the amphipathic nature of some proteins?

Essential/Guiding Questions

D1. Why is the nonpolarity of lipids essential for life?

D2. What makes lipids nonpolar?

D3. What are the different functions of Lipids?

D4. How do the differences between saturated and unsaturated fats impact health?

D5. Why is the ratio of HDL/LDL more important to know than total cholesterol?

D6. Why do organisms store long term energy as lipids?

D7. How do we detect lipids in the laboratory?

D8. How do lipids serve as protection?

D9. What careers are available in the field of biochemistry?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Describe the functions carbohydrates serve due to the various arrangement of monosaccharides.

Determine how the functions of nucleotide monomers differ from the polymer form.

Infer how the order of amino acids determine protein structure and function.

Explain how polarity distinguishes lipids from other macromolecules.

continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Biology

Cell Biology The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

- Enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions and the pH of the surroundings.

High School Chemistry

Organic Chemistry and Biochemistry The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.

- Large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of organic monomers.
- The bonding characteristics of carbon result in the formation of a large variety of structures, ranging from simple hydrocarbons to complex biological molecules and synthetic polymers.
- Amino acids are the building blocks of proteins.

Content/Topics

Critical content that students must KNOW

Essential Unit Vocabulary: structural formula, polar, nonpolar, amphipathic, hydrophobic, hydrophilic, mono, di, poly, -mer, dehydration synthesis, hydrolysis, indicator, carbohydrate, saccharide, -ose, glucose, cellulose, Benedict's Reagent, Lugol's (IKI, Iodine) protein, amino acid, essential amino acids, Biuret Reagent, enzymes, catalyst, activation energy, substrate, active site, denature, primary, secondary, tertiary, quaternary, Lipid. Phospholipid, cholesterol, steroids, hormones, HDL, LDL, saturated, unsaturated, trans fat, brown paper test, fat, wax, oil, DNA, RNA, nucleotide, nucleic acid, adenine, guanine, thymine, cytosine, uracil, ribose, deoxyribose, nitrogenous base, phosphate group

Skills

Transferable skills that students must be able to DO

- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 7. Other.

Essential Scientific Engineering Practices
Developing and using models
Analyzing and interpreting data
Constructing explanations (evidenced based)

Core Learning Activities

Macromolecule Indicator Lab

Enzyme Lab

Resources

Professional & Student

Building Macromolecules Macromolecule Caricature (Links to activities in Assessment Section.)	See assessments.

Assessments (Titles)

Diagnostic Macromolecules
Formative: Other written assessments

Carbohydrates

1. List 5 foods that contain carbohydrates.
2. Which macromolecule do we use as our primary source of energy?
3. What is the function of fiber in our diet?
4. Define monomer and polymer. How are they related?

Proteins

1. What is protein used for in the body?
2. List 5 foods that contain proteins.
3. Why would a weight lifter benefit from consuming protein before/after he/she lifts?
4. Why are enzymes considered catalytsts?

Lipids

1. What foods contain lipids?
2. What non-food sources contain lipids?
3. Why are lipids important?

Nucleic acids

1. What macromolecule makes you who you are?
2. What is the difference between DNA and RNA?
3. What roles do the nucleic acids DNA and RNA play in your body?
4. What roles do other nucleotides, such as ATP, play in your body?

Macromolecule - Carbohydrates, Proteins, Lipids & Nucleic Acids
Formative: Other written assessments

Carbohydrates

1. Which carbohydrate is used for structure?
2. Which types of carbohydrate are used for storage long term energy storage?
3. What types of organisms can they be found in?
4. Compare and contrast

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Math

dehydration synthesis and hydrolysis.
5. Why is cellulose essential in our diet if we can't digest it?
6. If certain animals can not digest cellulose, how can it be their only source of nutrition?

Proteins

1. How does the primary structure of proteins affect the secondary structure and tertiary structure of proteins?
2. List the different functions of a protein.
3. Why are proteins also called polypeptides?
4. Why are enzymes one of the most important proteins there are?
5. Why are enzymes necessary for survival?
6. What factors affect the function of enzymes?

Lipids

1. What are the approximate ratio of elements are found in lipids?
2. What is the chemical difference between a saturated and unsaturated fat?
3. Describe the structure of a phospholipid.
4. What functions other than energy storage are associated with lipids?
5. What makes lipids nonpolar?

Nucleic Acids

1. List 3 differences between DNA and RNA.
2. What holds the two strands of DNA together?
3. Describe the building blocks of a nucleic acid.
4. How are the monomers of a nucleic acid joined?
5. Describe the roles of DNA in the body.
6. Describe the role of ATP in the cell.

Macromolecule Indicator Lab
Formative: Lab Assignment
SMMc Macromolecule Procedure.doc

Building Macromolecule (Structure activity)
Formative: Visual Arts Project
Building_Macromolecules_Marshmallow style.docx

Macromolecule Quiz **Summative: Other written assessments** Quiz 1 -Carbohydrates and Lipids Quiz 2 Proteins and Nucleic acid Carb and Lipid Group Quiz.doc Proteins, enzymes and nucleic acids Group Quiz.doc **Macromolecule Caricature** **Summative: Other Visual Assessments** **Task:** Choose any macromolecule and draw it as a cartoon human with a job and accessories that symbolize and/or relate to the function of the macromolecule. Picture should indicate structure of molecule chosen. **Enzyme Lab** **Summative: Lab Assignment** Apple Juice Lab 2012.docx **Macromolecule Unit Exam** **Summative: Written Test** Macromolecule Test 2014 H.docx		

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Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 11 - Week 13

Last Updated: Monday, June 22, 2015 by Susan McConnell

Viruses

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's:

Systems exist at all levels of organization and are interdependent and/or intradependent, so that a change in one level may impact the system as a whole.

Understanding interactions between structure, function, and efficiency can generate new applications for design or improved design.

Unit EU's:

Nuances in viral structure force coevolution

Topical Generalizations:

A. Nuances in viral structure lead to differences in infection cycles, prevention and treatment.

B. Globalization has lead to greater opportunities for the spread of viruses.

C. The rate of evolution in viruses makes prevention and treatment a challenge.

D. Understanding the structure of viruses has lead scientists to novel applications.

Virus Unit Planner

Essential Question(s)

A. What nuances in viral structure lead to differences in infection cycles, prevention and treatment?

B. How has globalization lead to greater opportunities for the spread of viruses?

C. Why does the rate of evolution in viruses makes prevention and treatment a challenge?

D. How has understanding the structure of viruses lead scientists to novel applications?

Guiding Questions

Factual, Conceptual, Provocative

What are common components to viral structure?

What structural differences make viruses more virulent?

Why are there not vaccines against all viruses?

How do viruses infect cells?

Are viruses alive?

Why are viruses specific to certain species?

Why would differences in viral structure lead to different prevention strategies?

Why must the flu vaccine be administered every year?

What are common measures to prevent the spread of viruses?

Why can some viruses infect individuals more than once?

How do vaccines work?

Are there effective medications to cure individuals of viral disease?

How can individuals prevent viral infection?

What causes lysogenic viruses to enter a lytic phase?

How can reverse transcriptase be useful in the laboratory?

How can viruses be used as vectors?

Have viruses advanced gene therapy?

Can viruses be used as antimicrobials?

How are viruses used in genetic manipulation?

What are ethical implications of using viruses in gene therapy?

What careers are available in the field of virology?

What measures can be taken to prevent viral disease?

How has commerce and global travel increased the spread of viruses?

Should we be concerned about emerging viruses?

Can viral infection always be detected?

What is an incubation period?

How does evolution impact the spread of viruses?

Can viruses cause cancer?

Why are viruses good agents for bioterrorism?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Students Who are College and Career Ready In Reading, Writing, Speaking, Listening, & Language

- They value evidence.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

- WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

CT: Science Framework (2005)

CT: Grade 10

XI. Science & Technology in Society

Strand IV: Cell Chemistry and Biotechnology 10.2 - Microorganisms have an essential role in life processes and cycles on Earth.

- D 31. Describe the similarities and differences between bacteria and viruses.
- D 32. Describe how bacterial and viral infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.

CT: Grades 9-12

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Describe nuances in viral structure lead to differences in infection cycles, prevention and treatment.

Infer how globalization has lead to greater opportunities for the spread of viruses.

Demonstrate how the rate of evolution in viruses makes prevention and treatment a challenge.

Analyze how understanding the structure of viruses has lead scientists to novel applications.

High School Biology

Organisms have a variety of mechanisms to combat disease

- Vaccination protects an individual from infectious diseases.
- There are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.

Content/Topics

Critical content that students must KNOW

Essential Unit Vocabulary: Protein coat, nucleic acid core, receptors, protein spikes, Envelope, lytic cycle, Lysogenic cycle, Specificity, retrovirus, HIV, AIDS, reverse transcriptase, mutation, DNA Viruses, RNA Viruses, incubation period, epidemic, pandemic, emerging, endemic, coevolution

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.

Core Learning Activities

See assessments.

Resources

Professional & Student

See assessments.

Assessments (Titles)

Diagnostic Viruses
Formative: Other written assessments

1. How are viruses transmitted?
2. How can you prevent viruses?
3. What does a vaccine do?
4. What viral infections have you had in your lifetime?
5. Why do cold sores reoccur in humans throughout their lifetime?

Virus Unit
Formative: Other written assessments

1. What are common components to viral structure?
2. How do viruses infect cells?
3. Are viruses alive?
4. Are viruses specific to certain species?
5. What measures can be taken to prevent viral disease?
6. How are viruses transmitted?
7. What is an incubation period?
8. What is the difference between an epidemic and a pandemic?
9. Why must the flu vaccine be administered every year?
10. How do vaccines work?
11. What causes lysogenic

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

History

viruses to enter a lytic phase?
12. How can viruses be used as vectors?
13. How have viruses advanced gene therapy?

Outbreak
Formative: Extended Essay

Movie & Questions

VID Outbreak Questions.doc

Pandemic
Formative: Self Assessment

Board game

Vaccine Simulation
Formative: Technology Project

Online Activity

http://www.pbs.org/wgbh/nova/bioterror/vaccines.html#

COMP LAB Making Vaccines.doc

Exchange of Body Fluid
Formative: Lab Assignment

Transfer of Body Fluids copy.pdf

Virus Unit
Summative: Other written assessments

1. Justify the need for vaccines.
2. How does the viral structure lend itself to helpful/harmful purposes?

Viral Disease Presentation
Summative: Other Visual Assessments

- Research viral disease
- Create a PowerPoint presentation
- Present to class

Viral Medical Detectives.pptx
Diagnosis Disease.doc
Virus 1.doc
Virus 2.doc
Virus 3.doc
Virus 4.doc
Virus 5.doc
Virus 6.doc
Virus 7.doc
Virus 8.doc
Virus 9.doc
Virus 10.doc

Virus Quiz
Summative: Other written assessments

Virus Unit Exam
Summative: Written Test

Including: Bacteria & Infectious disease

Virus and Bacteria Test (Honors).doc

Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 14 - Week 16

Last Updated: Monday, June 22, 2015 by Susan McConnell

Bacteria

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

Understanding interactions between structure, function, and efficiency can generate new applications for design or improved design.

Systems, in order to survive, must balance against competing influences that cause change over time.

Unit EU's

Although some bacteria are the source of certain diseases, they are intricately linked to the survival of all life's systems and can be manipulated to improve the quality of life.

Topical Generalizations

A. Bacteria share common features.

B. Bacterial infection can be reduced by living a healthy lifestyle.

C. Bacteria have a multitude of positive attributes that contribute to sustenance of life.

D. Bacteria can be genetically altered to perform different functions.

Bacteria Unit Planner

Essential Question(s)

A.What features do Bacteria have in common?

B. How can Bacterial infection be reduced?

C. How do the positive attributes of bacteria contribute to sustenance of life?

D. How can bacteria be altered to perform different functions?

E. What constitutes good hygiene?

F. What are the different components to a healthy lifestyle?

G. How can food borne illness be reduced?

H. Do the benefits of irradiating food outweigh the risks?

I. How can probiotics help to prevent other bacterial infections?

J. Should antimicrobials in soaps be limited to hand use only?

K. What is the proper length of time for proper hand washing?

L. What is pasteurization?

M. Why should swollen canned food never be eaten?

N. How does diet help/inhibit bad bacteria?

O. Does sleep influence the ability to prevent bacterial infections?

P.Why should antibiotics be avoided if possible?

Q. Is it possible that bacteria eventually outwit medical treatment making antibiotics ineffective?

R. Does the government have the right to quarantine people and prevent them from traveling?

Guiding Questions

Factual, Conceptual, Provocative

A1. What are the common structural elements of bacteria?

A2. Why would some bacteria possess different structural features?

A3. Why are plasmids essential to bacterial evolution?

A4. What are the differences between bacterial cells and eukaryotic cells?

A5. How are the differences between bacterial cells and eukaryotic cells used in development of antimicrobials?

A6. How does bacteria structure lend itself to rapid evolution?

A7. Does size reflect level of complexity?

A8. How do bacteria obtain energy?

A9. What is the difference between Gram positive and Gram negative bacteria?

S. Do people who are contagious always look sick?

T. Why should one never drink un-bottled water or eat fresh vegetables when traveling?

U. Does freezing kill bacteria?

V. What proper precautions should be taken in the kitchen to prevent bacterial contamination?

A10. Are bacteria more evolutionarily successful than humans?

B1. What constitutes good hygiene?

B2. What are the different components to a healthy lifestyle?

B3. How can food borne illness be reduced?

B4. Do the benefits of irradiating food outweigh the risks?

B5. How can probiotics help to prevent other bacterial infections?

B6. Should antimicrobials in soaps be limited to hand use only?

B7. What is the proper length of time for proper hand washing?

B8. What is pasteurization?

B9. Why should swollen canned food never be eaten?

B10. How does diet help/inhibit bad bacteria?

B11. Does sleep influence the ability to prevent bacterial infections?

B12. Why should antibiotics be avoided if possible?

B13. Is it possible that bacteria eventually outwit medical treatment making antibiotics ineffective?

B14. Does the government have the right to quarantine people and prevent them from traveling?

B15. Do people who are contagious always look sick?

B16. Why should one never drink un-bottled water or eat fresh vegetables when traveling?

B17. Does freezing kill bacteria?

B18. What proper precautions should be taken in the kitchen to prevent bacterial contamination?

C1. How are bacteria essential in decomposition and recycling of nutrients?

C2. How do bacteria help increase the nitrogen content of certain plants?

C3. How can bacteria be used to help clean up the environment?

C4. How do bacteria assist in digestion?

C5. Can life exist without bacteria?

C6. What organisms rely on bacteria for digesting the bulk of ingested material?

C7. How does the food industry use bacteria?

C8. How do bacteria contribute to the well being of a human?

C9. Are there any multicellular organisms that don't have a symbiotic relationship with bacteria?

C10. Is there any place on earth uninhabited by bacteria?

C11. Why are fecal transplants successful where other treatments have been ineffective?

D1. Can bacteria be used to make artificial snow?

D2. How does the pharmaceutical industry use bacteria?

D3. How have bacteria been altered for bioremediation?

D4. Can bacteria be used to fight infectious bacteria?

D5. What are the limitations of using bacteria to make human protein?

D6. What the ethical implications of genetically altering bacteria?

D7. What could happen if genetically altered bacteria enter into the environment?

D8. How can bacteria be used in bioterrorism?

D9. What makes bacteria a good candidate for genetic modifications?

D10. How do bacteria impact the economy?

D11. Why is giving cows antibiotics an issue with the dairy industry? With humans?

D12. What careers are available in the field of microbiology?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They respond to the varying demands of audience, task, purpose, and discipline.

Reading: Science & Technical Subjects

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CT: Science Framework (2005)

CT: Grade 10

XI. Science & Technology in Society

Strand IV: Cell Chemistry and Biotechnology 10.2 - Microorganisms have an essential role in life processes and cycles on Earth.

- D 31. Describe the similarities and differences between bacteria and viruses.
- D 32. Describe how bacterial and viral infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.
- D 33. Explain how bacteria and yeasts are used to produce foods for human consumption.

Strand IV: Cell Chemistry and Biotechnology 10.3 - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.

- D 34. Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials.
- D 35. Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.

CT: Grades 9-12

High School Biology

Organisms have a variety of mechanisms to combat disease

- There are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Describe the common features that bacteria share.

Explain how bacterial infection can be reduced by living a healthy lifestyle.

Describe how bacteria have a multitude of positive attributes that contribute to sustenance of life.

Explain how bacteria can be genetically altered to perform different functions.

Content/Topics

Skills

Critical content that students must KNOW

Essential Unit Vocabulary:

Capsule, cell wall, plasmids, nuclear area, pili, ribosomes, flagella, prokaryotes, eukaryotes, unicellular, spirilium, cocci, bacilli, heterotroph, autotroph, Gram positive bacteria, Gram negative bacteria, probiotics, antimicrobial, antibiotics, pasteurization, botulism, E.coli, cholera, tuberculosis, typhoid, MRSA, salmonella, anthrax, bioterrorism, symbiotic, decomposition, nitrogen-fixing bacteria, vaccines

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 7. Other.

Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Constructing explanations
Engaging in argument
Obtaining, evaluating, and communicating information

Core Learning Activities

See Assessments.

Resources

Professional & Student

See assessments.

Assessments (Titles)

Diagnostic Bacteria Structure
Formative: Other written assessments

Diagnostic

1. Draw and label as many bacterial structures as you can and define their functions.
2. List as many roles for bacteria as you can.
3. Distinguish between pathogenic, parasitic, and symbiotic
4. How does the knowledge of bacteria impact society and technology?
5. What preventative measures do you take to protect yourself from harmful bacteria?
6. How are bacteria useful?

Bacteria Unit CFA
Formative: Other written assessments

1. Bacteria contain their genetic information
A. cell membrane
B. capsid
C. nuclear area
D. nucleus
2. One of the characteristics of bacteria is that they;
A. Are eukaryotic cells
B. Are prokaryotic, single-celled organisms
C. Are not able to perform essential life functions
D. Contain no DNA
3. Bacteria have plasmids to

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

History

A. Reproduce
B. Kill other bacteria
C. Protect themselves from antibiotics
D. Surrounds the bacteria to separate it from the environment
4. Certain bacteria enter a state of dormancy by
A. Replicating their plasmids
B. Fusing with another bacterium
C. Secreting minerals to form a shell
D. Reducing their size to contain little more than a chromosome

Sponges, Sinks and Rags oh my!
Formative: Other written assessments
Reading & Questions
- ARTICLE Sponges and sinks and rags.docx
- QUESTIONS Sponges and Sinks and Rags.doc

Sponge Soup Pre-Lab
Formative: Lab Assignment
Research and answer pre lab questions

Discovery - Discovering Bacteria
Formative: Other written assessments
Video and questions

Bacteria Mascot
Summative: Personal Project
Task: Choose any bacterium, good or bad. The task is to "morph" (transform) your chosen bacterium into a mascot with a team logo for a semi-pro sports team, group, club, or band. The intent is to relate structure to function.
- Bacteria Mascot.doc

Sponge Soup Lab
Summative: Lab Assignment

Bacteria Unit Exam
Summative: Written Test
- Bacteria Virus Test.docx

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Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 17 - Week 20

Last Updated: Monday, June 22, 2015 by Tim Dejulio

Eukaryotic Cells

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

The relationship between structure and function determines the efficiency and survival of all things.

Understanding critical elements and feedback mechanisms that contribute to the stability and behavior of a system is essential in order to predict and prevent catastrophic disruptions.

Unit EU's

A. Cells are the fundamental unit of life and must maintain homeostasis for survival.

B. Division of labor is achieved in cells by compartmentalization.

C. The functions of the nucleus extend beyond storing the genetic material.

D. DNA exists in different configurations.

Cell Unit Planner

Essential Question(s)

A. How are cells the fundamental unit of life, maintain homeostasis for survival?

B. How is the division of labor is achieved in cells?

C. What are the functions of the nucleus beyond storing the genetic material?

D. In what configurations does DNA exist?

Guiding Questions

Factual, Conceptual, Provocative

A1. What are the essential components of the cell membrane?

A2. How does the phospholipid bilayer make the cell membrane compatible with both A3. hydrophilic and hydrophobic substances?

A4. What limits what can pass across the cell membrane?

A5. How does the cell take in substances that cannot pass by simple diffusion?

A6. What is the law of diffusion?

A7. How does active transport differ from passive transport?

A8. What distinguishes osmosis from diffusion?

A9. What forms of energy can be used to move substances against the concentration gradient?

A10. What is facilitated diffusion?

A11. How do hypotonic, hypertonic, and isotonic solutions influence the cell?

A12. Why can plant cells survive a hypotonic solution and animal cells cannot?

A13. How does salting roads in the winter lead to environmental demise?

A14. How does the structure of the membrane hinder the delivery of medication to cells?

A15. Is there a better design for the cell membrane that has not evolved yet?

B1. What are the different "compartments"/organelles in the cell?

B2. How does each organelle contribute to maintaining homeostasis?

B3. What is the flow between organelles?

B4. Why would cell organelle numbers/types vary between different types of cells?

B5. What is the endomembrane theory?

B6. What are the similarities/difference between plant and animal cells?

B7. Why are mitochondria only inherited maternally?

B8. Could mitochondria contribute to genetic disorders?

B9. Are eukaryotic cells more advanced than bacterial cells?

B10. Which is more evolutionarily successful, bacteria or eukaryotic cells?

B11. Why don't antibiotics impact eukaryotic cells?

B12. What gives cells their shape?

B13. What are the structural/functional differences between cilia and flagella?

C1. How do molecules enter and leave the nucleus?

C2. What types of molecules enter and leave the nucleus?

C3. Why must DNA be protected by a nuclear membrane?

C4. What types of processes take place in the nucleus?

C5. How does the genetic material replicate and divide to form 2 new nuclei?

C6. Why do eukaryotic cells need a nucleus and bacteria don't?

C7.What is the function of the nucleolus?

C8. Technically, are there chromosomes in the nucleus?

C9. Is the nickname "control center" an appropriate name for the nucleus?

D1. What are the different configurations of DNA?

D2. What is the difference between chromatin and chromosomes?

D3. What is the function of the centromere?

D4. How do telomeres contribute to the aging of the cell?

D5. Should we pursue lengthening telomeres?

D6. Why does DNA need different configurations?

D7. Does the number of chromosomes contribute to the complexity of the organism?

D8. What careers are available in the field of cell biology?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 6-8

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They build strong content knowledge.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Discuss how cells are the fundamental unit of life and maintain homeostasis for survival.

Describe how the division of labor is achieved in cells.

Explain the functions of the nucleus beyond storing the genetic material.

Illustrate the different configurations of DNA.

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- They value evidence.
- They use technology and digital media strategically and capably.

CT: Science Framework (2005)

CT: Grade 8

VII. Heredity & Evolution

8.2 - Reproduction is a characteristic of living systems and it is essential for the continuation of every species.

- C 25. Explain the similarities and differences in cell division in somatic and germ cells.

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Biology

Cell Biology The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

- Cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
- Prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.
- The endoplasmic reticulum and Golgi apparatus have a role in the secretion of proteins.
- Usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.
- The role of the mitochondria is to make stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.

Genetics Mutation and sexual reproduction lead to genetic variation in a population.

- Meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.
- Only certain cells in a multicellular organism undergo meiosis.
- Random chromosome segregation explains the probability that a particular allele will be in a gamete.
- New combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).
- Approximately half of an individual's DNA sequence comes from each parent.
- Genes on specific chromosomes determine an individual's sex.

- Possible combinations of alleles in a zygote can be predicted from the genetic makeup of the parents.

Content/Topics
Critical content that students must KNOW

Essential Unit Vocabulary: Cell Membrane, Phospholipid, polar, semi/selectively permeable, hydrophilic, nonpolar, hdrophobic, channel protein, carrier protein, receptors, bilayer, Fluid Mosaic Model, Diffusion, Osmosis, Facilitated diffusion, Concentration gradient, with the gradient, against the gradient, hypertonic solution, hypotonic solution, isotonic solution, endocytosis, exocytosis, phagocytosis, pinocytosis, lysis, plasmolysis, ATP, ion gradients, Organelle, Ribosome, RER. SER. Golgi, Lysosome, Vesicle, Vacuole, Mitochondria, Chloroplast, Cell Wall, cytoplasm, cytoskeleton, cilia, flagella, microtubules, nucleolus, DNA, RNA, Chromosomes, Chromatin, Centromere, Telomere

Skills
Transferable skills that students must be able to DO

- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 7. Other.

Use dialysis tubing

Core Learning Activities
See Assessments

Resources
Professional & Student

See Assessments

Assessments (Titles)

Diagnostic Eukaryotic Cell
Formative: Other written assessments

Cell Parts

1. Which has more organelles, prokaryotic or eukaryotic cells?
2. What organelles are present in plant cells that are not present in animal cells and vise versa?
3. What are the functions of the following organelles: nucleus, ribosome, endoplasmic reticulum, mitochondria golgi bodies, vacuole, cell membrane, cell wall, cytoplasm, centrioles, chloroplast?

Cell Membrane

1. What is the function of the cell membrane?
2. What macromolecules make up the majority of the cell membrane?
3. Why can salt on roads be dangerous to life and their water balance?
4. What factors determine what can enter and leave the cell?

Cell Division

1. What type of reproduction is represented by mitosis? (asexual/sexual?)
2. What is the result of mitosis? (How many cells? Genetically

Graduation Standards
Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections
History

identical/different?)
3. What are the advantages/disadvantages of reproducing sexually/ asexually?

Eukaryotic Cell Unit Formative: Other written assessments

Cell Parts - Structure & Function

1. What are the differences between prokaryotic cells and eukaryotic cells in terms of structure and function?
2. What organelles are present in plant cells that are not present in animal cells and vise versa?
3. What are the functions of the following organelles: nucleus, ribosome, endoplasmic reticulum, golgi bodies, vacuole, cell membrane, cell wall, cytoplasm, centrioles, chloroplast?
4. How and why to organelles interact to carry out necessary functions of the cell?
5. Why do some organisms require membrane bound organelles and some do not?

Cell Membrane

1. What are the essential components of the cell membrane?
2. What limits the passage of materials across the cell membrane?
3. What is facilitated diffusion?
4. How does active transport differ from passive transport?
5. What distinguishes osmosis from diffusion?
6. How does the cell take in substances that cannot pass by simple diffusion?
7. What is the law of diffusion?

Mitosis/Meiosis

1. What are the difference between the outcome of mitosis and meiosis?
2. What types of cells undergo mitosis/meiosis?
3. How do spermatogenesis and oogenesis differ?
4. What happens when DNA can't be properly repaired?
5. Describe the process of

mitosis/meiosis.

6. Describe the steps of the cell cycle.
7. How does crossing over contribute to genetic diversity?

Cells Alive
Formative: Technology Project
Interactive Cell
http://www.cellsalive.com/cells/3dcell.htm
Cells Alive Chart fill in blanks.doc

Cell Membrane Activity
Formative: Other Visual Assessments
Cell Membrane Worksheet Questions Honors.docx
Cell Membrane Worksheet Questions.docx

Membrane Transport Lab
Formative: Lab Assignment
Diffusion Through a Pseudo Cell Membrane 2014 (additional page in data section for kids to do during

Cell Membrane/Transport Quiz
Formative: Other written assessments

Cell Scenario
Summative: Other oral assessments
Cell Organelle Speeches.docx

Claymation Activity
Summative: Other Visual Assessments
Using clay students demonstrate the stages of Mitosis and/or Meiosis and crossing over

Eukaryotic Cell
Summative: Other written assessments
Cell Reproduction

1. What 3 strategies do organisms use to contribute to genetic diversity?
2. What different lifestyle considerations do females have to take in regards to eggs versus males with sperm?
3. Is the quality of frozen human eggs in terms of "healthy" offspring the same as newly ovulated eggs?
4. Should humans try and accelerate mutation to produce greater genetic diversity to ensure survival

of humans? 5. Is it ethical to experiment with gametes? 6. Is selective breeding in humans ethical? 7. Would it be beneficial for humans to be able to reproduce by mitosis? 8. Why does crossing different species not produce viable offspring? **Eukaryote Cell Unit Exam** **Summative: Written Test**		

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Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 21 - Week 25

Last Updated: Monday, June 22, 2015 by Susan McConnell

Mendelian Genetics

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

System models illustrate interactions between internal components and external factors, which help to predict the behavior of systems.

Patterns are found at all levels of organization, forming trends and cycles that allow for identification, classification, prediction, intervention, response, and design.

Unit EU's

Informed decisions can be made using patterns of inheritance for lifestyle. Reproduction, and medical treatment.

Topical Generalization

Genetic crosses are useful in predicting traits in offspring.

Information obtained from Pedigrees can be used to improve the quality of life through life style interventions.

Traits in individuals are influenced by environmental factors.

Mendelian Genetics Unit Planner

Essential Question(s)

A. How are genetic crosses are useful in predicting traits in offspring?

B. How can Information obtained from Pedigrees can be used to improve the quality of life through life style interventions?

C. How are traits in individuals influenced by environmental factors?

Guiding Questions

Factual, Conceptual, Provocative

A1. What tools are used to predict traits in offspring?

A2. How does an individual genotype affect phenotypes?

A3. Why are tools used to predict certain traits in offspring?

A4. What are the different forms of alleles?

A5. What is the difference between codominance and incomplete dominance and how is each predicted?

A6. How is the inheritance pattern of sex linked traits different from autosomal traits?

A7. What types of inheritance patterns do red blood cells demonstrate and how does this affect blood type?

A8. Why are some trait more frequently passed on from mother to son?

A9. Can the tools of prediction be misleading?

B1. How are pedigrees designed?

B2. How are the components of the pedigree useful in predicting traits across generations?

B3. How are inheritance patterns identified?

B4. Can genotype always be determined using pedigrees?

B5. Should family genetic history be accessible to insurance companies to be used to determine medical coverage/cost?

B6. What careers are available in the field of genetics?

B7. Are there negatives associated with pedigree design?

B8. What ethical issues can arise from use of Pedigrees?

C1. Why are people a product of genes and environment?

C2. Can genetic destiny be controlled?

C3. What are some examples of traits influence by environmental factors?

C4. What environmental factors influence phenotypes?

C5. Should people be fined for not altering lifestyle in accordance with genetic predisposition?

C6. What are the political implications in the role of environment on genetics?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They build strong content knowledge.

Reading: History/Social Studies

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RH.9-10.1. Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

Reading: Science & Technical Subjects

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Demonstrate how genetic crosses are useful in predicting traits in offspring.

Explain how information obtained from Pedigrees can be used to improve the quality of life through life style interventions.

Predict how environmental factors can influence genetic traits.

(e.g., in an equation) into words.

Writing

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

High School Biology

Genetics Mutation and sexual reproduction lead to genetic variation in a population.

- Genes on specific chromosomes determine an individual's sex.

A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization.

- The probable outcome of phenotypes in a genetic cross can be predicted from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).
- Mendel's laws of segregation and independent assortment are the basis of genetics.
- The probable mode of inheritance can be predicted from a pedigree diagram showing phenotypes.

Evolution The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time.

- Natural selection acts on the phenotype rather than the genotype of an organism.
- Alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.
- New mutations are constantly being generated in a gene pool.
- Variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

Content/Topics

Critical content that students must KNOW

Genotype, phenotypes, heterozygous, homozygous, allele, dominant, recessive, sex linked traits, codominance, incomplete dominance, polygenetic inheritance, Punnett square, pedigree chart, generation, P, F

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and

accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
- 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Core Learning Activities

See assessments.

Resources

Professional & Student

See assessments.

Assessments (Titles)

Diagnostic Mendelian Genetics Formative: Other written assessments

Genetic Crosses

1. How do you construct a Punnett Square?
2. How do we determine which form a trait will end up in each egg or sperm?
3. Why are we unable to predict all traits in an offspring using Punnett Squares?
4. What is a dominant trait verses a recessive trait?
5. What is the difference between being homozygous or heterozygous for a particular trait?
6. What is the difference between genotype and phenotype?

Pedigrees

1. What is the difference between inheritance of dominant and recessive traits?
2. What do the symbols on a pedigree stand for?

Mendelian Genetics Unit Summative: Other written assessments

Genetic Crosses

1. Why are tools used to predict certain traits in offspring?
2. What are the different forms of alleles?
3. What is the difference between codominance and incomplete dominance and how is each predicted?
4. How is the inheritance pattern of sex linked traits different from autosomal

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

History

Math

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traits?
5. What types of inheritance patterns do red blood cells demonstrate and how does this affect blood type?
6. Compare sex linked patterns of inheritance to autosomal inheritance.
7. Does the inheritance of one trait always affect the inheritance of another?

Pedigrees

1. Using a pedigree, determine the pattern of inheritance. (dominant, recessive, autosomal or sex-linked)
2. Using a pedigree, identify the phenotype and genotype of each individual in the pedigree.
3. Compare and contrast the information represented in a punnett square and a pedigree.

Alien Genetics
Summative: Other Visual Assessments
Alien Genetics assignment.doc

Paternity/Maternity Blood Types
Formative: Other written assessments
Application of Punnett Squares
Blood Groups Practice.pdf
blood typing and pedigrees.doc

Predicting Genotype and Phenotype of Offspring
Formative: Other written assessments
Applications of Punnett Squares
dragon-genetics-packet.pdf
2 Factor Crosses.pdf
Punnett Squares.pdf
sex_linked_practice_problems.doc

Chances of Inheritance
Summative: Other written assessments
Advise a potential couple of their chances of inheriting a particular genetic disease using whichever genetic tool you deem possible.

Pedigree Online Activity
Summative: Technology Project
http://www.zerobio.com/drag_gr11/pedigree/pedigree_overview.htm

Construction of a Pedigree
Summative: Other Visual Assessments

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Construct a pedigree to show the inheritance of traits through a family: Autosomal recessive, sex-linked recessive, polygenic Constructing a Human Pedigree.docx **Mendelian Genetics Unit Exam** **Summative: Written Test** **Genetic Disease Brochure/Scavenger Hunt** **Summative: Other written assessments** Genetic disorder pamphlet.doc Genetic Disease Brochure Scavenger Hunt 2014.docx **Karyotype: Lab Assignment** **Formative: Lab Assignment** **Design a Child Activity** **Formative: Other written assessments** Ugly baby questions.pdf		

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Newtown Public Schools
Biology

Newtown High School > Grade 10 > Science > Biology > Week 26 - Week 34

Last Updated: Monday, June 22, 2015 by Susan McConnell

Molecular

Collaboration

Enduring Understanding(s)/ Generalization(s)

K-12 EU's

Patterns are found at all levels of organization, forming trends and cycles that allow for identification, classification, prediction, intervention, response, and design.

Systems, in order to survive, must balance against competing influences that cause change over time.

Unit EU's

Molecular transfer of information must occur with fidelity to ensure survival, yet without change, organisms would go extinct.

Topical Generalizations

A. Continuity and change are essential for survival.

B. The "normal" flow of information within a cell is from DNA to RNA to Protein.

C. Molecular change can take place at different levels.

D. Knowledge of molecular transfer of information has practical applications.

Molecular Genetics Unit Planner

Essential Question(s)

A. How are continuity and change essential for survival?

B. What is the "normal" flow of information within a cell?

C. What are the different levels that molecular change can take place.

D. How can knowledge of molecular transfer of information have practical applications.

Guiding Questions

Factual, Conceptual, Provocative

A1. What features built into the structure DNA allow for fidelity of replication?

A2. What are the base pairing rules?

A3. What happens when DNA can't be properly be repaired?

A4. What are the difference between the outcome of mitosis and meiosis?

A5. What are the advantages/disadvantages of reproducing sexually/ asexually?

A6. What types of cells undergo mitosis/meiosis?

A7. How does mitosis maintain continuity?

A8. How does meiosis maintain continuity yet lead to diversity?

A9. What 3 strategies do organisms use to contribute to genetic diversity?

A10. What are mutagens?

A11. What are the 3 outcomes of mutation?

A12. How do spermatogenesis and oogenesis differ?

A13. What different lifestyle considerations do females have to take in regards to eggs versus males with sperm?

A14. Is the quality of frozen human eggs in terms of "healthy" offspring the same as newly ovulated eggs?

A15. Should humans try and accelerate mutation to produce greater genetic diversity to ensure survival of humans?

A16. Is it ethical to experiment with gametes?

A17. Is selective breeding in humans ethical?

A18. Would it be beneficial for humans to be able to reproduce by mitosis?

A19. Why does crossing different species not produce viable offspring?

B1. Why must sections of DNA be copied to make a protein?

B2. What are the differences between DNA and RNA?

B3. What is the role of mRNA, tRNA, and rRNA in protein synthesis?

B4. How does transcription differ from translation?

B5. How does the RNA polymerase know where to begin transcription?

B6. Where do transcription and translation take place?

B7. What role does the ribosome play in translation?

B8. Why must cells turn off certain genes?

B9. How do cells regulate which proteins are made?

B10. What are the building blocks of proteins?

B11. What happens to a protein once it is released from the ribosome?

B12. How does tRNA know which amino acid to deliver?

B13. What is involved in initiation, elongation and termination?

B14. How do mutations impact transcription/translation?

B15. How does the universality of the genetic code support evolution?

B16. If the genetic code is universal, are humans all that different from other life forms?

C1. How can monosomy and polysomy occur?

C2. What are the results of monosomy and polysomy?

C3. What is a karyotype and what is it trying to detect?

C4. What are the different levels at which molecular changes take place?

C5. What is the difference between a chromosomal anomaly and a mutation?

C6. What are the different types of mutations that occur in DNA?

C7. If genetic testing leads to termination, should it be performed?

C8. What is the difference between spontaneous mutations and inherited mutations?

C9. Other than genetic diseases, what can mutations cause?

C10. What different genetic disorders can result from the various types of mutation?

C11. Is sickle cell trait a beneficial mutation in a population?

D1. What are the ethical implications of the following: Gene therapy, Human protein production, Infertility treatment, Transgenic organisms, Genetically modified plants, Genetic Testing, pGlo, Cloning, Stem Cell Therapy?

D2. Is it "playing God" when organisms are genetically altered?

D3. Is it immoral not to genetically alter an individual to cure a disease?

D4. Should genetic testing be kept confidential if it could save a family member's life?

D5. What careers are available in the field of Molecular Biology?

Standard(s)	Objective(s)
Content and CCSS	Bloom/ Anderson Taxonomy / DOK Language Justify how continuity and change are essential for survival.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

- They build strong content knowledge.
- They value evidence.
- They use technology and digital media strategically and capably.
- They come to understand other perspectives and cultures.

Reading: Science & Technical Subjects

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.9-10.1. Write arguments focused on discipline-specific content.
- WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.9-10.2a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

Production and Distribution of Writing
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

- WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and

Describe the "normal" flow of information within a cell.

Identify the different levels that molecular change can take place.

Predict the practical applications of molecular understanding.

interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Biology

Cell Biology The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

- The central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.

Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.

- Ribosomes synthesize proteins, using tRNAs to translate genetic information in the mRNA.
- The sequence of amino acids in a protein can be predicted from the sequence of codons in the RNA, by applying universal genetic coding rules.
- Mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.
- Specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.
- Proteins can differ from one another in the number and sequence of amino acids.
- Proteins having different amino acid sequences typically have different shapes and chemical properties.

The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.

- Base-pairing rules are used to explain the precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.
- Genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
- DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation and transformation) is used to construct recombinant DNA molecules.
- Exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.

Evolution The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time.

- New mutations are constantly being generated in a gene pool.

Content/Topics

Critical content that students must KNOW

mitosis, meiosis, diploid, haploid, polyploidy, molecular genetics, molecular biology, semiconservative replication. complementary, base pairing,

Skills

Transferable skills that students must be able to DO homologous chromosomes, sister chromatids, sexual reproduction, asexual reproduction, genome, cytokinesis, cell cycle, somatic cells, gonads, nondisjunction, tetrads, autosome, polar bodies, spermatogenesis, oogenesis, crossing over, random alignment, selective breeding, mutation, mutagen, eugenics, transcription, translation, mRNA, rRNA, tRNA, amino acids, ribosomes, codon, anticodon, initiation, elongation, termination, genetic code, promoter, termination signal, monosomy, polysomy, point mutation, frameshift mutation, insertion, deletion, inversion, translocation, sickle cell trait, Gene therapy, Human protein production, Infertility treatment, Transgenic organisms, Genetically modified plants, Genetic Testing, pGlo, Cloning, PGD, stem cell therapy, Human protein production, DNA fingerprinting, epigenetics, methylation,epigenetics

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.
- 7. Other.

Essential Scientific Engineering Practices

Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Constructing explanations (evidenced based)
Engaging in argument (evidenced based)
Obtaining, evaluating, and communicating information
Gel electrophoresis
Genetic transformation
Pipetting

Core Learning Activities

See assessment.

Resources

Professional & Student

See assessment.

Assessments (Titles)

Diagnostic Molecular
Formative: Other written assessments
DNA and RNA

1. What molecules are coded for by DNA?
2. What is the primary function of DNA?
3. What are the structural differences between DNA and RNA?
4. What are the essential structural components of DNA/RNA?

Protein Synthesis

1. What types of RNA are involved in protein synthesis?
2. What are the building blocks of proteins?
3. Explain why proteins are important.
4. What cell structures are involved in protein synthesis?
5. What roles to proteins play in genetic disease?

Mutations

1. What is a mutation?
2. At what level do genetic mutations occur?
3. What causes a genetic mutation?
4. What is a genetic disorder?
5. What different genetic disorders can result from the various types of

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Math

History

K 2

mutation?
6. What are the different types of mutations that occur in DNA?

Environmental Influence

1. What is genetic predisposition?
2. List environmental factors that can affect or mutate genes.
3. What are the possible results of genetic alternation due to environmental factors?
4. How are epigenetics and environmental factors links?
5. What is epigenetics?
6. Can epigenetic factors be controlled/altered?

Biotechnology/Bioethics

1. What is a stem cell?
2. What is cloning?
3. Are genetically modified organisms harmful and/or helpful and why?
4. How is gene therapy currently being used?
5. What are ethical dilemmas that go along with modifying DNA?
6. List some foods that you eat that are genetically modified.

Molucular Transfer of Information Unit
Formative: Other written assessments
DNA and RNA

1. What is the difference between chromatin and chromosomes?
2. What is the function of the centromere?
3. What role does complimentary base pairing play in DNA replication? Protein synthesis?
4. By what model does DNA replicate during cell division?
5. Where can we find DNA within the cell? RNA?
6. What are the 3 types of RNA and their functions?
7. What type of bonds hold the two strands of DNA together?
8. What macromolecule interacts with DNA to allow it to coil into a chromosome? What is the specific name for this molecule?
9. What is the consequence of DNA not replicating correctly?

10. What are some things that cause DNA not to replicate correctly?

Protein Synthesis

1. As a class, act out the process of Protein synthesis
2. Compare and contrast the three different types of RNA that are directly involved in translation.
3. Compare and contrast transcription and translation.
4. How do cells regulate which proteins are made?
5. After looking at two strands of DNA, identify the type of mutation that has occurred (point mutation, frameshift mutation, insertion, deletion, inversion, translocation).
6. Why might a change in the genetic code result in a different protein?

Mutations

1. Why would it be important to know one's karyotype?
2. You and your wife have a baby with severe Down's Syndrome, your wife is pregnant again and the doctor has told you that they have a new test to confirm if this baby has Down's as well. If genetic testing leads to spontaneous termination, should it be performed?
3. How can sickle cell trait be a beneficial mutation in a population?

Environmental Influence

1. You are an employer and know from genetic testing that the most qualified applicant for the job has a 70% chance of developing multiple sclerosis in one years time. Would you hire this person?

Biotechnology/Bioethics

1. What careers are available in the field of Molecular Biology?
2. What is a transgenic organism?
3. How do we transform organisms?
4. How do we select for genetically transformed bacteria?
5. Discuss the process of in vitro fertilization.
6. Describe nuclear transfer.
7. Discuss the difference between embryonic and adult stems cells

in terms of uses and controversy.
8. Define PGD and describe its uses.
9. What is gene therapy and how it is being used today?
10. How are restriction enzymes used in biotechnology?
11.What is the importance of palindromes in creating a transgenic organism?
12. How can gel electrophoresis be used to solve paternity/maternity cases/crimes?
13. What are potential vectors for transferring genetic material?

DNA Model/Puzzel
Formative: Other Visual Assessments

GATTACA Movie
Formative: Other written assessments
Movie & quiz
GATTACA Questions.doc

DNA Isolation Lab
Summative: Lab Assignment
DNA Isolation.doc

Molecular Gentics Unit
Summative: Other written assessments
RNA & Protein Synthesis

1. What is the role of mRNA, tRNA, and rRNA in protein synthesis?
2. How does the universality of the genetic code support evolution?
3. If the genetic code is universal, are humans all that different from other life forms?
4. How do mutations impact transcription/translation?

Mutations

1. What are the different types of mutations that occur in DNA?
2. What is the difference between spontaneous mutations and inherited mutations?

Environmental Influence

1. Do genes solely determine who we are?

Biotechnology/Bioethics

Explain the limitations of gene therapy, stem cells, and transgenic organisms.

How might epigenetics help or interfere with DNA therapies?

55

What are the limitations of currently used vectors? Bioethical Debates Unit Assessment pGLO Lab Stem Cell Interview DNA Fingerprinting Lab **You are a Superhero!** **Formative: Other Visual Assessments** Create a superhero mutant You are a Superhero.docx **Transcription Translation Activity** **Formative: Other written assessments** TranscriptionTranslationProtocol.rtf.doc **DNA Dilemas Debate** **Summative: Other oral assessments** DNA dilemmas.doc **DNA Fingerprinting Lab** **Summative: Lab Assignment** DNA Fingerprinting Lab Manual.pdf DNA Fingerprint lab scoring rubric.doc **pGlo Lab** **Summative: Lab Assignment** **Stem Cell Interview** **Summative: Other written assessments** **Molecular Unit Exam** **Summative: Written Test** **Learn.genetic – Epigenetics web quest** **Summative: Technology Project** Epigenetics PBS.docx **Lorenzo's Oil** **Formative: Other Visual Assessments** 11 - Lorenzo's Oil Worksheet.doc **Madam I'm Adam** **Formative: Other written assessments** Madam I'm Adam.pdf		

Atlas Version 8.1.1

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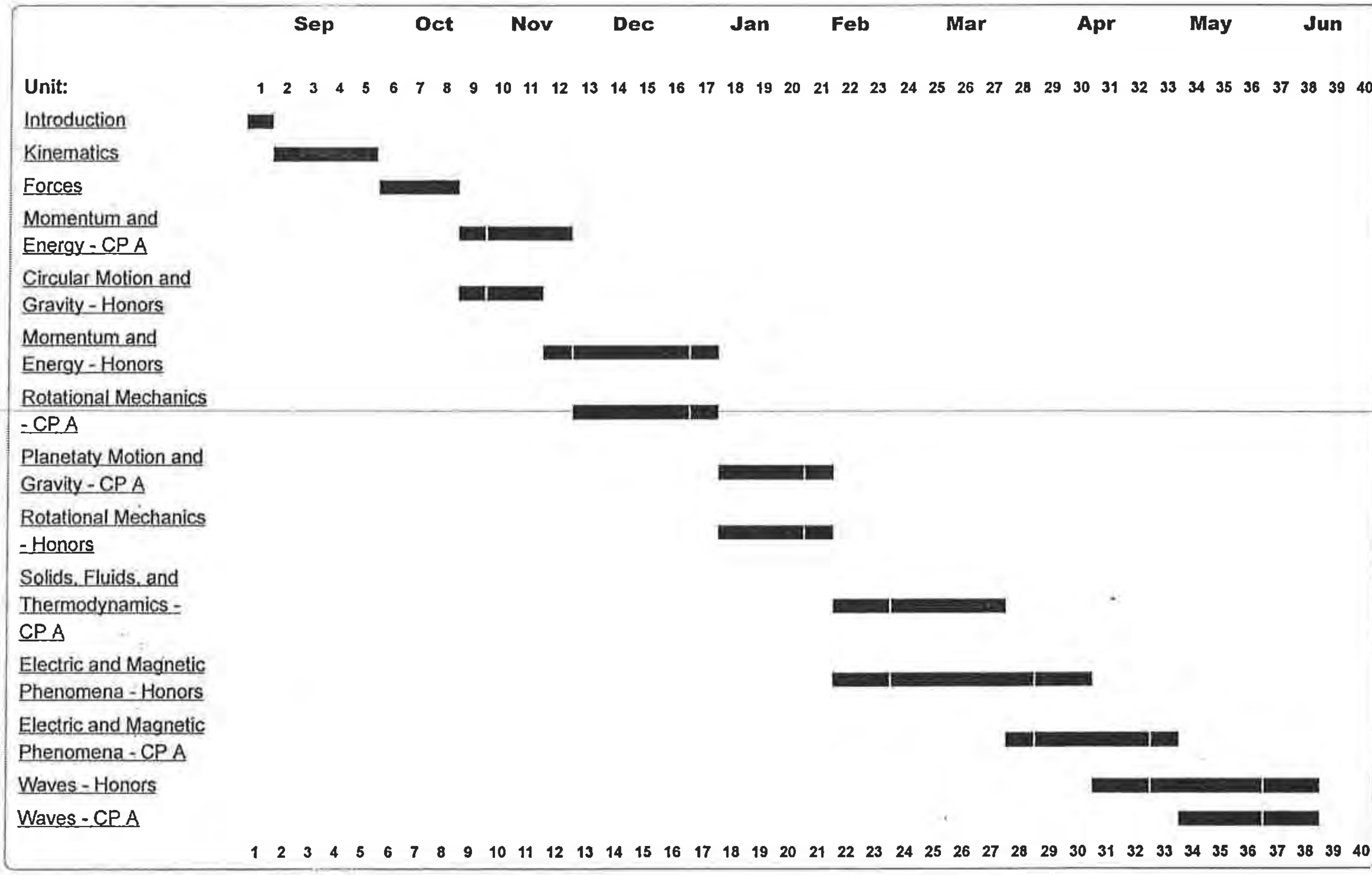
Newtown Public Schools

Physics

Newtown High School > Grade 11 > Science > Physics

Last Updated: Friday, June 19, 2015 by Steve Malary

Collaboration



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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 1

Last Updated: Monday, August 18, 2014 by Kim Lowell

Introduction

Collaboration

Enduring Understanding(s)/ Generalization(s)

The scientific method and technology allow us to gather data, analyze results, and draw conclusions to solve problems.

Graphs are useful tools for understanding and managing information about the world around us.

The sketch of a graph allows us to analyze and solve real world problems.

Critical thinking skills are used in the solution of mathematical problems.

Essential Question(s)

How do scientists design and conduct experiments and what can be learned from studying the data from those experiments?

Guiding Questions

Factual, Conceptual, Provocative

Can you interpret graphs

-to find the line of best fit?

-to make predictions from the graph?

Can you use the mathematics of science

-to convert between units?

-to write numbers in scientific notation?

-to solve algebraic equations?

-to solve trigonometric equations?

Can you explain the scientific method?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- explain how the scientific method underlies all physics investigations and apply this concept.
- analyze data so they can create graphs and calculate the slope of the graph.
- estimate values of future results using the graphs that they created.
- convert between units.
- compare scientific notation to decimal form.
- solve for angles and sides of a right triangle using trigonometric functions.

2

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

3

Content/Topics

Critical content that students must KNOW

- Scientific Method
- Graphing Skills
- Trigonometry Skills
- Algebra Skills

Key Terms-

scientific method, slope, intercept, axis, SI units, sine, cosine, tangent, conversion

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

Core Activities

- Laboratory Activity: Seeing is Believing (see Conceptual Physics, Laboratory Manual)
- Alternate Online Optical Illusions Lab

https://gitso-outage.oracle.com/thinkquest

Suggested Activity

- Robert Pershing Wadlow Graphing Activity

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print. Teacher Edition.
- Hewitt, Paul G. *Practicing Physics: Conceptual Physics.* 8th ed. Reading, MA: Addison-Wesley, 1998. Print. Teacher Edition.

Students Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Hewitt, Paul G. *Practicing Physics: Conceptual Physics.* 8th ed. Reading, MA: Addison-Wesley, 1998. Print.
- Library Media Center.
- Teacher websites.

http://www.physicsclassroom.com/
www.webassign.net

Assessments (Titles)

Seeing is Believing
Formative: Lab Assignment
This is a College Prep lab about optical illusions used to discuss the scientific method.

Robert Wadlow Lab
Formative: Lab Assignment
Data is given to students about the growth of a normal boy and the growth of the tallest person to have lived. Students need to graph the data, find the best fit line, and discuss the validity of predictions taken from the best fit line.

Quiz on Math and Science Skills
Summative: Standardized Test
This quiz is about math and science skills that students will need to be successful in physics class for the year.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Students will be reviewing their graphing, algebra, and trigonometry skills from previous math classes.

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4

Newtown Public Schools

Physics

Newtown High School > Grade 11 > Science > Physics > Week 2 - Week 5

Kinematics

Collaboration

Enduring Understanding(s)/ Generalization(s)

The motion of an object is a function of observed position in relation to the perceived passage of time.

Velocity describes the rate of change of position with time and acceleration describes the rate of change of velocity

The effect of gravity near the surface of the earth provides an effectively constant vertical acceleration in the downw

Vectors can describe properties that have both magnitude and direction and can be used to describe the motion of line.

Essential Question(s)

In what way are motions described?

Guiding Questions

Factual, Conceptual, Provocative

How do the characteristics of moti relate to each other for motion in a

What effect does gravity have on

What are vectors and how do they one direction?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Objective(s)

Bloom/ Anderson Taxonomy / D

- Students will analyze and inte terms of its characteristics: pc
- Students working in groups w examining an object falling du acceleration.
- Students will describe charac properties, in terms of their m vector components to find the

5

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate

forms.

- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

NGSS: K-12

Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .

Content/Topics

Critical content that students must KNOW

- 1-D motion
- Vectors
- 2-D motion

Skills

Transferable skills that students

- 1. Use real-world digital and c effectively apply information a
- 2. Work independently and cc accomplish goals.
- 3. Communicate information tools/media in varied contexts
- 4. Demonstrate innovation, fl work habits, and working/lear
- 5. Effectively apply the analys that enable productive proble

Core Learning Activities

- Motion Detector Lab
- Alternate Online Virtual Motion Detector Lab (http://ngsir.netfirms.com/englishhtm/Kinematics.htm)
- Alternate Online Virtual Motion Detector Lab (http://www.mste.uiuc.edu/murphy/MovingMan/MovingMan.html)
- Projectile Motion Lab
- Alternate Online Virtual Projectile Motion Lab (http://ngsir.netfirms.com/englishhtm/ThrowABall.htm)
- Alternate Online Virtual Projectile Motion Lab (http://www.walter-fendt.de/ph14e/projectile.htm)

Suggested Activities

- "Picket Fence" Laboratory
- Alternate Online Virtual "Picket Fence" Laboratory (http://jersey.uoregon.edu/AverageVelocity/index.html)
- Galileo Incline Lab
- Vector Treasure Hunt Activity
- Alternate Online Virtual Vector Lab (http://mysite.verizon.net/vzeoacw1/vector_addition.html)

Resources

Professional & Student

Professional

- Conceptual Physics: The Higl Teacher's Edition, or Physics,

Student

- Conceptual Physics: The Higl or Physics, 5th Ed., Giancoli,
- http://www.physicsclassrc concepts in physics.
- Library Media Center.
- Teacher websites.

http://www.physicsclassroom.c

Assessments (Titles)

Motion Detector Lab
Formative: Lab Assignment

Students move to match the graphs of different motion

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Inte Con

Studen previou algebra

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characteristics as a function of time. Student motion is captured and reproduced using motion detectors.

Picket Fence Lab
Formative: Lab Assignment
A photogate and a "picket fence" are used as tools in evaluating the acceleration due to gravity.

1-D Motion Test
Summative: Written Test
Test on characteristics of motion for motion in a straight line including vertical motion subject to gravity.

Galileo Incline Lab
Formative: Lab Assignment
Students use dynamics carts rolling down an incline to determine the acceleration due to gravity from the component of gravity acting along the length of the incline.

Vector Treasure Hunt Activity
Formative: Other written assessments
Students, working in groups, use various techniques in adding vectors to locate a "treasure."

Projectile Motion Lab
Formative: Lab Assignment
Students predict the landing location of a projectile based upon an evaluation of the projectile's launch characteristics.

Vectors and 2-D Motion Test
Summative: Written Test
Test on vectors and vector operations and describing the characteristics of motion in two dimensions including projectile motion.

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 6 - Week 8

Last Updated: Monday, August 18, 2014 by Kim Lowell

Forces

Collaboration

Enduring Understanding(s)/ Generalization(s)

Laws help predict and describe motion.

Force describes an interaction between two objects.
Unbalanced interactions cause an object's motion to change; the change in motion, not the motion itself, is in the direction of the unbalanced force.

Essential Question(s)

How is force related to changes in motions of objects?

How can an athlete in your sport improve their performance using one of Newton's three laws of motion?
What variables can you manipulate to affect the movement of objects?

Guiding Questions

Factual, Conceptual, Provocative

How can you physically/pictorially represent the forces exerted on a system?
How are balanced and unbalanced forces represented?
How do you determine the net force on an object?
How does Newton's first law relate to constant motion (v=0), zero net force?
What is the cause and effect relationship between net force, mass and acceleration as described in Newton's Second Law?

What is Newton's third law?
How can any side of a tug of war win if Newton's 3rd law is true?
What is the difference between a field force and a contact force?

What is normal force, how must is always be drawn?
What are the types of friction?
How can Newton's Laws, force diagrams, and motion diagram be utilized to represent various applications, such as but not limited to inclines, elevators, etc.?
How do students represent and analyze a system of two or more objects, for constant velocity and acceleration?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- apply Newton's laws in establishing the connection between changes in motion and force.
- create free body diagrams for an object.
- apply knowledge of Newton's Second Law to solve problems involving forces, mass, accelerations, motion, and friction.
- recognize the need for use of the kinematics equations to solve problems involving forces, mass, accelerations, motion, and friction.
- compare and contrast mass and weight.

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

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- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- When forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest.
- The law F = ma is used to solve motion problems that involve constant forces.
- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction.
- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction.
- Newton's laws are not exact but provide very good approximations unless an object is small enough that quantum effects become important.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

- HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Content/Topics

Critical content that students must KNOW

- The concept of Force
- Newton's First Law
- Newton's Second Law
- Newton's Third Law
- Multiple Types of Forces

Key Terms:

force, net force, inertia, friction, mass, weight, gravitational force, normal force, tension, coefficient of friction, equilibrium, free body diagrams

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
- 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

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Core Learning Activities

Core Activities

- Force Table Laboratory
- Modified Atwood's Machine Laboratory
- Alternate Online Virtual Force Lab

http://www.walter-fendt.de/ph14e/n2law.htm

- Alternate Online Virtual Force Lab

http://www.lon-capa.org/~mmp/kap4/cd082.htm

Suggested Activities

- Newton's Third Law Activity
- "Newton's Laws" Video
- Friction Laboratory

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print. Teacher Edition.
- Hewitt, Paul G. *Practicing Physics: Conceptual Physics*. 8th ed. Reading, MA: Addison-Wesley, 1998. Print. Teacher Edition.

Student Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Hewitt, Paul G. *Practicing Physics: Conceptual Physics*. 8th ed. Reading, MA: Addison-Wesley, 1998. Print.
- Library Media Center.
- Teacher websites.

http://www.physicsclassroom.com/

www.webassign.net

Assessments (Titles)

Force Table Lab
Formative: Lab Assignment
Students calculate for an unknown force that will balance the force table. They use their knowledge about vectors to do so.

Modified Atwood Lab
Formative: Lab Assignment
Students will prove Newton's Second law using a modified Atwood. They will get the acceleration of the system by experimentation and calculate for it as well.

Test on Forces
Summative: Standardized Test
Students will take test on forces which will have multiple choice, short answer, and conceptual questions.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 9 - Week 12

Last Updated: Tuesday, August 19, 2014 by Steve Malary

Momentum and Energy - CP A

Collaboration

Enduring Understanding(s)/ Generalization(s)

The momentum of an object is the product of its mass and velocity and is a vector quantity.

In a closed system, the momentum is conserved.

All energy can be considered kinetic, potential, or field.

The total energy of the universe is constant.

Essential Question(s)

What are energy and momentum?

In what way are these properties conserved?

How does their conservation allow predicting the motion of objects that interact interact with each other?

How can energy be transferred from one object to another?

Guiding Questions

Factual, Conceptual, Provocative

What is momentum and how does its change relate to what is defined as impulse?

What form does Newton's second law take in terms of momentum?

Under what circumstances is momentum conserved?

What happens to the momenta of objects that collide?

How do interactions between objects lead to definitions of work and power and how does work serve to define energy?

How are kinetic energy and potential energy defined as forms of energy?

What is the work-energy theorem and how does it relate work to changes in a system's energy?

Under what conditions is energy conserved?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Students will describe the momentum of the same object moving at different velocities.
- Students will explain that impulses produce changes in momentum.
- Students will apply knowledge of impulses to understand how seat belts and airbags work in cars.
- Students will investigate collisions and explosions and show that momentum is a conserved property.
- Students will predict the final velocity of objects after collisions, given the initial velocities.
- Students will identify where work is being performed in a variety of situations.
- Students will calculate the net work done when many forces are applied to an object.
- Students will describe different types of energy, show how energy is converted from one form to another and demonstrate the total energy of a system is conserved in the absence of work.
- Students will calculate kinetic and potential energy for an object.
- Students will explain situations in which conservation of mechanical energy is valid.
- Students will solve problems using conservation of mechanical energy.
- Students will demonstrate an understanding that energy cannot be created or destroyed, but only changed from one form to another.
- Students will distinguish between elastic and inelastic collisions.
- Students will calculate the changes in kinetic energy during perfectly

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Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Conservation of Energy and Momentum The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects

- Kinetic energy can be calculated by using the formula E = (1/2)mv2.
- Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh.
- Momentum is calculated as the product mv.
- An unbalanced force on an object produces a change in its momentum.
- The principles of conservation of momentum and energy can be used to solve problems involving elastic and inelastic collisions.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

- HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS.Energy

Performance Expectations

inelastic collisions

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- HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

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NGSS: K-12

Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 2. Cause and effect: Mechanism and explanation . Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .
- 5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

NGSS: Disciplinary Core Ideas (K-12)

NGSS: K-12

Physical Sciences

Core Idea PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

Core Idea PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces

Content/Topics

Critical content that students must KNOW

- Momentum and impulse
- Newton's second law in terms of momentum
- Conservation of momentum
- Collisions
- Work, power, and energy
- Kinetic and potential energies
- Work-energy theorem
- Conservation of energy

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

- "Explosions" and the Conservation of Momentum Lab
- Alternate Online Virtual Momentum Lab (http://ngsir.netfirms.com/englishhtm/DropABrick.htm)
- Alternate Online Virtual Conservation of Momentum Lab (http://www.walter-fendt.de/ph14e/collision.htm)

Suggested Activities

- Impulse and Change in Momentum Lab
- "Conservation of Momentum" Video
- "All About Work," a Work-Energy Principle Lab
- "Conservation of Energy" Video
- Block and Tackle Lab
- Conservation of Mechanical Energy Lab
- Alternate Online Virtual Conservation of Mechanical Energy Lab (http://jersey.uoregon.edu/PotentialEnergy/index.html)
- Energy Transfer in Collisions Lab
- Egg Drop Activity

Resources

Professional & Student

Professional

- Conceptual Physics: The High School Physics Program, Hewitt, P.G., Teacher's Edition.

Student

- Conceptual Physics: The High School Physics Program, Hewitt, P.G.
- http://www.physicsclassroom.com Basic background information on concepts in physics.
- Library Media Center.
- Teacher websites.

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Assessments (Titles)

Impulse and Change in Momentum Lab
Formative: Lab Assignment
Students will confirm impulse equates with the change in an object's momentum using a motion detector to record the change in motion of a dynamics cart pulled by an elastic cord attached to a force sensor.

"Explosions" and the Conservation of Momentum Lab
Formative: Lab Assignment
Students will use low friction carts to prove the law of conservation of momentum. They will use photogates to measure the velocities of each cart both before and after the collision.

"All About Work," a Work-Energy Principle Lab
Formative: Lab Assignment
Students show using a motion detector and a dynamics cart how work can be equated with the change in the cart's kinetic energy.

Block and Tackle Lab
Formative: Lab Assignment
Students use a block and tackle pulley system to examine mechanical advantage and mechanical efficiency.

Conservation of Mechanical Energy Lab
Formative: Lab Assignment
Students will use carts moving down an incline to prove conservation of energy.

Energy Transfer in Collisions Lab
Formative: Lab Assignment
Students use collision carts and photogates to confirm that momentum is conserved although energy is lost in completely inelastic collisions.

Egg Drop Activity
Formative: Group Project
Students will create a structure to put an egg into so that it will survive a two story fall without cracking. They will use their knowledge of impulse and momentum to do so.

Momentum and Energy Test
Summative: Written Test
Test on momentum and its conservation, work, power, and

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Students can relate what they are learning about work, power, and kinetic energy to activities they are doing in physical education classes.

energy and its conservation.		

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 9 - Week 11

Last Updated: Monday, August 18, 2014 by Kim Lowell

Circular Motion and Gravity - Honors

Collaboration

Enduring Understanding(s)/ Generalization(s)

Laws help predict and describe motion.

The net force that other objects exert on an object moving at constant speed in a circle points toward the center of the circle.

A gravitational force exists between any two masses. The magnitude of this force is directly proportional the product of the two masses and inversely proportional to the square of the distance between the centers of the two masses.

Essential Question(s)

How does gravity affect the motion of planets and satellites?

How is circular motion like and unlike linear motion?

Guiding Questions

Factual, Conceptual, Provocative

Why is an object moving in a circle at a constant speed accelerated?
How does centripetal acceleration depend upon the object's speed and the radius of the circle?
What force causes centripetal acceleration?

How does Kepler's law relate to the law of universal gravitation?
How does weightlessness relate to objects in free fall?
What is a gravitational field?

How can you change the orbital speed of a satellite?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Students will demonstrate how Newton's law of universal gravitation describes both the motion of the planets and the motion of objects subject to gravity near the Earth's surface.
- Students will recognize when an object is experiencing a centripetal acceleration.
- Students will calculate centripetal force and acceleration.
- Students will use Newton's Universal Law of Gravitation to calculation forces, accelerations, and velocities of different objects.
- Students will use Kepler's Laws to find the orbital period of different objects.

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- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- Circular motion requires the application of a constant force directed toward the center of the circle.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

- HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical,

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physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Content/Topics Critical content that students must KNOW	Skills Transferable skills that students must be able to DO

- Kepler's laws of planetary motion
- Newton's law of universal gravitation
- Acceleration due to gravity and apparent weight
- Ocean tides
- Orbital and escape velocities
- Concepts of general relativity

Key Terms:

centripetal force, centripetal acceleration, frequency, period, weightlessness, gravity, orbital speed, gravitational field

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

Core Activities

- Centripetal Force Lab
- Alternate Online Virtual Centripetal Force Lab

http://www.ngsir.netfirms.com/englishhtm/SteerACar.htm

Suggested Activities

- "Kepler's Laws" Video
- "The Apple and the Moon" Video
- "Curved Space and Black Holes" Video

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.Teacher Edition.

Students Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Library Media Center.
- Teacher websites.

www.webassign.net
www.thephysicsclassroom.com

Assessments (Titles)

Centripetal Force Lab
Formative: Lab Assignment
Students will show how radius, mass, and velocity affect the force of an object moving in a circle

Centripetal Force and Gravity Test
Summative: Standardized Test
Students will take test on centripetal force and gravity which will have multiple choice, short answer, and conceptual questions.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Connections can be made to social studies. Teachers can look and see how history affected what scientists thought of how the planets in the universe move.

Atlas Version 8.1.1

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 12 - Week 17

Last Updated: Monday, August 18, 2014 by Kim Lowell

Momentum and Energy - Honors

Collaboration

Enduring Understanding(s)/ Generalization(s)

The total energy of the universe is constant.

All energy can be considered kinetic, potential, or field.

The momentum of an object is the product of its mass and velocity and is a vector quantity.

In a closed system, the momentum is conserved.

Essential Question(s)

What are energy and momentum?

In what way are these properties conserved?

How does their conservation allow predicting the motion of objects that interact with each other?

How can energy be transferred from one object to another?

Guiding Questions

Factual, Conceptual, Provocative

What is momentum?
What is impulse?
What is angular momentum of an object?
How does Newton's third law relate to the law of conservation of momentum?
Under what conditions is momentum conserved?
What is the relationship between work and energy?
What is work?
How do you calculate power?

What is kinetic energy?

What is potential energy?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- Investigate collisions and explosions and show that momentum is a conserved property.
- Describe different types of energy, show how energy is converted from one form to another and demonstrate the total energy of a system is conserved in the absence of work.
- Identify where work is being performed in a variety of situations.
- Demonstrate an understanding that energy cannot be created or destroyed, but only changed from one form to another.
- Identify the factors that affect the potential energy of a spring.
- Calculate the net work done when many forces are applied to an object.
- Calculate kinetic and potential energy for an object.
- Explain situations in which conservation of mechanical energy is valid.
- Solve problems using conservation of mechanical energy.
- Distinguish between conservative and nonconservative forces.
- Apply the work–kinetic energy theorem to solve problems.
- Describe the momentum of the same object moving at different velocities
- Explain that impulses produce changes in momentum.
- Distinguish between elastic and inelastic collisions.
- Calculate the changes in kinetic energy during perfectly inelastic collisions
- Calculate the final velocity of an object in perfectly inelastic and elastic collisions.
- Apply knowledge of impulses to understand how seat belts and airbags work in cars.
- Solve complex collisions using both the conservation of energy and momentum.

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- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Conservation of Energy and Momentum The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects

- Kinetic energy can be calculated by using the formula E = (1/2)mv2.
- Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh.
- Momentum is calculated as the product mv.
- Momentum is a separately conserved quantity different from energy.
- An unbalanced force on an object produces a change in its momentum.
- The principles of conservation of momentum and energy can be used to solve problems involving elastic and inelastic collisions.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

- Predict the final velocity of objects after collisions, given the initial velocities.
- Compare and contrast conservation of momentum and conservation of kinetic energy in perfectly elastic and inelastic collisions.

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HS.Forces and Interactions

Performance Expectations

- HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*

HS.Energy

Performance Expectations

- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent,

and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Content/Topics

Critical content that students must KNOW

- Momentum and impulse
- Newton's second law in terms of momentum
- Conservation of momentum
- Collisions
- Work, power, and energy
- Kinetic and potential energies
- Work-energy theorem
- Conservation of energy

Key Terms:
work, energy, kinetic energy, potential energy, gravitational potential energy, elastic potential energy, mechanical energy, power, momentum, impulse, elastic collision, inelastic collision, conservative, nonconservative

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

Core Activities

- Work and Power Lab with Stairs
- Conservation of Mechanical Energy Lab
- "Explosions" and the Conservation of Momentum Lab
- Alternate Online Virtual Conservation of Momentum Lab

http://www.walter-fendt.de/ph14e/collision.htm

Suggested Activities

- Impulse and Change in Momentum Lab
- "Conservation of Momentum" Video
- "Conservation of Energy" Video
- Block and Tackle Lab
- Alternate Online Virtual Conservation of Mechanical Energy Lab
  http://jersey.uoregon.edu/PotentialEnergy/index.html
- Energy Transfer in Collisions Lab
- Egg Drop Activity

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.Teacher Edition.

Students Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Library Media Center.
- Teacher websites.

www.webassign.net
http://www.physicsclassroom.com/

Assessments (Titles)

Work and Power Lab with Stairs
Formative: Lab Assignment
Students will run up stairs and calculate the work done and power exerted depending on the mass, distance, and time.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Students can relate what they are learning about work, power, and kinetic energy to activities they are doing in physical education classes.

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Conservation of Mechanical Energy **Formative: Lab Assignment** Students will use carts moving down an incline to prove conservation of energy. **"Explosion" and the Conservation of Momentum Lab** **Formative: Lab Assignment** Students will use low friction carts to prove the law of conservation of momentum. They will use photogates to measure the velocities of each cart both before and after the collision. **Egg Drop Activity** **Formative: Group Project** Students will create a structure to put an egg into so that it will survive a two story fall without cracking. They will use their knowledge of impulse and momentum to do so. **Test on Work, Power, and Energy** **Summative: Standardized Test** Students will take test on work, power, and energy which will have multiple choice, short answer, and conceptual questions. **Test on Momentum and Impulse** **Summative: Standardized Test** Students will take test on momentum and impulse which will have multiple choice, short answer, and conceptual questions.		

Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 13 - Week 17

Last Updated: Wednesday, August 20, 2014 by Steve Malary

Rotational Mechanics - CP A

Collaboration

Enduring Understanding(s)/ Generalization(s)

Laws help predict and describe motion.

The net force that other objects exert on an object moving at constant speed in a circle points toward the center of the circle.

The total energy of the universe is constant.

Unbalanced torque causes angular acceleration of a rigid body.

Essential Question(s)

How is circular motion like and unlike linear motion?

How does the rate of rotation of an object or set of objects relate to the causes of a change in rotational rate?

What links the linear and rotational motion of an object?

How can a see-saw remain balanced with two children of different masses?

Guiding Questions

Factual, Conceptual, Provocative

How do tangential and angular speeds describe rotational motion and how are they related?

What is a centripetal acceleration and what are the characteristics of any associated centripetal force?

What is rotational inertia, what is torque, and how do they relate to changes in any rate of rotation of an object or system?

What is the center of mass of an object or system and what what established a condition of rotational equilibrium?

How is angular acceleration defined and how does it relate to other characteristics of rotational motion?

What is angular momentum and under what circumstances is it conserved?

What is rotational kinetic energy and how does it relate to the total kinetic energy of an object or system?

Standard(s)

Content and CCSS

GRADUATION STANDARDS

Graduation

PROBLEM SOLVING

Standard 1: The student demonstrates use of the scientific method and applies appropriate procedures to solve and communicate an authentic problem or situation.

- Identifies the problem adequately.
- Develops an action plan that addresses the problem adequately.
- Collects accurate and relevant information, data, or media to adequately address the problem.
- Demonstrates or applies a solution to the problem based on the data collected.
- Formulates a conclusion that adequately addresses the problem.
- The writing generally follows the given format.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Students will recognize when an object is experiencing a centripetal acceleration.
- Students will calculate centripetal force and acceleration.
- Students will distinguish between force and torque.
- Students will convert between angular and linear motion.
- Students will solve for angular motion problems.
- Students will apply rotational analogs of Newton's laws in describing the connection between torque and changes in rotational motion.
- Students will describe an object in rotational equilibrium.

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

- RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

- WHST.11-12.9. Draw evidence from informational texts to support analysis, reflection, and research.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction.
- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction.
- Circular motion requires the application of a constant force directed toward the center of the circle.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the

precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

NGSS: K-12

Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 2. Cause and effect: Mechanism and explanation . Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .
- 5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
- 7. Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

NGSS: Disciplinary Core Ideas (K-12)

NGSS: K-12

Physical Sciences

Core Idea PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions
- PS2.C: Stability and Instability in Physical Systems

Core Idea PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces

Content/Topics

Critical content that students must KNOW

- Tangential and angular speeds
- Centripetal acceleration and force
- Rotational inertia and torque
- Center of mass and rotational equilibrium
- Angular acceleration
- Angular momentum
- Conservation of angular momentum
- Rotational kinetic energy

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

- Centripetal Force Lab
- Alternate Online Virtual Centripetal Force Lab

(http://ngsir.netfirms.com/englishhtm/SteerACar.htm)

- Mobile Project

Suggested Activities

- Finding Mass with a Lever Lab
- "Rotational Derby" Activity (see Conceptual Physics, Laboratory Manual)

Resources

Professional & Student

Professional

- Conceptual Physics: The High School Physics Program, Hewitt, P.G., Teacher's Edition.

Student

- Conceptual Physics: The High School Physics Program, Hewitt, P.G.
- http://www.physicsclassroom.com Basic background information on concepts in physics.
- Library Media Center.
- Teacher websites.

Assessments (Titles)

Centripetal Force Lab
Formative: Lab Assignment
Students will show how radius, mass, and velocity affect the force of an object moving in a circle.

Finding Mass with a Lever Lab
Formative: Lab Assignment
Students will use a meter stick to create balance. They will put different masses on each side and figure out the lengths they need to use to balance the torques. They will also be given an unknown mass and try to calculate it.

Mobile Project
Formative: Group Project
Students will work in groups of 2-4 to create a mobile using their knowledge of rotational equilibrium. They will also create a write-up explaining both the physics and art choices for their project.

"Rotational Derby" Activity
Formative: Lab Assignment
Students will observe axially-symmetric objects of different sizes and shapes rolling down an incline. They will look for patterns and trends in conjunction with the times recorded for these objects to reach the bottom of the incline and seek to explain the results in terms of the relative amounts of translational and rotational kinetic energies the objects develop.

Rotational Mechanics Test
Summative: Written Test
Test on circular motion, centripetal acceleration and force, torque, moment of inertia, angular acceleration, and angular momentum and its conservation.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Problem Solving

Mobile Project

Interdisciplinary Connections

Students working on the mobile project research and justify artistic choices and apply the requirements of rotational equilibrium in the design and construction of a mobile.

Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 18 - Week 21

Last Updated: Wednesday, August 20, 2014 by Steve Malary

Planetaty Motion and Gravity - CP A

Collaboration

Enduring Understanding(s)/ Generalization(s)

Laws help predict and describe motion.

Kepler's laws describe the motions of the planets and other orbiting bodies subject to the force of gravity.

A gravitational force exists between any two masses. The magnitude of this force is directly proportional the product of the two masses and inversely proportional to the square of the distance between the centers of the two masses.

Essential Question(s)

In what sense is planetary motion connected to rotational motion?

How does gravity as a universal force affect the motion of planets and satellites?

Guiding Questions

Factual, Conceptual, Provocative

What are Kepler's laws and how do they describe the motion of the planets?

What is Newton's law of universal gravitation and how does it dictate both the motion of the planets as well as the motion of objects near the surface of the earth?

How does the acceleration due to gravity due to the earth relate to the law of universal gravitation and how does this relate to the concept of apparent weight?

How do the ocean tides relate to the gravitational pull of the sun and the moon?

How does the law of universal gravity relate to the motion of satellites and their escape velocities?

What is the theory of general relativity and how does it differ from the law of universal gravitation?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Students will use Kepler's Laws to find the orbital period of different objects.
- Students will demonstrate how Newton's law of universal gravitation describes both the motion of the planets and the motion of objects subject to gravity near the Earth's surface.
- Students will use Newton's Universal Law of Gravitation to calculation forces, accelerations, and velocities of different objects.

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Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- The law F = ma is used to solve motion problems that involve constant forces.
- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction.
- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction.
- Circular motion requires the application of a constant force directed toward the center of the circle.

Conservation of Energy and Momentum The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects

- Kinetic energy can be calculated by using the formula E = (1/2)mv2.
- Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

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- HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

NGSS: K-12

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Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 2. Cause and effect: Mechanism and explanation . Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .
- 5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

NGSS: Disciplinary Core Ideas (K-12)

NGSS: K-12

Physical Sciences

Core Idea PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

Core Idea PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer

Content/Topics

Critical content that students must KNOW

- Kepler's laws of planetary motion
- Newton's law of universal gravitation
- Acceleration due to gravity and apparent weight
- Ocean tides
- Orbital and escape velocities
- Concepts of general relativity

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

Apparent Weight Lab

Suggested Activities

- "Kepler's Laws" Video
- "Being Eccentric," a Kepler's First Law Activity (see Conceptual Physics, Laboratory Manual)
- "The Apple and the Moon" Video
- "Curved Space and Black Holes" Video

Resources

Professional & Student

Professional

- Conceptual Physics: The High School Physics Program, Hewitt, P.G., Teacher's Edition.

Student

- Conceptual Physics: The High School Physics Program, Hewitt, P.G.
- http://www.physicsclassroom.com Basic background information on concepts in physics.
- Library Media Center.
- Teacher websites.

Assessments (Titles)

"Being Eccentric," a Kepler's First Law Activity
Formative: Lab Assignment
Students use string and push pins to make nearly circular and highly eccentric ellipses and compare

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Connections can be made to social studies. Teachers can look and see how history affected what scientists thought of how the planets in the universe move.

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them to the orbital paths of planets and comets. **Apparent Weight Lab** **Formative: Lab Assignment** Students measure their apparent weights as they accelerate up and down in an elevator. **Kepler's Laws and Gravity Test** **Summative: Written Test** Test on Kepler's laws, the law of universal gravitation, and satellite motion.		

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 18 - Week 21

Last Updated: Monday, August 18, 2014 by Kim Lowell

Rotational Mechanics - Honors

Collaboration

Enduring Understanding(s)/ Generalization(s)

Laws help predict and describe motion.

The total energy of the universe is constant.

Unbalanced torque causes angular acceleration of a rigid body.

Essential Question(s)

How does the rate of rotation of an object or set of objects relate to the causes of a change in rotational rate?

What links the linear and rotational motion of an object?

How can a see-saw remain balanced with two children of different masses?

Guiding Questions

Factual, Conceptual, Provocative

Why does a spinning skater accelerate when his/her arms are brought closer to the
body?

What factors affect the moment of inertia for a rotating object?
How can the moment of inertia be found for a rotating object?
How can you change radians to degrees? Degrees to radians?
How are angular displacement, angular velocity, and angular acceleration related?
What is the difference between an object that is revolving and an object that is rotating?
What is the difference between angular and linear terminology?
How can you convert between linear and angular terms?
How can linear kinematics be used to solve for rotating objects?

What is torque?
How can torque and angular acceleration be calculated?

Standard(s)

Content and CCSS

GRADUATION STANDARDS

Graduation

PROBLEM SOLVING

Standard 1: The student demonstrates use of the scientific method and applies appropriate procedures to solve and communicate an authentic problem or situation.

- Identifies the problem adequately.
- Develops an action plan that addresses the problem adequately.
- Collects accurate and relevant information, data, or media to adequately address the problem.
- Demonstrates or applies a solution to the problem based on the data collected.
- Formulates a conclusion that adequately addresses the problem.
- The writing generally follows the given format.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- apply rotational analogs of Newton's laws in describing the connection between torque and changes in rotational motion.
- distinguish between force and torque.
- solve for angular motion problems.
- convert between angular and linear motion.
- describe an object in rotational equilibrium.

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3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ1. Identify questions that can be answered through scientific investigation.
- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- When forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Energy

Performance Expectations

- HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created

and used based on mathematical models of basic assumptions.

- Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.
- Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Content/Topics

Critical content that students must KNOW

- Tangential and angular speeds
- Centripetal acceleration and force
- Rotational inertia and torque
- Center of mass and rotational equilibrium
- Angular acceleration
- Angular momentum
- Conservation of angular momentum
- Rotational kinetic energy

Key Terms:
torque, static equilibrium, lever arm, angular displacement, angular speed, angular acceleration, tangential velocity, angular momentum, rotational kinetic energy, rotational inertia

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

Core Activities

- Mobile Project

Suggested Activities

- Finding Mass with a Lever Lab (see attached)
- "Rotational Derby" Activity (see Conceptual Physics, Laboratory Manual)

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.Teacher Edition.

Students Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed.

Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Library Media Center.
- Teacher websites.

www.physicsclassroom.com
www.webassign.net

Assessments (Titles)

Mobile Project
Formative: Group Project
Students will work in groups of 2-4 to create a mobile using their knowledge of rotational equilibrium. They will also create a write-up explaining both the physics and art choices for their project.

Test on Rotational Motion
Summative: Standardized Test
Students will take test on rotational motion which will have multiple choice, short answer, and conceptual questions.

Finding Mass with a Lever Lab
Formative: Lab Assignment
Students will use a meter stick to create balance. They will put different masses on each side and figure out the lengths they need to use to balance the torques. They will also be given an unknown mass and try to calculate it.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Problem Solving

Interdisciplinary Connections

Students can see how mobiles use science as well as artistic principles in their designs.

Newtown Public Schools

Physics

Newtown High School > Grade 11 > Science > Physics > Week 22 - Week 27

Solids, Fluids, and Thermodynamics - CP A

Collaboration

Enduring Understanding(s)/ Generalization(s)

Density, the ratio of an object's mass to its volume, is the same, at a given temperature and pressure, for all objects

Hooke's law, which shows the change in a spring's length is directly proportional to the force that stretches or compr relationship between stress and strain for elastic solids within the proportional limit.

Pressure is a fluid property equal to the ratio of the force of the fluid pushing against a surface to the area of that su

Pressure increases with depth in a fluid and leads to an upward buoyant force equal to the weight of fluid displaced fluid's surface.

Temperature is a macroscopic property, directly related to the average kinetic energy of the molecules of a system r the same for any two systems in thermal equilibrium.

Heat is the transfer of energy other than by work between systems at different temperatures.

Energy cannot be created or destroyed although, in many processes, energy is transferred to the environment as he be used to do work.

Essential Question(s)

What physical properties characterize the states of solids and fluids?

What energy transfers may take place and how do they change the physical properties of substances?

Guiding Questions

Factual, Conceptual, Provocative

What is density and how does it re

How does Hooke's law relate tens compression of elastic solids and l architectural structures?

What is pressure and how can it b hydraulic systems?

How is pressure increase with dep

What is buoyancy force and how i: it?

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How does the thermal energy of a molecules and atoms comprising t system related to these energies?

How does the temperature change contraction?

What is heat and under what cond

How are properties such as specif in deducing the heat transferred tc

What is the first law of thermodyna energy in the form of heat and wor refrigerators?

What is the second law of thermoc efficiencies of engines and refriger

What is the third law of thermodyn condition of absolute zero?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant

Objective(s)

Bloom/ Anderson Taxonomy / D

- Students will characterize the and demonstrate how these p applications.
- Students will evaluate transfe evaluating the changes in ene
- Students will demonstrate tha transfers of energy in the forn

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and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

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- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction.

Heat and Thermodynamics Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat

- Heat flow and work are two forms of energy transfer between systems.

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- The work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature.
- The internal energy of an object includes the energy of random motion of the object's atoms and molecules. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.
- Most processes tend to decrease the order of a system over time, so that energy levels are eventually distributed more uniformly.

Electric and Magnetic Phenomena Electric and magnetic phenomena are related and have many practical applications.

- Plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Energy

Performance Expectations

- HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.

- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the

comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

NGSS: K-12

Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 2. Cause and effect: Mechanism and explanation . Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .
- 5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
- 7. Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

NGSS: Disciplinary Core Ideas (K-12)

NGSS: K-12

Physical Sciences

Core Idea PS1: Matter and Its Interactions

- PS1.A: Structure and Properties of Matter

Core Idea PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.C: Stability and Instability in Physical Systems

Core Idea PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer

Content/Topics

Critical content that students must KNOW

- Density
- Hooke's law, tensile and compressive stresses, and architectural structures
- Pressure and hydraulics
- Pressure increase with depth
- Buoyancy and Archimedes' principle
- Thermal energy and temperature
- Thermal expansion
- Heat and thermal equilibrium
- Specific heat and latent heats of fusion and vaporization
- The first law of thermodynamics and engines and refrigerators
- The second law of thermodynamics, entropy, and efficiencies
- The third law of thermodynamics and the unattainability of absolute zero

Skills

Transferable skills that students

- 1. Use real-world digital and
effectively apply information a
- 2. Work independently and co
accomplish goals.
- 3. Communicate information
tools/media in varied contexts
- 4. Demonstrate innovation, fl
work habits, and working/lear
- 5. Effectively apply the analys
that enable productive proble

Core Learning Activities

- Buoyancy Lab
- Specific Heat of Metal Lab

Suggested Activities:

- Lab Activity: Strong as an Ox (see Conceptual Physics, Laboratory Manual)
- Thermal Expansion Lab
- Lab Activity: Specifically Water (see Conceptual Physics, Laboratory Manual)

Resources

Professional & Student

Professional

- Conceptual Physics: The High
Teacher's Edition.

Student

- Conceptual Physics: The High
- http://www.physicsclassro
concepts in physics.
- Library Media Center.
- Teacher websites.

Assessments (Titles)

Strong as an Ox
Formative: Lab Assignment
Students use Magdeburg hemispheres to explore how strong pressure forces can be.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

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and/or

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Buoyancy Lab
Formative: Lab Assignment
Students use Archimedes' principle and the evaluation of buoyancy force to determine and verify the density of different-sized brass objects.

Solids and Fluids Test
Summative: Written Test
Test on density, Hooke's law, stress and strain, pressure, hydraulics, the hydrostatic balance, and buoyancy.

Thermal Expansion Lab
Formative: Lab Assignment
Students use a thermal expansion apparatus to confirm the value of the coefficient of thermal expansion of a rod made from a known substance.

Specifically Water
Formative: Lab Assignment
Students mix different proportions of cool and warm water and compare the theoretical mixture temperature to the measured value.

Specific Heat of Metal Lab
Formative: Lab Assignment
Students use a calorimeter and room temperature water to determine the specific heat of an unknown metal block initially at the boiling point of water. From the specific heat and color, the students attempt to identify the unknown metal.

Test on Thermodynamics
Summative: Written Test
Test on temperature and thermal equilibrium, thermal expansion, heat, and the laws of thermodynamics.

Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 22 - Week 30

Last Updated: Monday, August 18, 2014 by Kim Lowell

Electric and Magnetic Phenomena - Honors

Collaboration

Enduring Understanding(s)/ Generalization(s)

Electrostatics is the study of charges in particles and exert forces between them, attractive and repulsive forces.

Electricity is a form of energy that can be transformed by moving charges doing work in various devices.

Magnetic field interacts with moving electrically charged particles and wires with electric currents.

Electricity and Magnetism are connected to each other.

Essential Question(s)

In what ways are electricity and magnetism connected and applied? Are force fields scientific?

Why are electric fields Important?

Guiding Questions

Factual, Conceptual, Provocative

When a battery dies does it run out of charge?
Why are Christmas lights wired in series but house lights wired in parallel?

How do we use magnetic fields to generate currents?

How can static electricity be reduced?
How are batteries different that have different voltages?

What conditions affect the voltage, the current, and the resistance in a circuit?

What are the differences between conductors and insulators?
What is the relationship between electric forces, charges, and distance?
How do you charge objects by conduction and induction?
What is an electric field?
What are electric field lines?
What conditions create current in an electrical circuit?
What is Ohm's law?
What are series and parallel circuits?

What is the difference between AC and DC?

Why are some materials Magnetic?
How do Magnetic Field affect moving Charges?

What happens when there is a changing Magnetic Field?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- demonstrate that charge is a fundamental physical property that gives rise to attractive and repulsive forces that are exploited in the transfer of energy in electric circuits.
- Use Coulomb's Law to calculate the force between charges.
- will explain how electricity and magnetism are related and apply the laws describing this relationship to electromagnetic devices.
- Explain the concept of electric field.
- Sketch the electric field pattern in the region between charged objects.
- Determine the resultant electric field at a point some distance from two or more point charges.
- Determine the magnitude and direction of the electric force on a charged particle in an electric field.

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Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific Inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Electric and Magnetic Phenomena Electric and magnetic phenomena are related and have many practical applications.

- The voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors can be predicted using Ohm's law.
- Any resistive element in a DC circuit dissipates energy, which heats the resistor.

- Compare and contrast the gravitational force with the electrostatic force.
- Evaluate which force is stronger – gravitational or electrostatic?
- Solve problems involving electric potential difference.
- Calculate the electric potential for various charges.
- Evaluate the importance of Capacitors in modern electronics.
- Solve problems relating current, charge and time.
- Calculate resistance, current and potential difference using Ohm's Law.
- Recognize the factors that effect the resistance in a wire.
- Relate electric power to the rate at which electric energy is converted to other forms of energy.
- Calculate electric power and the cost of running electrical appliances.
- Interpret and construct circuit diagrams. Identify circuits as open or closed.
- Calculate currents, voltage drops, and equivalent resistance in series and parallel circuits.
- Calculate charge, voltage stored, and equivalent capacitance in series and parallel circuits.
- Use Kirchhoff's Rules to calculate the current, potential drop in various resistors in a complex circuit.
- Recognize that Kirchhoff's Laws are applications of the Law of Conservation of Energy, and the Law of Conservation of Charge.
- Describe the magnetic field produced by a current in a straight conductor and in a solenoid.
- Use the right hand rule to determine the direction of the magnetic field in a current carrying wire.
- Use the right hand rule to determine the direction of the magnetic force on a moving charge in the presence of a magnetic field.
- Solve problems involving moving charges and current carrying wires in the presence of magnetic fields.
- Determine the direction of the force between two parallel current carrying wires.
- Predict whether magnets will repel or attract each other.
- Evaluate the relevance of magnets and how they affect our daily life

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- The power in any resistive circuit element can be calculated by using the formula Power = 12R.
- Charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
- Magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.
- Changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

- HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
- HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS.Energy

Performance Expectations

- HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for

linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Content/Topics

Critical content that students must KNOW

- Charge
- Coulomb's law
- Electric field
- Electric potential energy and electric potential
- Capacitors
- Current, resistance, and Ohm's law
- Electric power
- Resistors in combination
- AC and DC
- Magnets and magnetic fields
- Magnetic forces on charges and currents and electric motors
- Induction and Faraday's law
- Generators and transformers

Key Terms:
electric charge, conductors, insulators, conduction, induction. electric field, electrostatic force, electrostatic potential, potential difference, capacitance, equipotential surfaces, electron volt, voltage, current, resistance, circuit, electromotive force, magnetic field, induced current, electromagnetic induction , magnetic flux, electric motor, electric generator, transformer, Lenz's Law, Faraday's Law

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
- 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Core Learning Activities

Core Activities

- Electrostatic Lab
- Ohm's Law Lab
- Alternative Online Ohm's Law Lab

http://www.walter-fendt.de/ph14e/ohmslaw.htm

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications.* 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.Teacher Edition.

Students Resources

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Suggested Activities

- Balloon Lab
- Play-Doh Lab
- Alternative Online Play-Doh Lab

http://www.pulsedpower.net/Applets/Electronics/resistance2/resistance.html

- Circuit Lab
- Alternative Online Circuit Lab

http://www.walter-fendt.de/ph14e/combres.htm

- House Wiring Activity
- Drawing Magnetic Field Lines
- Magnetic Fields of Coil Lab
- Making a Motor

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Library Media Center.
- Teacher websites.

www.physicsclassroom.com
www.webassign.net

Assessments (Titles)

Test on Electrostatics
Summative: Standardized Test
Students will take test on Electrostatics which will have multiple choice, short answer, and conceptual questions.

Test on Current Electricity
Summative: Standardized Test
Students will take test on circuits which will have multiple choice, short answer, and conceptual questions.

Test on Electricity and Magnetism
Summative: Standardized Test
Students will take test on electricity and magnetism which will have multiple choice, short answer, and conceptual questions.

Electrostatic Lab
Formative: Lab Assignment
Students will use pith balls and electroscopes to discover how charges interact with each other. They will learn about charging by induction and conduction.

Ohm's Law Lab
Formative: Lab Assignment
Students will use resistors to prove Ohm's Law. They will change the voltage to see the effect on current and the resistance to see the effect on current.

Play-Doh Lab
Formative: Lab Assignment
Students will use Play-Doh to simulate how resistance can change in a wire. They will change the length, area, and color of the Play-Doh to see the effect on resistance.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

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Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 28 - Week 33

Last Updated: Wednesday, August 20, 2014 by Steve Malary

Electric and Magnetic Phenomena - CP A

Collaboration

Enduring Understanding(s)/ Generalization(s)

Electrostatics is the study of charges in particles and exert forces between them, attractive and repulsive forces.

Electricity is a form of energy that can be transformed by moving charges doing work in various devices.

Magnetic field interacts with moving electrically charged particles and wires with electric currents.

Electricity and Magnetism are connected to each other.

Essential Question(s)

In what ways are electricity and magnetism connected and applied? Are force fields scientific?

Why are electric fields important?

Guiding Questions

Factual, Conceptual, Provocative

What is electric charge and how does it relate to the basic building blocks of matter?

How does Coulomb's law express the force due to static charges?

What is an electric field and how does it describe the effect of electrostatic forces at a distance?

What is electric potential energy and how does it relate to the concept of electric potential?

What are capacitors and in what way do they store charge and energy?

How does current express charge motion and how does Ohm's law define resistance to charge motion?

How is the power expended in moving current through a circuit evaluated?

How do resistors in series and parallel combine?

How do AC and DC circuits compare?

What are the characteristics of magnets and magnetic fields and how does magnetism arise?

How are magnetic forces on moving charges and currents evaluated?

How do electric motors work?

How do magnetic fields induce charge motion in an electric circuit and how does Faraday's law express this effect?

How do generators and transformers work?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Reading: Science & Technical Subjects

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

- Students will demonstrate that charge is a fundamental physical property that gives rise to attractive and repulsive forces that are exploited in the transfer of energy in electric circuits.
- Students will use Coulomb's Law to calculate the force between charges.
- Students will explain the concept of electric field.
- Students will sketch the electric field pattern in the region between charged objects.

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3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Motion and Forces Newton's laws predict the motion of most objects

- The law F = ma is used to solve motion problems that involve constant forces.
- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction.
- Circular motion requires the application of a constant force directed toward the center of the circle.

Electric and Magnetic Phenomena Electric and magnetic phenomena are related and have many practical applications.

- The voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors can be predicted using Ohm's law.
- Any resistive element in a DC circuit dissipates energy, which heats the resistor.
- The power in any resistive circuit element can be calculated by using the formula Power = 12R.
- Charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
- Magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.

- Students will determine the magnitude and direction of the electric force on a charged particle in an electric field.
- Students will compare and contrast the gravitational force with the electrostatic force.
- Students will solve problems involving electric potential difference.
- Students will calculate the electric potential for various charges.
- Students will evaluate the importance of Capacitors in modern electronics.
- Students will solve problems relating current, charge and time.
- Students will calculate resistance, current and potential difference using Ohm's Law.
- Students will recognize the factors that affect the resistance in a wire.
- Students will relate electric power to the rate at which electric energy is converted to other forms of energy.
- Students will calculate electric power and the cost of running electrical appliances.
- Students will interpret circuit diagrams.
- Students will calculate currents, voltage drops, and equivalent resistance in series and parallel circuits.
- Students will calculate charge, voltage stored, and equivalent capacitance in series and parallel circuits.
- Students will explain how electricity and magnetism are related and apply the laws describing this relationship to electromagnetic devices.
- Students will describe the magnetic field produced by a current in a straight conductor and in a solenoid.
- Students will use the right hand rule to determine the direction of the magnetic field in a current carrying wire.
- Students will use the right hand rule to determine the direction of the magnetic force on a moving charge in the presence of a magnetic field.
- Students will solve problems involving moving charges and current carrying wires in the presence of magnetic fields.
- Predict whether magnets will repel or attract each other.
- Evaluate the relevance of magnets and how they affect our daily lives.

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- Changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Forces and Interactions

Performance Expectations

- HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
- HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the

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investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

NGSS: Crosscutting Concepts (K-12)

NGSS: K-12

Crosscutting Concepts

The seven crosscutting concepts are as follows:

- 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 2. Cause and effect: Mechanism and explanation . Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- 4. Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering .
- 5. Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

NGSS: Disciplinary Core Ideas (K-12)

NGSS: K-12

Physical Sciences

Core Idea PS1: Matter and Its Interactions

- PS1.A: Structure and Properties of Matter

Core Idea PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

Core Idea PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer

Content/Topics

Critical content that students must KNOW

- Charge
- Coulomb's law
- Electric field
- Electric potential energy and electric potential
- Capacitors
- Current, resistance, and Ohm's law
- Electric power
- Resistors in combination
- AC and DC
- Magnets and magnetic fields
- Magnetic forces on charges and currents and electric motors
- Induction and Faraday's law
- Generators and transformers

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities

- Electrostatic Lab
- Ohm's Law Lab
- Alternative Online Ohm's Law Lab (

Resources

Professional & Student

Professional

- Conceptual Physics: The High School Physics Program, Hewitt, P.G.,

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http://www.walter-fendt.de/ph14e/ohmslaw.htm)

Suggested Activities

- Lab Activity: "Sticky Electronics" (see Conceptual Physics, Laboratory Manual)
- Van de Graaff Machine
- Play-Doh Lab
- Alternative Online Play-Doh Lab (http://www.pulsedpower.net/Applets/Electronics/resistance2/resistance.html)
- Circuit Lab
- Alternative Online Circuit Lab (http://www.walter-fendt.de/ph14e/combres.htm)
- House Wiring Activity
- Drawing Magnetic Field Lines
- Magnetic Fields of Coil Lab
- Making a Motor

Teacher's Edition.

Student

- Conceptual Physics: The High School Physics Program, Hewitt, P.G.
- http://www.physicsclassroom.com Basic background information on concepts in physics.
- Library Media Center.
- Teacher websites.

Assessments (Titles)

Electrostatic Lab
Formative: Lab Assignment
Students will use pith balls and electroscopes to discover how charges interact with each other. They will learn about charging by induction and conduction.

"Sticky Electronics"
Formative: Lab Assignment
Students use plastic tape and rubber balloons to confirm that charge transfer occurs when dissimilar materials come into contact.

Van de Graaff Machine
Formative: Lab Assignment
Students use Van de Graaff generators to distinguish conductive and inductive charging and establish that electrostatic discharge occurs at points where the electric field strength reaches the highest value.

Ohm's Law Lab
Formative: Lab Assignment
Students will use resistors to prove Ohm's Law. They will change the voltage to see the effect on current and the resistance to see the effect on current.

Play-Doh Lab
Formative: Lab Assignment
Students will use Play-Doh to simulate how resistance can change in a wire. They will change the length, area, and color of the Play-Doh to see the effect on resistance.

Circuit Lab
Formative: Lab Assignment
Students and light bulbs are arranged in different types of

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

Interdisciplinary Connections

Students will recall that charge, as a property, was first introduced in interdisciplinary earth sciences and/or chemistry.

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circuits to explore the effects on current and bulb brightness.

Electrostatics and Circuit Electricity Test
Summative: Written Test
Test on charge, electrostatic force, electric fields, electric potential energy, electric potential, capacitance, batteries, current, resistance, electric power, and simple circuits.

Magnetic Fields of Coil Lab
Formative: Lab Assignment
A slinky is connected to a power supply to act as a solenoid with a magnetic field that can be measured in the center of the coil.

Making a Motor
Formative: Group Project
Students working in groups will use a D cell battery, wire and a magnet to build a simple electric motor.

Magnetism and Induction Test
Summative: Written Test
Test on magnets, magnetic fields, forces on moving charges and currents, electric motors, induction and Faraday's law, generators, and transformers.

Newtown Public Schools
Physics

Newtown High School > Grade 11 > Science > Physics > Week 31 - Week 38

Last Updated: Thursday, August 21, 2014 by Steve Malary

Waves - Honors

Collaboration

Enduring Understanding(s)/ Generalization(s)

A wave describe the apparent motion of a pulse that carries energy.

Waves that interact can create constructive or destructive Interference.

Sound is a longitudinal compression wave that travels through matter.

Light is a transverse electromagnetic wave.

All waves reflect, refract, and diffract.

Essential Question(s)

What are the properties of sound and light are how are they used in the real world?

Guiding Questions

Factual, Conceptual, Provocative

- What is the difference between transverse and longitudinal waves?
- What is the relationship between wave speed, wavelength, and frequency?
- Why is the knowledge of vibrations important in understanding the destructive power of earthquakes, the tuning circuit in a radio receiver, or the timing mechanism in a digital watch?
- Why are optical fibers preferred over electrical cables to send information?
- How is light reflected and refracted?
- What are the practical applications of reflection and refraction?
- What is the Doppler Effect?
- What is the law of reflection?
- How do concave and convex mirrors form images?
- Why do pencils immersed in water in a clear glass appear disjointed when viewed from the side?

Standard(s)

Content and CCSS

GRADUATION STANDARDS

Graduation

PROBLEM SOLVING

Standard 1: The student demonstrates use of the scientific method and applies appropriate procedures to solve and communicate an authentic problem or situation.

- Identifies the problem adequately.
- Develops an action plan that addresses the problem adequately.
- Collects accurate and relevant information, data, or media to adequately address the problem.
- Demonstrates or applies a solution to the problem based on the data collected.
- Formulates a conclusion that adequately addresses the problem.
- The writing generally follows the given format.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 11-12

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- demonstrate their knowledge of the general characteristics of waves through applications involving sound as a representative wave phenomenon.
- Identify how waves transfer energy without transferring matter.
- Contrast transverse and longitudinal waves.
- Solve problems relating the frequency, wavelength and velocity of sound.
- Demonstrate an understanding of resonance, especially as applied to air columns.
- Solve problems using the mirror equation and the thin lens equation.
- Solve problems using Snell's Law
- Use ray diagrams to find the position of an image produced by converging or diverging mirrors and lenses.
- Calculate the magnification of lenses and mirrors.
- Develop a practical understanding for the uses of lenses and how telescopes and microscopes are constructed.
- Predict which direction light will bend when it passes from one medium to another.
- Predict the specific location of images formed from objects placed at various distances away from mirrors and lenses.
- Evaluate the consequences of total internal reflection.

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Reading: Science & Technical Subjects

3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

- RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

- RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.11-12.1. Write arguments focused on discipline-specific content.
- WHST.11-12.1a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
- WHST.11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

CT: Science Framework (2005)

CT: Grades 9-12

I. Inquiry

SCIENTIFIC INQUIRY • Scientific Inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

- D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- D INQ6. Use appropriate tools and techniques to make observations and gather data.
- D INQ7. Assess the reliability of the data that was generated in the investigation.
- D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

High School Physics

Waves Waves have characteristic properties that do not depend on the type of wave

- Waves carry energy from one place to another.
- Transverse and longitudinal waves exist in mechanical media, such as springs and ropes, and in the earth as seismic waves.
- Wavelength, frequency, and wave speed are related.

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- Sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
- Radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3 x 108m/s, and less when passing through other media.
- Waves have characteristic behaviors such as interference, diffraction, refraction and polarization.
- Beats and the Doppler Effect result from the characteristic behavior of waves.

NGSS: Science Performance Expectations(2013)

NGSS: HS Physical Sciences

HS.Waves and Electromagnetic Radiation

Performance Expectations

- HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
- HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

NGSS: Science and Engineering Practices

NGSS: 9-12

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop a complex model that allows for manipulation and testing of a proposed process or system.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Select appropriate tools to collect, record, analyze, and evaluate data.

Practice 4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.

Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Content/Topics

Critical content that students must KNOW

- Properties of waves and characteristics of simple harmonic motion
- Waves on a stretched cord
- Interference and standing waves
- Doppler effect
- Bow and shock waves
- Sound waves
- Reflection and refraction of sound waves
- Resonance
- Interference and beating
- Light waves
- Reflection and refraction of light waves
- Mirror and lens images
- Diffraction

Key Terms:
simple harmonic motion, spring constant, amplitude, cycle, frequency, period, equilibrium position, longitudinal wave, transverse wave, resonance,

Skills

Transferable skills that students must be able to DO

- 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.
- 2. Work independently and collaboratively to solve problems and accomplish goals.
- 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
- 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
- 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

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superposition, interference, diffraction, wavelength, wave velocity, reflection, refraction, virtual image, focal point, focal length, refraction, electromagnetic spectrum, interference

Core Learning Activities

Core Activities

- Speed of Sound Lab
- Optical Bench Lab
- Alternative Online Optical Bench Labs

http://www.walter-fendt.de/ph14e/imageconvlens.htm

http://www.mhhe.com/physsci/physical/giambattista/optics/optics.html

Suggested Activities

- Phone Number Lab
- Ripple Tank Lab
- Light Box Reflection/Refraction Activity
- Refraction of Light/ Snell's Law
- Alternative Online Refraction Lab

http://www.walter-fendt.de/ph14e/refraction.htm

Resources

Professional & Student

Teacher Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.Teacher Edition.

Students Resources

- Giancoli, Douglas C. *Physics: Principles with Applications*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
- Library Media Center.
- Teacher websites.

www.physicsclassroom.com
www.webassign.net

Assessments (Titles)

Test on Waves and Sound
Summative: Standardized Test
Students will take test on waves and sound which will have multiple choice, short answer, and conceptual questions.

Test on Light
Summative: Standardized Test
Students will take test on light which will have multiple choice, short answer, and conceptual questions.

Speed of Sound Lab
Formative: Lab Assignment
Students will use PVC pipes and tuning forks to calculate the speed of sound in air.

Optical Bench Lab
Formative: Lab Assignment
Students will use the lens equation to calculate different image distances. They will then test these calculations using the optical bench.

Graduation Standards

Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Problem Solving

Interdisciplinary Connections

Students can connect what they are learning about sound to the musical instruments that they play in band.

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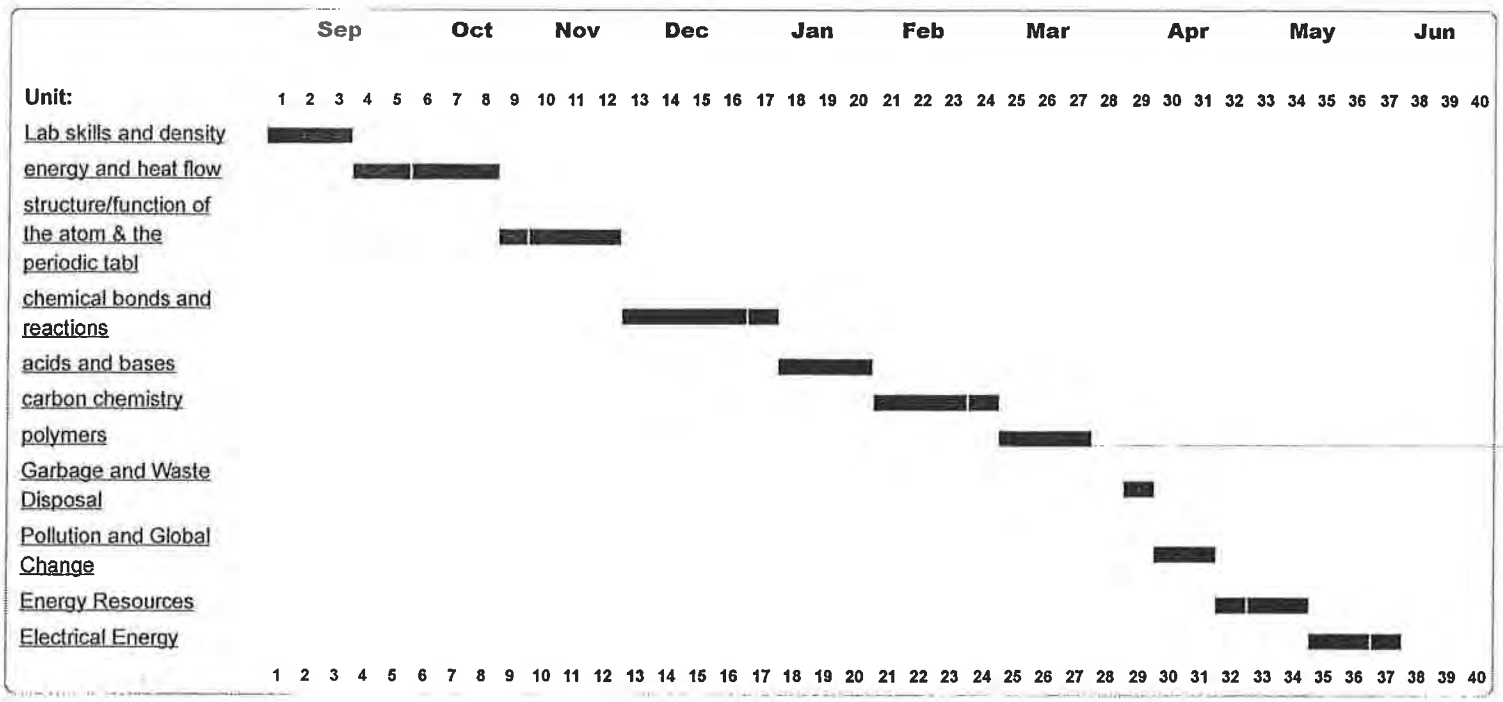
Newtown Public Schools

Integrated Physical and Earth Science

Newtown High School > Grade 9 > Science > Integrated Physical and Earth Science

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Collaboration



Atlas Version 8.1.1

Unit Planner: Lab skills and density
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:11AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 1 - Week 3

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Scientific inquiry inspires independent and collaborative critical evaluation and communication of information that can be used for further application, decision making, product design, and solutions to problems.

Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze, and present scientific data and ideas.</td></tr>
<tr><td>Essential Question(s)

What is science?

How do scientists use appropriate lab equipment and techniques to make observations and gather data?

How do scientists assess the reliability of the data that was generated in the investigation?

How can mathematical operations be used to analyze and interpret data and present relationships between variables in appropriate terms?</td><td>Guiding Questions
Factual, Conceptual, Provocative

What is the scientific method?

What are the steps of the scientific method?

How do we measure in science?

What is data?

What is the relationship between mass, volume, and density?

How are simple mathematical relationships applied to scientific problems?

Which type of graph is appropriate for a particular set of data?

How can data be used to show relationships between variables, draw conclusions and make inferences?

How does the scientific method attempt to eliminate bias or subjectivity?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
CCSS: Grades 9-10 Writing</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

Students will:
use the scientific method to investigate a problem.
use appropriate tools and techniques to measure physical properties, such as mass, volume and density.
identify independent variables, dependent variables, controls and constants.
communicate effectively through a properly written procedure.</td></tr>
</table>

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **CT: Science Framework (2005)** **CT: Grades 9-12** **I. Inquiry** SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also	• be able to discern between qualitative and quantitative data.

includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ1. Identify questions that can be answered through scientific investigation. D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls. D INQ6. Use appropriate tools and techniques to make observations and gather data. D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms. 	

Content/Topics *Critical content that students must **KNOW*** Students will know: • the steps of the scientific method. • the metric system. • calculate mass, volume and density. • measure physical properties. • the importance of lab safety. • quantitative and qualitative data. • graphs and charts.	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
Core Learning Activities Density of Aluminum Lab Practical Density of Water Density of Fluids Scientific Method Comic Measuring activity Questioning using Snapple bottle activity The Obscertainer	Resources *Professional & Student* Physical Science with Earth Science text, Unit 1, chapters 1 and 2 pages 4-36 Online Resources for the text including online quizzes and chapter review http://glencoe.mheducation.com/sites/0078802482/student_view0/unit1/chapter1/index.html http://glencoe.mheducation.com/sites/0078802482/student_view0/unit1/chapter2/index.html

Converting metric units worksheets Density practical - aluminum - short version.doc density of water - graph m&V.doc Density Cube Lab.doc ob-scertainer activity.pdf questioning activity with snapple-water balloon.docx Conversions and dimensional analysis.docx lab safety worksheet.pdf	

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Density of Aluminum Lab Practical Summative: Lab Assignment Uses aluminum rectangular prism, cylinder, can, foil to reinforce writing procedures, making data tables, and calculating density Density practical - aluminum - short version.doc Scientific	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving Students will engage in lab scenarios to practice commonly used lab skills that will be carried through the year. Students will be required to design and conduct a procedure and will learn and practice the scientific method. This unit will lay the groundwork for all following units that require lab skills.	Science and Math. This unit has a strong focus on Math integration. Using the metric system to measure in base 10's is a practiced skill and will be used in data collection and calculations. Text book resources for these math skill are found on page 16. Also on multiple pages through out the chapter in the form of practice problems. Math is also integrated through the use of graphs to interpret data which is a skill that will be used throughout the course and during lab experiences. Resources may be found in chapter 1 section 3 as well as throughout the text in content based chapters (chapter 3 about motion and forces).

Method Comic Summative: Other Visual Assessments Creates comic illustrating the scienctific method comic sci method - K.doc Density of Fluids Summative: Lab Assignment Measures and calculates the density of several fluids and small objects then predicts which fluids the objects would float in density of fluids.doc Measuring Activity Formative: Lab Assignment Practice measuring using various tools and then converting metric units measuring activity.pdf Measuring and Lab skills test Summative: Written Test		

HIES quest 1 - 2014.doc		

<< Previous Year

Unit Planner: energy and heat flow
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:11AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 4 - Week 8

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)

Energy and Matter: Flows, Cycles, and conserves.

Energy and energy flow alters the state of existing matter

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
D1: What effect does energy have on matter? D2: How is energy transferred by conduction, convection, and radiation? D3: How does energy transform among heat, light, electricity, and motion?	**D1** How is heat measured? What is the difference between temperature, heat, latent heat? What are the differences between the phases of matter? Why doesn't the addition/subtraction of heat always cause a temperature change in that substance? Why does a pond freeze in winter but a flowing brook not? Why is it warmer in winter and cooler in summer along coastlines? **D2** How does heat flow through matter? Why does convection occur in fluids rather than solids? How does the rate at which thermal energy is transferred change based on the material it travels through? Why do some things feel hot and some things feel cold? Why do temperature differences on the earth's surface create different weather patterns? **D3:** What are different types of energy?

	What are some energy transformations present in a real world system? What is the law of conservation of energy? How can kinetic energy be transformed into electricity, thermal energy, or light? If the law of conservation of energy is valid, where does the energy on earth come from and go to? Why aren't earth systems 100% efficient in energy transformations?
Standard(s) *Content and CCSS* **CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12** **CCSS: Grades 9-10** **Reading: Science & Technical Subjects** 3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text. **Writing** Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Objective(s) Bloom/ Anderson Taxonomy / DOK Language Students will: • analyze energy transformations using the Law of Conservation of Energy. • use mathematical equations to calculate kinetic, potential, and thermal energy of systems. • distinguish the differences between conduction, convection, and radiation. • predict the flow of energy in experimental situations • graphically describe changes in state of matter • design and conduct appropriate experiments involving heat • collect and analyze data from temperature measurements • draw conclusions from collected data and background knowledge

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CT: Science Framework (2005)** **CT: Grades 9-12** **I. Inquiry** SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and	

electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic. D INQ3. Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment. D INQ4. Design and conduct appropriate types of scientific investigations to answer different questions. D INQ5. Identify independent and dependent variables, including those that are kept constant and those used as controls. D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.	

D INQ.9 Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation. **High School Earth Science** Energy in the Earth System Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. The sun is a major source of energy for Earth and other planets. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents Differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat. Biogeochemical Cycles Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles. The movement of matter among	

reservoirs is driven by Earth's internal and external sources of energy. **High School Physics** Conservation of Energy and Momentum The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects Kinetic energy can be calculated by using the formula E = (1/2)mv2. Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh. Heat and Thermodynamics Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat Heat flow and work are two forms of energy transfer between systems. The internal energy of an object includes the energy of random motion of the object's atoms and molecules. The greater the temperature of the object, the greater the energy of motion of the atoms and	

molecules that make up the object. Waves Waves have characteristic properties that do not depend on the type of wave Waves carry energy from one place to another. Transverse and longitudinal waves exist in mechanical media, such as springs and ropes, and in the earth as seismic waves. Wavelength, frequency, and wave speed are related. 	
Content/Topics *Critical content that students must **KNOW*** Students will know: • states of energy • types of energy • use of energy formulas for GPE, KE and heat • energy transformations • Law of Conservation of Energy • energy loss in systems	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

• temperature vs. heat • thermal energy • latent heat • heating curve • heat flow: conduction, convection and radiation • states of matter • convection in the atmosphere/earth • water cycle	
Core Learning Activities Bouncy Balls lab Slingshot Lab Worksheets on GPE and KE Slinky Lab Heating and Cooling lab (Marty's Day at the Beach) Latent Heat Lab Heating by Conduction Lab Bill Nye - Energy Bill Nye - Heat Latent Heat H2O 2012-13.doc heat versus temp 2013.doc heat flow lab 2012.doc energy concept	Resources *Professional & Student* Physical Science with Earth Science; Unit 2; Chapter 5, pages 128-145 Unit 3, Chapter 9, pages 254-279 Online Resources for the text including online quizzes and chapter review http://glencoe.mheducation.com/sites/0078802482/student_view0/unit2/chapter5/index.html http://glencoe.mheducation.com/sites/0078802482/student_view0/unit3/chapter9/index.html Bill Nye Energy - https://www.youtube.com/watch?v=xw5qtadMSno Bill Nye Heat - https://www.youtube.com/watch?v=fBeJPpeeYJQ Energy Transformations Poster.doc

map.doc Calculating GPE and KE.doc Bill Nye energy questions.doc GPE and KE calculations - short version.doc	

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Heating and cooling lab Summative: Lab Assignment compare heat absorption and radiation for different earth materials latent heat lab Summative: Lab Assignment melt, heat, boil water and measure tempertaure changes over time heat transfer lab Summative: Lab Assignment heat transfer using aluminum bar from a hot cup to a cold cup Energy Test Summative:	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving Students will engage in one or two labs this unit. They will design, write, and conduct lab tests that involve heat transfer, specific heat capacity, temperature change, etc. They will follow the scientific method, or parts of the scientific method, during all lab exercises. At this point in the course students are still practicing and making progress towards mastering problem solving.	Math is distinctly integrated in formulas used to calculate conservation of energy. (i.e. PE=m*g*h) Students will have to learn and apply basic arithmetic and algebra skills to solve for different variables in a given problem. These equations demonstrate that the amount of energy in a system depends on factors such as height, mass, velocity, gravity, etc. Math integration is also present in the content about heat. Students are given a formula to calculate heat energy. (Q=m*C*Tf-Ti). Students must use their basic algebra skills to solve for variables. History and Science integration resource found in Chapter 5 on page 146. An article is given that references a historical "Impossible Dream" of constructing a perpetual motion machine. Students are meant to make a connection between what they know about the conservation of energy and that fact that a true perpetual motion machine is impossible because of the need for energy to be continuously supplied to a system in order to keep it running due to conditions on Earth.

Written Test test - H-energy, waves, density 2014.doc Heat Test Summative: Written Test Test-H heat, states of matter, water cycle 2014.doc Thermal Energy from Foods Formative: Lab Assignment thermal energy from foods.pdf Slingshot Lab Formative: Lab Assignment slingshot lab.docx Slinky Waves Lab Formative: Lab Assignment slinky waves.doc		

<< Previous Year
Atlas Version 8.1.1

Unit Planner: structure/function of the atom & the periodic tabl
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:12AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 9 - Week 12

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)

The relationship between structure and function of atoms determines the properties of all matter

Patterns are found in the periodic table forming trends that allow for identification, classification, prediction, and design of matter.

Essential Question(s)

How are the characteristic properties of an element determined by the arrangement of the particles in the atom?

How are atoms and matter organized and classified by using physical and chemical properties?

Guiding Questions

Factual, Conceptual, Provocative

What is matter?

What is an atom?

How do the number and arrangement of subatomic particles determine the properties of an element?

Why is the periodic table arranged the way it is?

How does the periodic table allow us predict the chemical and physical properties of elements?

Why aren't all atoms the same?

Why are atoms considered the building blocks of matter?

Standard(s)

Content and CCSS

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

CCSS: Grades 9-10

Reading: Science & Technical Subjects

Craft and Structure
4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word

Objective(s)

Bloom/ Anderson Taxonomy / DOK Language

Students will

- use models to examine the structure of the atom
- recognize patterns and trends in the periodic table
- classify elements based on their properties
- predict characteristics of elements by interpreting the periodic table

choices shape meaning or tone. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. **CT: Science Framework (2005)** **CT: Grades 9-12** **High School Chemistry** Atomic and Molecular Structure The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure The nucleus of the atom is much smaller than the atom yet contains most of its mass. The position of an element in the periodic table is related to its atomic number. The periodic table can be used to identify metals, semimetals, non-metals, and halogens. The electronic configuration of elements and their reactivity can be identified based on their position in the periodic table. © Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.	
Content/Topics *Critical content that students must* ***KNOW***	Skills *Transferable skills that students must be able to* ***DO*** • 2. Work independently and collaboratively to solve problems and

Students will know:

- structure of the atom
- organization of the periodic table
- valence electrons
- atomic models
- elements
- chemical and physical properties
- matter
- metals, non-metals, and metalloids

accomplish goals.

Core Learning Activities

alien periodic table

element flash cards

Hunting the Elements video

Metals, Non-metals, Metalloids mini lab

Alkali metals demonstration

periodic table with Bohr models.doc
ElementWksht.pdf
metals-nonmetals worksheets.pdf
Its elementary worksheet.pdf
Organizing the elements worksheet.pdf
worksheet - bohr_models.doc

Resources
Professional & Student

Physical Science with Earth Science; Unit 5, Chapter 18, pages 552-569. Chapter 19, pages 578-599

Online resources for text

http://glencoe.mheducation.com/sites/0078802482/student_view0/unit5/chapter18/index.html

http://glencoe.mheducation.com/sites/0078802482/student_view0/unit5/chapter19/index.html

Assessments (Titles)
Periodic Table Project
Summative: Personal Project

Students create there own periodic table of the first 20 elements

periodic table project KB.doc

Graduation Standards
Information Literacy
Problem Solving
Spoken Communication
Written Performance

- Problem Solving

Students will engage in several chemistry based

Interdisciplinary Connections

History can be integrated when talking about the development of the periodic table by Dimitri Mendelev. This can be linked with problem solving skills and how he used cards to find patterns of organization based on properties.

There are several other historic figures of note concerning chemistry that students should be made

Properties of Elements: Metals, Nonmetals, and Metalloids Summative: Lab Assignment Students examine and test several physical properties of 9 elements, attempt to classify them, research properties of metals, nonmetals, and metalloids, and then reclassify Properties_of_Elements_Lab.doc	mini-labs. During these they will be required to perform different parts of the scientific method as well as perform lab skills. They will practice writing detailed procedures, collecting data and other information, and making valid predictions based on prior knowledge.	aware of including Bohr, Rutherford, Curie, etc. These scientists are called to attention because the monumental strides taken in chemistry based on their work. In more distant history, chemistry has roots in medieval alchemy when scientists were driven by a desire to create or discover a substance that would produce pure gold. Advances in chemistry as we know it today tell us that the plight of the alchemists was futile because of the law of conservation of matter and the fact that each element is distinct based on its atomic structure.

<< Previous Year

Unit Planner: chemical bonds and reactions
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:13AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 13 - Week 17

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)
There is a finite amount of matter in the universe which has implications for law of conservation of matter. Chemical reactions illustrate interactions between atoms and energy which help to predict the nature and behavior of matter.

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
How do atoms bond with each other and other atoms in order to achieve stability? How do the arrangement of atoms in a compound determine the physical and chemical properties that are different from the original atoms properties? How is matter conserved during chemical reactions?	**D11** What are the differences between pure substances, compounds, and mixtures? How are compounds and molecules formed? How are the properties of a compound affected by its bonds? How do you describe a compound? Why do most atoms form chemical bonds? Why do atoms form bonds with some atoms but not others? How do the arrangement of protons and electrons in an atom contribute to the formation of compounds? Why is energy essential to chemical bonding? How are the laws of conservation of matter and energy demonstrated in a chemical reaction?

Standard(s) *Content and CCSS*	Objective(s) Bloom/ Anderson Taxonomy / DOK Language
CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12	Students will be able to: distinguish between physical and chemical reactions identify reactants and products balance chemical equations

CCSS: Grades 9-10 **Reading: Science & Technical Subjects** 3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text. Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. RST.9-10.4. Determine the meaning of symbols, key	model ionic and covalent bonds using electron dot diagrams predict the chemical formula for ionic and covalent compounds Identify types of reactions predict the products of reaction

terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. **CT: Science Framework (2005)** **CT: Grade 9** **II. Properties of Matter** Strand II: Chemical Structures and Properties 9.4 - Atoms react with one another to form new molecules. Show details D 10. Describe the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures. D 11. Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).	

NGSS: Disciplinary Core Ideas **NGSS: K-12** **Physical Sciences** Core Idea PS1: Matter and Its Interactions PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions © Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.	
Content/Topics *Critical content that students must **KNOW*** Mixtures vs pure substances ionic and covalent bonds physical and chemical changes types of reactions reactions involving energy balancing chemical equations	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.

Core Learning Activities	Resources *Professional & Student*
Ionic bond matchmaking cut-out activity "Fire Extinguisher" former CAPT lab Strength of bonds lab (sugar/salt/wax) Reactions in Well Plates lab Conservation of mass mini lab Grime off pennies - mini lab Mystery match up mini lab mixtures lab LAB (paper lab) Ionic Bonding cut outs.docx ionic bond worksheet.pdf covalent bond worksheet.pdf balancing chem equations - by Dorrie.pptx Chem reaction lab- in well plates - V2.doc Chem reaction lab- CP- in well plates - V2.doc conservation of mass mini lab.pdf	Text book; Physical Science with Earth Science. 2006. Unit 6 Interactions of Matter Chapter 22 Chemical bonds, pages 686-711 http://glencoe.mheducation.com/sites/0078600510/student_view0/unit5/chapter20/index.html (Note; above link goes to a different edition of the same text. The newer chapter is number 20 but covers the same material) Chapter 23 Chemical reactions, pages 718-743 http://glencoe.mheducation.com/sites/0078600510/student_view0/unit5/chapter21/index.html (Notes; the above link goes to a different edition of the same text. The newer chapter is number 21 but covers the same material) videos from Crash Course series on YouTube: https://www.youtube.com/watch?v=FSyAehMdpyI&list=PL8dPuuaLjXtPHzzYuWy6fYEaX9mQQ8oGr

grime off pennies mini lab.docx Mystery Match up.docx matter and its changes ws.pdf physical and chem changes ws.pdf reactions involving energy.pdf practice balancing equations.doc mixtures_lab shorter - use this one.doc pure substance vs mixtures ws.pdf	

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Fire Extinguisher Lab Summative: Lab Assignment Formal Inquiry Lab - students design and conduct an experiment to collect CO2 from the reaction between baking soda and vinegar Test on changes, bonds, reactions Summative:	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving Students will engage in at least one formal lab scenario this unit (Fire extinguisher Lab). At this time students may be formally assessed and graded with the graduation standards to gauge interim progress towards mastery of the skills outlined in the rubric. Students will use the scientific method to design, conduct, and write about their formal lab experience.	History Integration with a study of chemistry notables such as Antione Lavoissier. China is historically credited with the invention of gun powder. Their understanding of chemical reactions led the way for advances in gun powder, rockets, fireworks, etc. Social Studies integration with chemistry based advanced in technology that has greatly impacted society. For example many chemical reactions are used in everyday life in cooking, cleaning, and medicine. Without an understanding of chemical reactions many parts of our life would be dramatically different and certainly less convenient.

Written Test A summative test on chemistry topics		

<< Previous Year

Atlas Version 8.1.1

Unit Planner: acids and bases
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:14AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 18 - Week 20

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Acids and bases are essential components of and have a significant impact on living and nonliving systems.

Acids and bases have distinct physical and chemical properties and react in predicable ways.

D12, D22</td></tr>
<tr><td>Essential Question(s)

How do acids and bases change the concentrations of hydrogen ions in water?

How do acids and bases react with each other?

How is acid deposition formed?</td><td>Guiding Questions
Factual, Conceptual, Provocative

What are acids and bases?

What is the pH scale?

How are acids and bases related to the pH scale?

What are the properties of acids and bases?

What state of matter can acids and bases exist in?

Are acids and bases always harmful?

What happens when acids and bases combine?

Do all acids neutralize all bases?

Is water and acid or a base?

What is acid rain and what are its causes and effects?

Can acid rain be remediated or prevented?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grade 9
I. Inquiry
SCIENTIFIC INQUIRY •</td><td>Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

Students will;

compare and contrast properties of acids and bases

identify real world applications of acids and bases

describe a neutralization reaction using a chemical equation</td></tr>
</table>

Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical	predict the products of a neutralization reaction identify substances by pH describe the relationship between pH and a strong or weak acid/base

operations and procedures to calculate, analyze and present scientific data and ideas. D INQ1. Identify questions that can be answered through scientific investigation. D INQ6. Use appropriate tools and techniques to make observations and gather data. **II. Properties of Matter** Strand II: Chemical Structures and Properties 9.4 - Atoms react with one another to form new molecules. Show details D 12. Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions. Copyright © 2002-2014 State of Connecticut.	
Content/Topics *Critical content that students must* ***KNOW*** pH scale neutralization reactions	Skills *Transferable skills that students must be able to* ***DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable

identifying acids and bases by pH properties of acids and bases products of an acids base reaction real world uses of acids and bases	productive problem solving.

Core Learning Activities Cabbage Juice lab Fire Extinguisher Lab HCl + NaOH reaction mini-lab Modern Marvels video: Acids Red Cabbage Indicator Production - K.docx acids-bases ws.pdf worksheet on acids and bases.pdf describing acids and bases.pdf	Resources *Professional & Student* Text Book: Physical Science with Earth Science. 2006. Unit 6. Chapter 24; Solutions, Acids, and Bases. pages 750-777. http://glencoe.mheducation.com/sites/0078600510/student_view0/unit6/chapter23/index.html (Note; the above link is from a newer edition of the text. The new listing is chapter 23 but covers the same material about acids and bases.)

Assessments (Titles) Fire Extinguisher Formal Lab Summative: Lab Assignment Students performed the reaction of vinegar and baking soda to produce carbon dioxide gas in order to create a	Graduation Standards Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving The scientific method is used throughout this course to teach a logical way to approach any problem systematically. The fire extinguisher lab may also be used during this unit due to	Interdisciplinary Connections Math integration with calculating concentration of a solution (acid or base). Also the concept of surface area and its affect on the rate of dissolving is introduced. Students will use basic arithmetic skills to calculate surface area and record the rate of dissolving in solution. Students will also investigate how temperature affects the rate of dissolving. This relationship will be expressed as a graph that students will analyze and interpret (page 761). Culinary; Acids and bases are used extensively in cooking and baking. Both of these activities are hinged upon the chemical science of acid base reactions in order to do things

home-made fire extinguisher. They designed and implemented their own experiment regarding this reaction. Students are required to write a formal lab report with pre-lab, data, results, and conclusions. fire extinguisher lab accomodation.docx Acids and Bases Quiz Formative: Written Test Students may be tested with a traditional style quiz/pop quiz/test to gauge basic understanding of topics related to acids and bases. This may be done mid-chapter to formatively assess and progress learning further.	overlapping content. Other lab activities during this unit (cabbage indicator lab, etc) will use the scientific method and lab skills to approach given scenarios.	such as make baked goods rise, tenderize meats, and preserve many foods by pickling.

Unit Planner: carbon chemistry
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:14AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 21 - Week 24

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)

Carbon atoms bond in predictable ways and their uses are dependent upon the resulting structures.

The structure of the carbon atom allows it to form a broad array of compounds that have a wide variety of applications.

Understanding the flow of various forms of carbon and the interactions of these forms within Earth systems can be helpful in predicting system behavior.

D13, D14, D19,

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
D13 How does the structure of carbon facilitates its ability to form numerous compounds? D14 Describe combustion reactions of hydrocarbons and the resulting by-products. (Hydrocarbons frequently undergo combustion reactions.) D19 How do chemical and physical processes cause carbon to cycle through the major earth reservoirs?	What are the different bonding arrangements carbon is able to form? How do the bonds that carbon makes determine its physical and chemical properties? How can carbon form one of the hardest and softest materials on Earth? Why is carbon so critical to life on Earth? How does carbon combine to form hydrocarbons? What are the results/ by-products of combustion reactions? What are carbon sources and carbon sinks? What are the various processes that move carbon through Earth systems? How do *you* impact the carbon cycle?
Standard(s) *Content and CCSS* **CCSS: Literacy in History/Social**	Objective(s) Bloom/ Anderson Taxonomy / DOK Language Students will:

Studies, Science, & Technical Subjects 6-12 **CCSS: Grades 9-10** **Reading: Science & Technical Subjects** Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. **CT: Science Framework (2005)** **CT: Grade 9** **II. Properties of Matter** Strand II: Chemical Structures and Properties 9.5 – Due to its unique chemical structure, carbon forms many organic and inorganic compounds.	explain how the structure of a carbon atom affects the types of bonds it can make. compare and contrast the properties of different forms or carbon. predict the reactants or products of a combustion reaction. explain how carbon cycles through the major Earth reservoirs.

Show details

D 13. Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.

D 14. Describe combustion reactions of hydrocarbons and their resulting by-products.

VIII. The Changing Earth

Strand III: Global Interdependence 9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.

Show details

D 19. Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.

NGSS: Science Performance Expectations(2013)

NGSS: HS Earth & Space Science

HS.Earth's Systems

Performance Expectations

Show details

HS-ESS2-6.

Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. Show details 	
Content/Topics *Critical content that students must **KNOW*** Structure of the carbon atom graphite, diamond, bucky balls, nanotubes formation of fossil fuels hydrocarbons Complete and Incomplete combustion carbon sinks and carbon sources human effect on carbon cycle	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions.
Core Learning Activities Modern marvels;	Resources *Professional & Student* Text Book: Physical Science and Earth Science. Unit 4. Chapter 17, section 4 , pages

carbon carbon cycle diagrams flame thrower lab ball and stick models (predicting hydrocarbon formulas) living carbon cycle Molecular Model activity - KB.docx.doc Flame Thrower Lab 2012[1].doc chem bonding carbonb style.pdf Carbon_The element of life.ppt simplest hydrocarbons.pdf WS VID QUESTIONS modern marvels-Carbon[1].doc carbon compounds.pdf	535-539. There is a brief reference to the carbon cycle on page 536 and 537. Online text book chapter including section review, online quizzes and online resources. This is a newer edition of our text book. Chapter 24 Organic Compounds. http://glencoe.mheducation.com/sites/0078600510/student_view0/unit6/chapter24/index.html attached is a copy of Chapter 24 Organic Compounds which is not included in our current edition of the text book. Short video segment from NPR on Carbon: https://www.youtube.com/watch?v=ypbb9Zi5Tao chap24 organic compounds.pdf

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Living Carbon Cycle Formative: Other Visual Assessments students represent a carbon atom that travels to sinks and sources through the carbon cycle. Students track their	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving Students may perform the "Flame Thrower Lab" where students combust acetylene gas obtained from calcium carbonate. They will use the scientific method to compose a procedure and collect qualitative (observations) and quantitative (amount of acetylene produced) data.	Health integration; DNA and other "molecules of life" are composed of carbon and other elements. The health and medical fields rely on organic chemistry to understand DNA and genetics and to invent new compounds to be used as drugs to target specific ailments. Art integration; Graphite is a pure form of carbon that has a layered structure with weak bonds between the layers. This is what allows graphite to write so well. Art supplies such as pencils of different hardness and charcoal utilize the properties of carbon bonding. History/Social Studies integration; Diamond is a pure form of carbon that is the hardest known naturally occurring substances. It has been historically coveted and therefore valuable because of its attractive qualities as well as its

journey through the cycle an how long they stayed in sinks/sources. Carbon cycle Cards.docx carbon cycle handouts.docx carbon cycle lesson.doc Carbon quiz Summative: Written Test Students take a traditional style quiz to sum up their knowledge about carbon. Includes vocab fill in the blank, carbon structure diagrams, carbon cycle flow chart, and short answer. carbon unit quiz.docx		hardness. Students may be asked to critically think about an object's value and whether it is based on an unexplainable attraction or practical usefulness. History; Fossil fuels which are composed of hydrocarbons have had a great impact on society and modern living. Students will be asked to think about how their life may be different is we did not depend on fossil fuels as an energy source. This dependence can be traced back to the industrial revolution.

Unit Planner: polymers
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:15AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 25 - Week 27

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Understanding interactions between structure, function, and efficiency of polymers can generate new applications for improved design.

Daily living has been greatly affected by the science, technology and engineering of polymers with varying structures, functions, and properties.</td></tr>
<tr><td>Essential Question(s)

D15, D16, D17

How does the form and structure of polymers determine their properties and variety of uses?</td><td>Guiding Questions
Factual, Conceptual, Provocative

What is a polymer?

How are polymers created?

How are the properties of a polymer determined by its structure?

How are polymers categorized?

Why are so many polymers used in modern life?

How have polymers affected the quality of life?

What systems have been put in place to dispose of polymers?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
CCSS: Grades 9-10
Reading: Science & Technical Subjects
Craft and Structure
4. Interpret words and phrases as they are used in a</td><td>Objective(s)
<u>Bloom/ Anderson Taxonomy</u> / <u>DOK Language</u>

Students will be able to:

Explain how properties of polymers change with structure

Identify a polymer based on its properties

Formulate a persuasive multimedia argument about banning plastic bags using evidence researched from a variety of sources.</td></tr>
</table>

text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. **CT: Science Framework (2005)** **CT: Grade 9** **XI. Science & Technology in Society** Strand II: Chemical Structures and Properties 9.6 - Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals. Show details D 16. Explain how simple chemical monomers can be combined to	

create linear, branched and/or cross-linked polymers. D 17. Explain how the chemical structure of polymers affects their physical properties. **CT: Grades 9-12** **I. Inquiry** SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search	

for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ10. Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic. © Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.	
Content/Topics *Critical content that students must **KNOW*** Monomers Natural and synthetic polymers	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.

Crosslinking How properties of polymers change depending on structure HDPE vs LDPE properties of polymers identifying polymers based on properties	

Core Learning Activities Making Gak Properties of polymers lab Plastic bag stretch off QPA: Plastic Bags: Yay or Nay	Resources *Professional & Student* 2006 edition of text does not include a chapter on polymers. The newer edition of the text does. The attachment below is a copy of Chapter 25; New materials through chemistry (Polymers). http://glencoe.mheducation.com/sites/0078600510/student_view0/unit6/chapter25/index.html web resource for relevant chapter chap25 new materials through chem.pdf

Assessments (Titles) Plastic Bags: Yay or Nay Summative: Personal Project Students will create a persuasive presentation as to whether plastic bags should be banned from Newtown Properties of Polymers Lab	Graduation Standards Information Literacy Problem Solving Spoken Communication Written Performance • Information Literacy Plastic vs. Paper bag project requires outside in depth research	Interdisciplinary Connections History integration; Synthetic polymers were invented in recent history. A study of the first polymers created (i.e. John Wesley Hyatt inventing nitritic cellulose and Leo Bakeland and bakelite) can help give students historic perspective about how polymers are only a recent addition to modern society. Modern topics and environmental impact is heavily related. New polymers are being designed as we speak.

Formative: Lab Assignment Students will analyze different properties of polymers and then use the properties to identify an unknown polymer properties of polymers lab.doc Plastc Bag Stretch off Formative: Lab Assignment Students will investigate the how plastic bags stretch differently in different directions LAB polyethylene bags[1].pdf Making Gak Formative: Lab Assignment Students make Gak using Elmers Glue and Borax GAK-playing with polymers.do		

c Polymer Test Summative: Written Test H polymer test.doc		

<< Previous Year
Atlas Version 8.1.1

Unit Planner: Garbage and Waste Disposal
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:16AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 29

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

<table>
<tr><td colspan="2">Enduring Understanding(s)/ Generalization(s)

Science, Engineering, and Technology in Society builds and satisfies needs, influences careers, and designs solutions for the development of superior technologies and sustainable environments.

Waste disposal systems illustrate interactions between internal components and the external environment so that a change on one level can impact the system as a whole.</td></tr>
<tr><td>Essential Question(s)

D18 How do the short and long term impacts of landfills, incineration, and recycling of waste materials affect the quality of the environment?

D25 How do human activities including land development, transportation options, and consumption of resources affect the environment?

D26 How have humans attempted to reduce the consumption of raw materials and improve air and water quality?</td><td>Guiding Questions
Factual, Conceptual, Provocative

What is waste?

How do humans dispose of waste?

What are some "cradle to grave" implications of waste disposal?

What are some short and long term impacts of disposing of waste in landfills, incinerators, and recycling?

What is the difference between reduce, reuse, and recycle?

How do <u>you</u> impact the the volume of human waste?

What can you do to decrease the impact of waste disposal on the environment?

Why has modern life adopted the "disposable mentality"?</td></tr>
<tr><td>Standard(s)
Content and CCSS
CT: Science Framework (2005)
CT: Grade 9
XI. Science & Technology in Society
Strand III: Global Interdependence 9.9 Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.
Show details

D 25. Explain how land development,</td><td>Objective(s)
<u>Bloom/ Anderson Taxonomy</u> / <u>DOK Language</u>

Students will be able to:
Identify types of and sources of MSW
identify patterns in MSW disposal and recycling in the US over time
compare and contrast different methods of waste disposal
compare and contrast reduce, reuse, and recycle
evaluate the impact of a consumptive lifestyle
create a persuasive presentation about banning single use plastic bags</td></tr>
</table>

transportation options and consumption of resources may affect the environment. D 26. Describe human efforts to reduce the consumption of raw materials and improve air and water quality. **CT: Grades 9-12** **I. Inquiry** SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. • Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation. • Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists. SCIENTIFIC LITERACY • Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science. • Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. SCIENTIFIC NUMERACY • Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas. D INQ8. Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms. Copyright © 2002-2014 State of Connecticut.	
Content/Topics *Critical content that students must **KNOW*** What is sustainability? What is the type of and source of our municipal solid waste? How is waste disposed of?	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

How do landfills and incinerators work? How can waste be reduced through reduce, reuse, recycle?	
Core Learning Activities Ban plastic bag project MSW graphing Assessing garbage lab watch video - Garbage: the Works watch video - the Story of Stuff garbage lab.docx MSW graphing.doc video The Works-Garbage.doc	Resources *Professional & Student* EPA website on MSW - http://www.epa.gov/epawaste/nonhaz/municipal/ EPA website on recycling - http://www2.epa.gov/recycle The story of Stuff - http://storyofstuff.org/movies/story-of-stuff/ Newtown recycling info - http://www.newtown-ct.gov/public_documents/NewtownCT_Recycling/RECYCLINGx.pdf

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Plastic bags: Yay or Nay Summative: Personal Project Students will create a presentation of their choosing (can be written, visual, multimedia) to persuade the audience that Newtown should ban the use of single use plastic bags or not. CFA - Waste Disposal and Recycling Formative: Written Test summative test Summative: Written Test includes questions about polymers, carbon, and garbage	Information Literacy Problem Solving Spoken Communication Written Performance • Information Literacy • Problem Solving	Garbage and waste disposal is connected to modern topics in the media. There are current articles and news stories about advancements in environmental science such as proposals for cleaning up the Great Pacific Garbage Patch, biodegradable plastics, and plastics that are non-fossil fuel dependent. American consumption and waste disposal quantities can be investigated through a mathematical lens using large quantities or per person totals or graphing totals. Students can investigate national vs. personal waste disposal.

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Unit Planner: Pollution and Global Change
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:16AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 30 - Week 31

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)

Environmental systems, in order to survive, must balance against competing influences including human impact, that cause change over time.

Understanding critical elements and feedback mechanisms that contribute to the stability and behavior of an environmental system is essential in order to predict and prevent catastrophic disruptions and encourage sustainability.

Essential Question(s)

D24: How does the accumulation of toxins such as heavy metals and nutrients effect the quality of water and the aquatic organisms.

D22 and D23: How do the products and by-products of human activity lead to the formation of pollution, acid rain, and global climate change?

Guiding Questions
Factual, Conceptual, Provocative

What is pollution?

What human activities contribute to pollution?

How are the environment and organisms affected by pollution?

What is biomagnification?

What is the greenhouse effect and why is it important for life on earth?

What are the possible impact of human activity on global climate?

What are some of the implications of climate change for today and for the future?

How would the earth be different if humans never existed?

Is it possible for humans to live sustainability?

Standard(s)
Content and CCSS

CT: Science Framework (2005)

CT: Grade 9

XI. Science & Technology in Society

Strand III: Global Interdependence 9.8 - The use of resources by human populations may affect the

Objective(s)
Bloom/ Anderson Taxonomy / DOK Language

Students will be able to

- Identify the difference between Greenhouse Effect and climate change
- Understand causes of historical and current climate change
- Research effects of climate change
- Analyze temperature and CO2 data
- Identify sources and effects of air and water pollution.
- Describe how acid rain forms
- Describe how septic and sewage treatment systems work.

quality of the environment. D 22. Explain how the release of sulfur dioxide (SO_2) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures. D 23. Explain how the accumulation of carbon dioxide (CO_2) in the atmosphere increases Earth's "greenhouse" effect and may cause climate changes. D 24. Explain how the accumulation of mercury, phosphates and nitrates affects the quality of water and the organisms that live in rivers, lakes and oceans. Copyright © 2002-2014 State of Connecticut.	• Describe how "nutrients" can cause dead zones • Evaluate their contribution to air and water pollution and climate change. •
Content/Topics *Critical content that students must **KNOW*** How does the burning of fossil fuels contribute to air pollution, acid rain, and climate change? What is climate? What is the Greenhouse Effect and what is the role of greenhouse gasses? How have humans added greenhouse gasses to the atmosphere? What are the historical and current causes of climate change? What are potential effects of climate change? What is air pollution? What are sources and effects of	Skills *Transferable skills that students must be able to **DO*** • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions. • 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

air pollution? What are some sources and effects of water pollution? How is groundwater different from surface water? How and why do humans use water? What is eutrophication and how is it caused? How do septic systems and sewage treatment systems work? What is a brownfield? How can it be remediated? How can a pollutant bio-magnify up a food chain? (bio-magnification) What are some solutions to pollution? How can you reduce your impacts to water pollution, air pollution, and climate change?	
Core Learning Activities Watch Cosmos - episode 12 Graph CO2 and Temperature data over time (Mauna Loa in the Classroom) Research the effects of climate change (can do as jigsaw) Climate change concept map AIr pollution jigsaw Brownfield brochure A grave mistake	Resources *Professional & Student* Text Book; Physical Science with Earth Science, Unit 4, Chapter 17. Section 4. pages 535-549. Unit 5, Chapter 21, Section 3, pages 663-668. Chapter in the text on Weather and Climate. Section 3 and 4 recommended are about Climate and Earth's Changing Climate. Chapter in the text on Groundwater may be useful when addressing water pollution. Science and Society article on page 678 discusses importance of local fresh water resources. NASA website on climate change: http://climate.nasa.gov/

Septic-sewage jigsaw biomagnification worksheet.pdf IPES Lesson Plan - Why Study Air Pollution.doc Full Plan - Why study air pollution.pdf Brownfield Brochure instructions.doc A grave Mistake.pdf Septic Systems.docx location location.pdf freshwater pollution.pdf Concept Map Directions - climate change - CP.docx effects of cc - mini - research - jigsaw.docx Mauna Loa in classroom graphing activity for honors class.pdf	EPA website on climate change: http://www.epa.gov/climatechange/ EPA website on air pollution: http://www.epa.gov/oaqps001/urbanair/ National Geographic website on water pollution: http://environment.nationalgeographic.com/environment/freshwater/pollution/

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Brownfields Brochure Summative: Other written assessments Students will research brownfileds, remediation, and one particular type of pollutant and present the information in a brochure format. Acid Rain and Greenhouse Gasses CFA Formative: Written Test Summative test Summative: Written Test Brownfield Brochure instructions.doc	Information Literacy Problem Solving Spoken Communication Written Performance • Information Literacy • Problem Solving Students will use current articles and research to investigate modern topics in this unit. Students may also engage in a mini-lab known as "The Grave Mistake" that deals with ground water contamination. The focus for this will be data collection and demonstrating solutions to problems as outlined on the graduation standard rubric.	Students will examine data with an objective math lens. They will be asked to make inferences based on what they see only in the data. They will then think about current global issues and events and attempt to make valid connections between the two. This is both a math and a social studies connection. These relevant science topics are modern concerns that students should be made aware of in order to be a educated citizen in the 21st century.

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Unit Planner: Energy Resources
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:17AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 32 - Week 34

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)
Understanding the flow of various forms of matter as energy and the interactions of these forms within a system. Understanding that in the universe there is a finite amount of matter/energy and this has implications for alternative energy decision making . Alternative energy sources are necessary for maintaining a system since energy takes many forms and while total energy remains constant within a closed system, usable energy declines.

Essential Question(s)	Guiding Questions *Factual, Conceptual, Provocative*
D7: How is heat used to generate electricity? D8/D9/D25: How are non-renewable and renewable resources used in society? How does their usage and availability affect the environment?	What is the difference between renewable and non renewable resources? What are the advantages and disadvantages of the different energy resources? What energy transformations are used to generate electricity? Why is it critical to develop and utilize low impact energy sources? Why should the amount of usable energy influence human decisions and behaviors? What is the role of energy in our world? How much energy is there? Can all renewable and nonrenewable resources be utilized all over the world?

Standard(s) *Content and CCSS*	Objective(s) Bloom/ Anderson Taxonomy / DOK Language
CT: Science Framework (2005) **CT: Grade 9** **XI. Science & Technology in Society** Strand I: Energy Transformations 9.3 - Various sources of energy are used by humans and all have	Students will; identify modern energy resources compare and contrast renewable and non-renewable energy resources describe energy transformations used to produce electricity explain the effects of using non-renewable resources such as fossil fuels

advantages and disadvantages. Show details D 7. Explain how heat is used to generate electricity. D 9. Describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity. Strand III: Global Interdependence 9.9 Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems. Show details D 26. Describe human efforts to reduce the consumption of raw materials and improve air and water quality. Copyright © 2002-2014 State of Connecticut.	analyze advantages and disadvantages of different energy resources evaluate current energy resource usage and offer alternatives
Content/Topics *Critical content that students must **KNOW*** renewable vs. nonrenewable fossil fuels hydroelectricity wind power solar power biomass nuclear generators transformers	Skills *Transferable skills that students must be able to **DO*** • 1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. • 2. Work independently and collaboratively to solve problems and accomplish goals. • 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. • 4. Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving. • 6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

power plants current resource usage	
Core Learning Activities design a wind turbine PV cell lab solar absorption of fluids lab Modern Marvels: Renewable Energy Create a poster detailing pros and cons of a renewable resource design a wind turbine.docx Testing PV Cells.doc solar absoprtion=liquids.doc Renewable_Movie_questions[1].doc	Resources *Professional & Student* Text Book; Physical Science with Earth Science. 2006. Unit 4. Chapter 16, pages 484-409. http://glencoe.mheducation.com/sites/0078600510/student_view0/unit2/chapter9/index.html web resource including section review and quizzes. Listing is from newer edition of text.

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Mapping the Resources Summative: Group Project Students will research energy resources presently used around the country. They will also research geographic, geologic, and climatic variables around the country. They will evaluate and synthesize this information to make decisions about the alternative energy resource best suited for each state in the	Information Literacy Problem Solving Spoken Communication Written Performance • Information Literacy • Problem Solving	Social Studies/Geography integration; A suggested project for this unit involves a map of the United States being labeled according to their most used energy resources to produce electricity. Students will have to label each state on a map as well as write supporting reasons for why they chose a specific energy resource for that state. Their decision should be based on geographic location, climate and weather patterns, geologic deposits of fossil fuels, and land forms such as plains or rivers. Students' study of energy resources should also include the impact on society, modern technology, and economics.

United States. Energy QPA purpose and questions.docx energy resource stickers for map.docx Resources Map QPA.docx design a wind turbine.docx		

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Unit Planner: Electrical Energy
Integrated Physical and Earth Science
Friday, May 22, 2015, 11:18AM

Newtown High School > 2014-2015 > Grade 9 > Science > Integrated Physical and Earth Science > Week 35 - Week 37

Last Updated: Tuesday, May 19, 2015 by Fawn Georgina

Baumgartner, Karolyn; Canfield, Christian; Georgina, Fawn; Harrison, Trent; Linfante, Elizabeth; Nicholson, Darryl

Enduring Understanding(s)/ Generalization(s)	
Understanding the flow of various forms of matter as energy and the interaction of these forms within a system can be helpful in predicting system behavior. System models illustrate interactions between internal components and external factors, which help to predict the behavior of systems. The relationship between resistance, current and voltage predicts the energy within a system.	
Essential Question(s) How is electrical energy created from the forces that electrical charges exert on one another? How do systems that utilize electrical energy affect the quality of life? What relationships exist between electrical forces and their affects on different circuits?	Guiding Questions *Factual, Conceptual, Provocative* What is electricity? What factors determine the flow of electricity? What is the relationship between voltage, resistance, current and power? How do objects become electrically charged? What is the difference between series and parallel circuits? Can electricity be lost? Why is efficiency important in electrical systems? Why can't a system ever be 100% efficient? What is the role of magnets in the generation of electricity? What is the role of electricity in creating magnets? How is electricity transferred through a circuit? What is a circuit and what makes it work?
Standard(s) *Content and CCSS* **CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12**	Objective(s) Bloom/ Anderson Taxonomy / DOK Language Design and build an electrical circuit to a given specification. Independently produce, self assess and critique

CCSS: Grades 9-10 **Reading: Science & Technical Subjects** 3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text. **CT: Science Framework (2005)** **CT: Grades 9-12** **High School Physics** Electric and Magnetic Phenomena Electric and magnetic phenomena are related and have many practical applications. The voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors can be predicted using Ohm's law. Any resistive element in a DC circuit dissipates energy, which heats the resistor. The power in any resistive circuit element can be calculated by using the formula Power = 12R. © Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.	Evaluating the energy flow through a circuit Mathematically analyze a circuit using Ohm's Law. Build an electromagnet and assess its strength
Content/Topics *Critical content that students must **KNOW*** electrons and electricity	Skills *Transferable skills that students must be able to **DO*** • 2. Work independently and collaboratively to solve problems and accomplish goals. • 4. Demonstrate innovation, flexibility and adaptability in thinking

circuits voltage current power resistance ohms and ohms law watts circuit construction generators V=IR parallel series AC/DC static electricity electromagnetism	patterns, work habits, and working/learning conditions. • 5. Effectively apply the analysis, syntheses, and evaluative processes that enable productive problem solving.
Core Learning Activities Build a simple circuit, a series circuit, and a parallel circuit Exploring static electricity with the Vann de Graff generator Mythbusters (Ben Franklin with a Kite) Citrus Fruit battery Coin battery Build an electromagnet electromagnet mini mini lab - KB.doc franlins folly & shocking	Resources *Professional & Student* Text Book; Physical Science with Earth Science, 2006. Unit 4. Chapter 13 and 14. pages 390-415. pages 422-447 Recommended using Chapter 14 about magnetism as it regards to producing electric current in sections 2 and 3. Electricity http://glencoe.mheducation.com/sites/0078600510/student_view0/unit2/chapter7/index.html Magnetism http://glencoe.mheducation.com/sites/0078600510/student_view0/unit2/chapter8/index.html

facts.pdf Electric circuits Lab -KB-mod.docx ohm's law worksheets.pdf series and parallel circuit w-s.pdf thief_in_my_kitchen_lesson[1].doc power, kWh, cost.doc series and parallel practice probs.doc	

Assessments (Titles)	Graduation Standards	Interdisciplinary Connections
Build a circuit mini lab Formative: Lab Assignment Students will use wires, batteries, and light bulbs to create simple series and parallel circuits. They will record each step of their construction and each type of circuit they make. Students will compare and contrast the results of each circuit and how bright their light bulb gets. Electricity Quiz/Test Summative: Written Test Students may be assessed using a traditional style test/quiz about all relevant topics in electricity. Fruit Battery Formative: Lab	Information Literacy Problem Solving Spoken Communication Written Performance • Problem Solving When learning about electricity students will be asked to design and/or assess an electrical circuit. They will apply the scientific method in their way of thinking in order to solve the problem as well as to record and document their process of constructing or assessing the circuit.	Math integration; Students will be given formulas to calculate current, voltage, resistance, etc. (V=IR) Students will have to apply basic algebra skills to solve for variables when given an example circuit. Students will also have to solve problems based on circuit diagrams that may include the use of arithmetic skills to predict the flow of electricity or whether a circuit will overload a light bulb etc. History integration; Students can be introduced to notable figures from history concerning electricity. For example investigating Ben Franklin's fabled experiment, Michael Faraday and electromagnetic induction, and Nikola Tesla and Thomas Edison.)

Assignment Students will design and construct a fruit battery to attempt to light a small bulb. They will record voltage created and compare and contrast voltage using different metal leads. fruit battery worksheet.docx		