Southington Board of Education Meeting

Thursday, October 12, 2023 6:30 PM
John Weichsel Municipal Center Public Assembly Room
200 North Main Street
Southington, CT 06489

COMMITTEE OF THE WHOLE - OPERATIONS

1. CALL TO ORDER
2. Executive Session
   a. Technology Department Staff
   b. Student Matters
   c. Personnel
3. Reconvene Meeting - Regular Session 7:00 p.m.
4. Pledge of Allegiance
5. Approval of Minutes - September 14, 2023
6. Public Communications
   a. Communications from Student Board Representatives
   b. Communications from Board of Education
   c. Communications from Administration
   d. Communications from Public - Agenda Items Only
7. Committee Reports
   a. Curriculum & Instruction Committee Meeting - September 22, 2023
8. Superintendent's Report
   a. Personnel Report
9. Old Business
   a. Town Government Communications
   b. ConEd Battery Storage Project
10. New Business
    a. Multilingual Presentation
    b. STEAP Matching Funds
    c. SHS Accelerated Physics Unit #3 Momentum & Impulse - First Reading
    d. SHS Accelerated Physics Unit #4 - Work & Energy - First Reading
    e. SHS Accelerated Physics Unit #5 - Simple Harmonic Motion - First Reading
    f. SHS Accelerated Physics Unit #6 - Electrostatics & Circuits - First Reading
    g. SHS Accelerated General Chemistry Unit #3 - Matter & Energy Changes - First Reading
    h. SHS Accelerated General Chemistry Unit #4 - Gas Law & Kinetics - First Reading
    i. SHS Accelerated General Chemistry Unit #5 - Flint Water Crisis - First Reading
    j. Middle School Needs Assessment - First Reading
11. Public Communications
    a. Public

    b. Student Expulsion

12. Adjournment

The minutes presented within this document provide a summary of the discussion that took place at the Board of Education meeting. For the complete discussion of the agenda items, please view the video of the Board meeting on our website at www.southingtonschools.org. These minutes are considered a draft until approved at the following regular Board of Education meeting.

SOUTHINGTON BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

REGULAR MEETING
SEPTEMBER 14, 2023

The regular meeting of the Southington Board of Education (Committee of the Whole - Operations) was held on Thursday, September 14, 2023, at 7:00 p.m. as a public meeting in the John Weichsel Municipal Center Public Assembly Room, 200 North Main Street, Southington, Connecticut with an Executive Session preceding at 6:30 p.m.

1. CALL TO ORDER

Mrs. Colleen Clark, Chairperson, called the meeting to order at 6:27 p.m.

Board members present: Mrs. Dawn Anastasio, Mr. Joseph Baczewski, Mrs. Terri Carmody, Mr. Sean Carson *(arrived 6:36 p.m.)*, Mrs. Colleen Clark, Mr. David Derynoski, Mr. Zaya Oshana, Mr. Jasper Williams.
Absent: Mr. James Chrzanowski
Cabinet administrators present: Mr. Steve Madancy, Superintendent of Schools; Mr. Frank Pepe, Assistant Superintendent

2. EXECUTIVE SESSION – UNAFFILIATED COMPENSATION: TECHNOLOGY DEPARTMENT STAFF, DIRECTOR OF PUPIL SERVICES, SUBSTITUTE TEACHER

MOTION: by Mr. Derynoski, seconded by Mr. Oshana:

"Move to go into Executive Session, excluding the public and the press, for the purpose of discussing Unaffiliated Compensation for Technology Department Staff, Director of Pupil Personnel Services and Substitute Teacher, and upon conclusion reconvene to public session."

Motion carried unanimously by voice vote.

Mrs. Clark ended the Executive Session at 6:50 p.m.
The Regular Board meeting was reconvened at 7:02 p.m.

3. RECONVENE MEETING – REGULAR SESSION

Board members present: Mrs. Dawn Anastasio, Mr. Joseph Baczewski, Mrs. Terri Carmody, Mr. Sean Carson, Mrs. Colleen Clark, Mr. David Derynoski, Mr. Zaya Oshana, Mr. Jasper Williams. Absent: Mr. James Chrzanowski

Cabinet administrators present: Mr. Steven Madancy, Superintendent of Schools; Mr. Frank Pepe, Assistant Superintendent; Mrs. Jennifer Mellitt, Director of Business & Finance; Ms. Rebecca Cavallaro, Director of Pupil Personnel Services
Student Representatives present: Uptej Singh, Chelsey Arduini, Akari Win

4. PLEDGE OF ALLEGIANCE & MOMENT OF SILENCE

The Student Representatives led in reciting the Pledge of Allegiance.

Mrs. Clark called for a moment of silence in memory of Priscilla Kolpak who passed away on August 22, 2023. She began her career as a school aide in 1978 and worked for the Southington Public Schools until her retirement in December of 2009.

5. APPROVAL OF MINUTES

a. June 8, 2023

MOTION: by Mrs. Carmody, seconded by Mr. Derynoski:

"Move to approve the regular Board of Education Meeting Minutes of June 8, 2023, as submitted."
Motion carried unanimously by voice vote.

b. June 29, 2023 Special Meeting

MOTION: by Mrs. Carmody, seconded by Mr. Derynoski:

"Move to approve the Special Board of Education Meeting Minutes of June 29, 2023, as submitted."
Motion carried unanimously by voice vote.

c. August 17, 2023 Special Meeting

MOTION: by Mrs. Carmody, seconded by Mr. Derynoski:

"Move to approve the Special Board of Education Meeting Minutes of August 17, 2023, as submitted."
Motion carried unanimously by voice vote.

6. PUBLIC COMMUNICATIONS

a. Communications from Student Board Representatives

Uptej Singh reported on the following high school events: Student survey to be conducted by the Student Representatives later in the year on the positive and negatives of the new Block Scheduling; Senior year kicked off with Senior Sunrise at 5:45 a.m. on August 29; Robotics; College Fair will be held September 19 from 6:15-7:45 p.m.; Unified Arts Program; FBLA National Convention competition during summer of 2023.

Chelsey Arduini gave the fall sports report to date for opening week for the high school Varsity Football, Field Hockey, Boys & Girls Cross Country, Girls Swim & Drive Team. The middle schools were holding fall sport team tryouts during the week. Many events during opening week were postponed due to the weather.

Akari Win reported on the other schools in the district including South End Elementary participating in the One Book, One School Program. JFK Middle School held their open house, and a kickoff assembly, the fall sports season tryouts and practices were underway along with afterschool clubs, and other activities that could be found on the JFK website. JAD Middle School held their open house; the Sixth Grade Blue Team and Silver Teams attended a field trip to Camp Sloper for team building skills; over 200 students signed up for the JAD Leadership Program with training at Camp Sloper on Saturday. JAD held their Open House and was getting ready for their Alex's Lemonade Stand at the Apple Harvest Festival.

Mr. Williams and Mr. Derynoski were looking forward to feedback on the Block Scheduling and requested to have Block Scheduling as an agenda item for follow-up as a mid-year or quarterly update.

Mr. Baczewski addressed the College Fair at the high school and questioned if any trades people were invited to do presentations. Mr. Madancy stated that the Career Fair was a separate event, which was highly successful in the past.

b. Communications from Board Members

Mr. Williams commented on the positive feedback that he received from parents on the start of school kick-off. Mr. Derynoski received questions regarding the effect of the Meriden New Britain Transportation bus strike on Southington. Mr. Madancy explained that there was no impact on Southington due to Meriden being a different bargaining unit. However, on the first day of school there are new bus drivers, new routes, parents taking photos that always cause delays. Mr. Derynoski received a complaint about the traffic jam at JAD Middle School in the morning at drop-off. Mrs. Clark thought that as time went on the traffic patterns would improve. Mr. Baczewski addressed the JAD Middle School open house that was well attended and always well organized and that as a Board member he was very proud.

c. Communications from Administration

1. Opening of School: Mr. Madancy stated that it was a smooth opening day this year and that he received 99% positive feedback. The only problem was due to the weather with the high heat and humidity index in the elementary schools resulting in weather-related closures.
2. Summer Work Update: Mr. Madancy reported that Mr. Peter Romano, Director of Operations, Custodians, and the Maintenance Department worked hard all summer getting the schools ready for opening day. He noted that the schools were immaculate for the first day and thanked them for their efforts. Mr. Madancy will provide a comprehensive list of the school projects completed during the summer for the next meeting.
3. Redistricting: Mr. Madancy explained that in November of 2023 they were not going to referendum on building/renovating Kelley, Flanders, Derynoski Elementary Schools and were pausing on redistricting. He noted that birth rates were higher in Southington than expected from the previous Enrollment Study. In

addition, State Legislation passed changing the start age of a Kindergartner beginning in 2025. Mr. Madancy stated that this all needed to be factored into a new Enrollment Study for class size and building utilization.

4. Plantsville Center 9/11 Memorial Service: Mr. Madancy stated that a Memorial Service and tribute to the heroes and the victims of 9/11 was held on September 11 as a community event. He noted that many of the current students were not born on 9/11/2001 and did not understand the impact of that day.

d. Communication from Public – Agenda Items Only

There was no communication from the public.

7. COMMITTEE REPORTS

a. Finance Committee Meeting – September 11, 2023

Mrs. Mellitt reported that the Finance Committee met and reviewed the Fiscal Year 2023 Financial update that included total expenditures of $105,487,401 with an unexpended balance of $103,708. There was an expected encumbered unemployment liability of $17,342 for a former employee to be paid using the unexpended funds, which would bring the 2023 non-lapsing account balance to $86,366 (.08% of the budget per Mr. Oshana). It was pointed out that in the past, the non-lapsing account had a significant amount more funds than $86,366 and that is with a budget freeze put on supplies in December. Mrs. Mellitt reported that the committee discussed the FY'23 financial update for the Food Service Program. Revenues were generated through grant funding for the National School Lunch Program and the SMART fund provided for the 2022-23 school year. Meals were provided free to all students this year until SMART funds ran out in early December. The SMART funds 2.0 iteration began March 1st. There was a net profit of $684,603 for FY'2022-2023. The Committee received an update on the Mobile Device Management 5-year Agreement and that Mr. Savage, Network Manager, was able to reduce the number of devices covered with the new five-year agreement resulting in a savings of $14,612 from the original $24,452. Mrs. Mellitt announced that Mr. Kyle Fickel is the new Accounting Manager recently hired and is a Southington resident. Due to the retirement of Ms. Nya Welinsky, who was the Food Service Director for the district for many years, Ms. Nicole LeFebvre was hired as the new School Lunch Director. Mrs. Mellitt stated that she and Ms. Nicole Lefebvre were currently participating in a review of the School Lunch Program with state auditors who audit school districts every three years, which was postponed due to the pandemic. Mrs. Mellitt and Ms. Lefebvre have been attending workshops provided by the State School Nutrition Department to prepare for the review.

Mrs. Clark questioned the number of families signing up for the Free & Reduced Lunch. Mrs. Mellitt explained the new program called STABLE and that the district received funding for the School Lunch Program for all students to receive Free Breakfast. Students who apply for Free or Reduced Lunches will receive both breakfast and lunch accordingly. Discussed was the MyPaymentsPlus software for families to pay for Lunches online, as well as by check.

8. SUPERINTENDENT'S REPORT

a. Personnel Report

MOTION: by Mrs. Carmody, seconded by Mr. Baczewski:

"Move to approve the Personnel Report, as presented by administration."

Mr. Derynoski noted that Mr. Rit Campbell, AV Technology Analyst for the Southington Public Schools for 25 years, was on the Personnel Report under retirements.

Motion carried unanimously by voice vote.

9. OLD BUSINESS

a. Town Government Communications

There was no Town Government Communication.

10. NEW BUSINESS

a. Summer School Update

Mr. Tom Hinman, Director of Summer School Programming K-12, gave a PowerPoint presentation regarding the Southington Summer Academy. He recognized the teams of teachers along with Mrs. Zappone and Mrs. Lawlor who made it successful. He addressed streamlining the program registration process, IEPs and 504s, timesheets, and tuition payments utilizing software programs. He highlighted the 2023 session dates and times for the K-5 Summer Academy, grades 6-8 Summer Academy, High School Credit Recovery and Enrichment programs. Mr. Hinman noted that the planning process starts in January/February and that grants were applied for but were denied. The sessions dates were July 3 through July 27, 2023.

The Elementary K-5 Reading & Math Intervention classes for 103 Tier III students were held at DePaolo Middle School with eight teachers. The Elementary Enrichment classes had 27 families participating. The middle school Grades 6-8 Reading & Math Intervention and Course Recovery for 19 students was held at Kennedy Middle School with four teachers. Mr. Hinman discussed the focus at length on Tier III students who needed intervention. The High School Academy for Grades 9-12 was held in collaboration and partnership with the Karen Smith Academy (KSA) 11 students for a total of 85 students enrolled in Credit Recovery with an 88% success rate. Mr. Hinman noted that the l1% failure rate was due to attendance. He addressed the courses offered with 11 teachers and other staff.

In planning for the 2024 Summer School Academy, Mr. Hinman plans to address the enrollment timeline and get the information out for Enrichment & Remediation Programs before the other Summer Camps do. He addressed at length the ESSER (Elementary & Secondary School Emergency Relief) funds from the pandemic that had ended, tuition costs, support for families in need, teacher compensation, structural redesign, digital payment platform with MyPaymentPlus, adding more enrichment classes, and staff time and attendance.

Mr. Carson questioned the ESSER pandemic stipends being removed for Summer School Academy teachers, recruiting teachers, contractual rates, tuition-based costs prior to COVID and staffing. Mr. Pepe explained that the original rate was back to the contractual rate, which was lower post-pandemic, and that an agreement was entered into last year at a mid-point between the pandemic (higher rate) and the contractual rates (lower) in order to attract quality teachers. Discussed were stipends for 2024 Summer School teachers and cost factors. Mr. Madancy stated that this would need continued review and discussion.

Mr. Carson also questioned the focus on Tier II and Tier III students, more insight on increasing elementary enrichment programs. Mr. Hinman explained in detail the intervention focus and his plans for improving the offering of Enrichment courses such as sending an email to staff who were interested in offering an enrichment program and the timing component. He explained that he was late in addressing the Enrichment programs for the 2023 Summer School. Mr. Williams questioned what the pre-COVID tuition rates were, which Mr. Hinman believed was over $200 per course but needed to confirm that. Mr. Baczewski questioned tuition costs and the difference between Tier II and Tier III (more intense intervention) students and offering to other students who could benefit from summer school programs, which was done in 2022, not 2023. Mr. Madancy, in his budget process, will address Summer School Academy tuitions for 2024.

11. PUBLIC COMMUNICATIONS

There was no public communication.

12. ADJOURNMENT

MOTION: by Mr. Derynoski, seconded by Mr. Oshana:

"Move to adjourn."

Motion carried unanimously by voice vote.

The meeting adjourned at 8:05 p.m.

Respectfully submitted,
Linda Blanchard
Recording Secretary

Board of Education

Administrative Report

October 12, 2023

1. Redistricting-PTO Meetings
2. K starting age update
3. UELP program development
4. Science of Reading Update
5. DW Facilities Committee

Southington Public Schools

Steven G. Madancy
Superintendent of Schools

Frank M. Pepe
Assistant Superintendent of Schools

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Board of Education
Southington, Connecticut
Curriculum & Instruction Committee Meeting
Friday, September 22, 2023 – 9:30 a.m.
Technology Training Lab (Public Assembly Room)

Members Present: Committee Chair - Dawn Anastasio, Terri Carmody
Absent: Jasper Williams

Administration Present: Assistant Superintendent - Frank Pepe, Director of Teaching & Learning for Secondary Education - Amy Zappone
School Staff Present: Lisa Daigle, Southington High School Chemistry Teacher

Meeting was called to order at 9:30 a.m. by Committee Chair Dawn Anastasio.

Lisa Daigle, on behalf of Zachary Ouellette, presented revisions to the **SHS – Accelerated Physics** course. Unit #3 – Momentum & Impulse which focuses on properties of matter and collisions. Unit #4 – Work & Energy allows students to discover various forms of energy and energy transformation. Unit #5 – Simple Harmonic Motion explores its namesake as a new type of motion to most. And finally, Unit #6 – Electrostatics and Circuits explores forces between charges, moving charges, and application of current and resistance.

Lisa Daigle continued with three updated units within **SHS – Accelerated General Chemistry** course. The first, Unit #3 – Matter & Energy Changes, focuses on classifying and balancing chemical equations and predicting products with known reactants. The second unit reviewed was Unit #4 – Gas Law & Kinetics. In this unit students focus on Kinetic Molecular Theory and Gas Laws. The third and final unit presented was Unit #5 – Flint Water Crisis in which students focus on components of a solution, solubility curves, molarity, and molarity calculations.

Jennifer Discenza, Head of Counseling, presented a Middle School Needs Assessment. This assessment will inform support staff in each middle school of potential topics for group discussions throughout the year. Student participation in groups is only permitted with parent permission. Committee members unanimously agreed to forward the above items to the full Board for review.

Meeting was adjourned at 10:05 a.m.

Respectfully Submitted,

Frank Pepe

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only______________________ Board Meeting Date___October 2023________________

Decision Requested_______X_____________ Agenda Code___8 a________________________________

AGENDA REPORTING FORM

Agenda Topic: Personnel Report

Summary of Issue: This Personnel Report includes appointments, resignations, retirements, and transfers for certified and classified personnel for the 2023-2024 school year. This report includes activity for the month of September 2023.

Background: The human resource department provides the Board of Education with a monthly update of personnel additions/reductions/changes.

Alternative Strategies:________________________________

Cost (if applicable): N/A **Funding Source:** Board of Education

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: Recommend that the Board of Education approve the Personnel Report as submitted by the human resource department.

Michelle Passamano
Signature of Staff Member Submitting Report

Steven Madancy
Signature of Superintendent

Included:
Personnel Report

Personnel Report
September 2023

APPOINTMENTS

	NAME	POSITION	SCHOOL	FTE	EFFECTIVE	DEGREE	SALARY
CLASS	Adkins, Matthew	Paraeducator, FT, TLC	SHS	1.0	10-17-2023	N/A	$19.59
CERT	Blackwood, Bethany	Biology Teacher	SHS	1.0	10-31-2023	6th	$100,986
CERT	Brady, Erika	Special Education Teacher	JAD	1.0	10-10-2023	MA	$89,000
CLASS	Buzzell, Adam	Evening Custodian, PT	SHS	0.49	10-10-2023	N/A	$16.38
CERT	Calvo, Jennifer	School Psychologist	SEES	1.0	10-16-2023	6th + 30	$101,600
CLASS	Cross, Aneesa	Paraeducator, FT	KES	1.0	10-11-2023	N/A	$18.36
CLASS	Cruz, David	Evening Custodian, PT	SHS	0.49	10-16-2023	N/A	$16.38
CLASS	Grabowski, Keith	Security Attendant, PT	SHS	0.47	10-2-2023	N/A	$20.44
CLASS	Lindstrom, Ben	Evening Custodian, PT	SHS	0.49	10-16-2023	N/A	$16.38
CLASS	Santee, Ashley	ABA Therapist, FT, SLC	HES	1.0	10-16-2023	N/A	$19.59
CLASS	St. John, Teresa	Paraeducator, Pre-K, PT	SES	0.38	10-10-2023	N/A	$18.36

RESIGNATIONS/RETIREMENTS

	NAME	POSITION	SCHOOL	EFFECTIVE	YRS	RET/RES
CLASS	Cannatelli, Anthony	Custodian, PT	MC	10-2-2023	2	RESIGN
CLASS	Cordova, RaeAnne	Paraeducator, FT	JAD	10-2-2023	2 mo.	RESIGN
CLASS	Griffin, Carla	Paraeducator, FT, SLC	HES	9-18-2023	10	RESIGN
CLASS	James, Cameron	Custodian, PT	SHS	9-22-2023	8 mo.	RESIGN
CLASS	Kwolek, Ryan	Custodian, PT	FES	10-9-2023	10	RESIGN
CLASS	Melnyk, Mary	Registered Nurse, FT	JAD	9-21-2023	1.5	RESIGN
CLASS	Meneo, Anthony	Paraeducator, FT, TLC	HES	10-7-2023	4	RESIGN
CLASS	Nattrass, Jeffrey	Security Attendant, PT	SHS	9-29-2023	3.5	RESIGN
CERT	Ottochian, Scott	Health & Physical Ed. Teacher	SHS	6-30-2024	30	RETIRE
CLASS	Oquendo, Luz	EL Tutor, FT	DES/OES	9-18-2023	1 mo.	RESIGN
CLASS	Stark, Melissa	ABA Therapist, FT, SLC	HES	9-18-2023	2	RESIGN
CLASS	Schmutz, Silvia	Custodian, PT	SHS	9-11-2023	1	RESIGN
CLASS	Tresselt, Stephanie	Paraeducator, FT	SHS	10-19-2023	1	RESIGN
CLASS	Turek, Caroline	Paraeducator, FT	DES	7-1-2024	27	RETIRE
CERT	Verderame, Janice	Principal	DES	8-31-2024	35	RETIRE
CERT	Walsh, Jeanne	Special Education Teacher	DES	7-1-2024	31	RETIRE

ASSIGNMENT CHANGE

	FROM (PREVIOUS ASSIGN)		TO (NEW ASSIGN)		
NAME	POSITION/SCHOOL	FTE	POSITION/SCHOOL	FTE	EFFECTIVE
Berk-Pocock, Stephanie	Paraeducator, KES	1.0	Paraeducator, HES	1.0	9-18-2023

TRANSFERS

	FROM (PREVIOUS ASSIGN)		TO (NEW ASSIGN)		
CERT NAME	POSITION/SCHOOL	FTE	POSITION/SCHOOL	FTE	EFFECTIVE
None to report					

Personnel Report
September 2023

STIPENDS

COACHING

Resignations/Non-Renewals

Sporbert, Marilyn	Assistant Gymnastics Coach	SHS	RESIGN

Appointments

Blitz, Deborah	Asst. Cross Country Coach	JFK	STIPEND
Dietz, Jack	Girls' Volleyball Coach	JAD	STIPEND
Kavanaugh, Megan	Asst. Girls' Soccer Coach	SHS	STIPEND

OTHER

Resignations/Non-Renewals

Samarotto, Tammy	Yearbook Advisor	JAD	RESIGN

Appointments

Bartoletti, Vincent	World Language Honor Society Advisor	SHS	STIPEND
Cody, Pamela	Unified Sports Site Coordinator	JAD	STIPEND
Garfinkel, David	Key Club Advisor	SHS	STIPEND
McAloon, Jill	Special Education Dept. Leader	SHS	STIPEND
Miller, David	Unified Sports Site Coordinator	JAD	STIPEND
Miller, Khandis	Unified Sports Site Coordinator	JFK	STIPEND
Phelps, Jessica	Emblem Advisor	SHS	STIPEND
Reardon, Brian	Special Education Asst. Dept. Leader	SHS	STIPEND
Yanosy, Alexis	Junior Class Advisor	SHS	STIPEND

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only ____________ Board Meeting Date October 12, 2023

Decision Requested X Agenda Code 9 b.

AGENDA REPORTING FORM

Agenda Topic: ConEd Battery Storage Project

Summary of Issue: The Town of Southington is considering entering into an agreement with RWE to lease property at Joseph A. DePaolo and John F. Kennedy Middle Schools for a battery storage system.

Background: N/A

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: TBD

Ending Date of Program or Project: TBD

Recommendation or Comment: Move that the Board of Education approve moving forward with the concept of the RWE property lease for the battery storage system at Joseph A DePaolo and John F. Kennedy Middle Schools to be considered by the Town Council.

Steve Madancy

Signature of Superintendent of Schools

Southington Public Schools Multilingual Department 2023-2024

Department Staff- Non-certified

- 5 Full Time/1 Part Time ML(Multilingual) Tutors - Paraprofessional contract
- **Primary Responsibilities:**
- Push into classes to support students with limited language skills
- Help teachers to modify work
- Pull students to work on language skills
- Assist department by filing, screening and testing to meet state deadlines

TESOL Certified Staff

3 Certified Staff Members: Diana Hunter, Beth Hosmer, Patricia Pettit

ML Staff Assignments

- **Primary Responsibilities:**
  - Oversee the ML tutors and support with planning and management
  - Provide language instruction to students with limited English language skills
  - Attend PPTs and academic planning meetings in assigned schools
  - Support teachers in classrooms with modifying and planning for students to ensure their success in the classroom

Numbers of MLs in District

- 2019-2021: 125-145 MLs in district
- 2022-2023: 190 in district by June
- 2023-2024: 216 in the district

* Many students are at a level 1-2 English proficiency. The need for support is high!

State Requirements

- All MLs must be identified in PSIS by October 1st (screening K-12)
- Notification of Service - August/September
- Dually Identified Students - accommodations for SBA, NGSS, CT School Day, CAAELP (CT Alternative Assessment for English Language Proficiency)
- LAS Links Administration - January 2nd-March 1st
- Filing LAS Links Results/share with staff and students
- Home Proficiency Reports shared with parents (May/June)

Translation Support

- Language Line - Language Line: Directions and Uses
- SPS Staff Interpretation Volunteers:

  SPS Staff Interpretation Volunteers

- CREC- Contact Lynn Oliveira for the form
- PPTs, special planning meetings

Family Support

- **Meetings with Families:**
- Use Language Line to set up a time that works best for the necessary staff member. Be sure to communicate with your TESOL staff member so they can be present.
- **Parent Square-** Ensure family knows how to change the language. Contact Simone for more information.

More Information

- State Page for ELs - EL Page
- EL Guidelines for Administrators
- CELP Standards

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only ____________ Board Meeting Date October 12, 2023

Decision Requested X Agenda Code 10 b.

AGENDA REPORTING FORM

Agenda Topic: STEAP Matching Funds

Summary of Issue: The Board of Education is looking to approve the reallocation of funds from the Operating Budget or existing Non-lapsing funds to Matching Funds as identified in the recently submitted STEAP Grant.

Background: N/A

Alternative Strategies: N/A

Cost (if applicable): 206,000 **Funding Source:** Operating Budget

Beginning Date of Program or Project: TBD

Ending Date of Program or Project: TBD

Recommendation or Comment: Move that the Board of Education approve the reallocation of $206,000 from the Operating Budget or existing Non-lapsing funds to Matching Funds as identified in the recently submitted STEAP Grant as recommended by the administration.

Steve Madancy

Signature of Superintendent of Schools

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested ______ **Agenda Code** 10 c.

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated Physics – Unit #3 – Momentum & Impulse – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated Physics – Unit #3 – Momentum & Impulse.

Background: ______

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated Physics – Unit #3 – Momentum & Impulse to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

UNIT 3: Momentum
Unit Documents: Unit Notes ; Unit Launch ; Summary Table ; TIPERs & Engagement Points ; Quiz 1; Summative

Unit Overview	
Unit Title:	Unit 3: Momentum & Impulse
Teacher:	Ouellette
Grade Level/Course:	11-12 (Accelerated Physics)
Length/Dates:	~ 14 (88 minute) instructional periods
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	Students discover properties of matter in motion, which defines momentum. An emphasis is placed on collisions. Students investigate the momentum of massive objects in motion or at rest before and after a collision. Students first encounter the idea of conservation, which plays an important role throughout other units of study. Students build a device to protect a fragile payload.

Standard Bundles

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. [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]** • **HS-PS2-3 Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]**

SEP Implications	DCI Implications	CCC Implications
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems 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. (HS-PS2-5) **Constructing Explanations and Designing Solutions** 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. • Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3)	**PS2.A: Forces and Motion** • Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (HS-PS2-2) • If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3) **ETS1.A: Defining and Delimiting an Engineering Problem** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. *(secondary to HS-PS2-3)* **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS2-3)*	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) • Systems can be designed to cause a desired effect. (HS-PS2-3) **Systems and System Models** • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

Transfer Goals (Vision of the Graduate) List the long-term and/or school-wide independent student behaviors that this unit will address.
Transdisciplinary Goal: **Critical Thinking Transdisciplinary Goal:** Students inquire, identify, and ethically solve real-world problems through reasoning and a reflection on the challenges and benefits of the process and/or solution(s). **Creativity/Innovation Transdisciplinary Goal:** Students work creatively to design and refine implementation of ideas by taking risks, persevering, and exploring possibilities.

Explore Anchoring Phenomenon: Bennu and the DART Mission
Attempt to Make Sense: Impulse and Momentum Investigation ; Conservation of Momentum Investigation
Identify Related Phenomena: Egg Drop, Seatbelts, Airbags and Crumple Zone Readings and Investigation
Develop Potential Student Questions/Observations:

- What options do we have in stopping an asteroid?
- Can we watch those movies?
- Is NASA doing it?
- We should blow it up.
- We need to deflect/change the motion of the asteroid.
- We should apply a force and cause acceleration

Preconceptions:

- Students have little intuition for the idea of an impulse
- Momentum is often thought of as being synonymous with inertia
- Difficulty distinguishing between p and Δp
- Thinking of "before" and "after" an interaction
- Impulse causes momentum
- Signs of p and J. Students see momentum as an inherently positive quantity similar to mass and speed.

Sample Student Explanation:

We should blow Bennu up into a bunch of little pieces or hit it really hard to knock it off course.

Momentum Bundle				
Day(s)	**Target Question(s)**	**Lesson-level phenomenon**	**Activities & Assessments**	**What Students Will Learn/Expected Outcome (Knowledge and Skills)**
1	How can humanity protect itself from an asteroid?	Anchoring Phenomenon Launch	• Unit 4 Phenomenon Launch	**DCI:** HS-PS2-2 **SEP: Asking questions and defining problems.** • I can ask questions that arise from careful observation of phenomenon, or unexpected results, to clarify and/or seek additional information. • I can evaluate a question to determine if it is testable and relevant. **CCC: Systems and System Models** • I can investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs • I can use models (e.g., physical, mathematical, computer models) to simulate the flow of energy, matter, and interactions within and between systems at different scales. **Learning Targets:** • I can identify and describe the momentum of each object in the system as the product of its mass and its velocity, p = mv, using the mathematical representations. **Connection to Anchoring Phenomenon:** N/A **What's next?** Students are familiar with forces and motion at this point. How can we apply previous learning to the anchoring phenomenon?
2 - 8	How can force change the motion of an object via a collision?	Impulse-Momentum Theorem	• Impulse and Momentum Investigation • Summary Table • Notes/Examples • Impulse and Momentum Problem Set	**DCI:** HS-PS2-2 **SEP: Planning and Carrying Out Investigations** • I can 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) • I can select appropriate tools to collect, record, analyze, and

				evaluate data. • I can make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated. **CCC: Cause and Effect** • I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. **Learning Targets:** • I can identify and describe the momentum of each object in the system as the product of its mass and its velocity, p = mv, using the mathematical representations. • I can use mathematical representations to support the claim that the total momentum of a system is changed when an external force acts on the system **Connection to Anchoring Phenomenon:** A net force acting on an object for some amount of time can change that object's momentum. If we want to change the momentum (motion) of an asteroid, we need to provide an impulse. We can hit it very hard very quickly or hit it with a smaller force over a longer period of time. This corresponds to some of the various ways we can deal with an asteroid, like a kinetic impact or a solar sail. **What's next?** External net forces cause changes in momentum. What happens when no net force acts on a system?
9 - 12	What happens when no external forces act on a system with momentum?	Conservation of Linear Momentum	• Conservation of Momentum Investigation • Momentum Conservation Problem Set • Bennu Anchoring Phenomenon Problem • Impulse and Conservation of Momentum Quiz	**DCI: HS-PS2-2** **SEP: Using Mathematics and Computational Thinking** • I can use mathematical representations of phenomena to describe explanations **CCC: Systems and System Models** • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. **Learning Targets:** • I can analyze the total momentum of a system and support the claim that the initial momentum of a system is equal to the

				final momentum of a system if that system experiences no external net force. **Connection to Anchoring Phenomenon:** Bennu's momentum will remain constant (conserved) if there is no external impulse. A collision with Earth would be a perfectly inelastic collision, and momentum would be conserved as long as no external impulses are applied. Momentum is also conserved in the explosion (nuclear) option. We also carry out a problem around Bennu with a kinetic impact approach and decide if we've done enough to knock Bennu off course. **What's next?** How can we use our understanding of impulse and momentum to design safety features for cars?
13 - 15	How can we make cars/driving safer by understanding momentum?	Car/Driver Safety	• Seatbelts, Airbags and Crumple Zone Readings and Investigation • Blueprint Discussion • Egg Drop Performance Task	**DCI:** **HS-PS2-3** **SEP:** **Constructing Explanations and Defining Solutions** • I can apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. **CCC:** **Cause and Effect** • Systems can be designed to cause a desired effect. **Connection to Anchoring Phenomenon:** Seatbelts and crumple zones are engineered to help passengers undergo a safer change in momentum by increasing the time of collision and thus decreasing the amount of force acting on the passenger. Seatbelts act as an external force, which allows a person to not continue to move with their initial momentum. **Learning Targets:** • I can conduct a literature review of common safety devices and evaluate their effectiveness • I can incorporate physics principles into my design process. **What's next?** Now that we understand why seatbelts, airbags, and crumple zones are important, can we engineer a device to protect a payload using material restraints?

16 - 24	How can we engineer devices to protect a payload?	Egg Drop	Egg Drop Performance Task	DCI: HS-PS2-3 **SEP: Constructing Explanations and Defining Solutions** ● I can apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. **CCC: Cause and Effect** ● Systems can be designed to cause a desired effect. **Learning Targets:** ● I can conduct a literature review of common safety devices and evaluate their effectiveness. ● I can describe the scientific rationale for choice of materials and for the structure of my device. ● I can design a device that minimizes the forces acting on an object during a collision **Connection to Anchoring Phenomenon:** Seatbelts and crumple zones are engineered to help passengers undergo a safer change in momentum by increasing the time of collision and thus decreasing the amount of force acting on the passenger. Seatbelts act as an external force, which allows a person to not continue to move with their initial momentum. **What's next?** Unit review and assessment
25 - 27			Momentum Problem Set Momentum Exam	

Evaluative Criteria
Performance Statements (PS2-2, PS2-3)

Observable features of the student performance by the end of the course:		
1	Representation	
	a	Students clearly define the system of the two interacting objects that is represented mathematically, including boundaries and initial conditions.
	b	Students identify and describe* the momentum of each object in the system as the product of its mass and its velocity, p = mv (p and v are restricted to one-dimensional vectors), using the mathematical representations.
	c	Students identify the claim, indicating that the total momentum of a system of two interacting objects is constant if there is no net force on the system.
2	Mathematical modeling	
	a	Students use the mathematical representations to model and describe* the physical interaction of the two objects in terms of the change in the momentum of each object as a result of the interaction.
	b	Students use the mathematical representations to model and describe* the total momentum of the system by calculating the vector sum of momenta of the two objects in the system.
3	Analysis	
	a	Students use the analysis of the motion of the objects before the interaction to identify a system with essentially no net force on it.
	b	Based on the analysis of the total momentum of the system, students support the claim that the momentum of the system is the same before and after the interaction between the objects in the system, so that momentum of the system is constant.
	c	Students identify that the analysis of the momentum of each object in the system indicates that any change in momentum of one object is balanced by a change in the momentum of the other object, so that the total momentum is constant.

Observable features of the student performance by the end of the course:		
1	Using scientific knowledge to generate the design solution	
	a	Students design a device that minimizes the force on a macroscopic object during a collision. In the design, students:
		i. Incorporate the concept that for a given change in momentum, force in the direction of the change in momentum is decreased by increasing the time interval of the collision ($F\Delta t = m\Delta v$); and
		ii. Explicitly make use of the principle above so that the device has the desired effect of reducing the net force applied to the object by extending the time the force is applied to the object during the collision.
	b	In the design plan, students describe* the scientific rationale for their choice of materials and for the structure of the device.
2	Describing criteria and constraints, including quantification when appropriate	

Accelerated Physics:

Unit 3: Momentum and Impulse Unit

Unit Overview

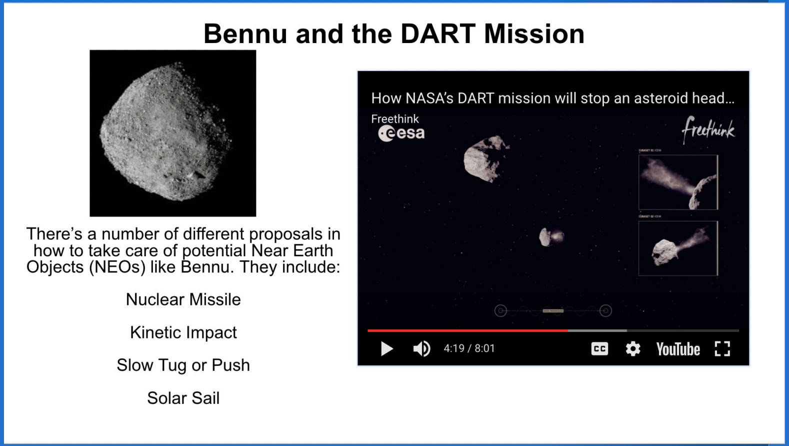
- Students discover properties of matter in motion, which defines momentum. An emphasis is placed on collisions.
- Students investigate the momentum of massive objects in motion or at rest before and after a collision.
- Students first encounter the idea of conservation, which plays an important role throughout other units of study.
- Students build a device to protect a fragile payload.

Performance Expectations

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. [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]   • HS-PS2-3 Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.* [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]

Anchoring Phenomenon

Bennu and the DART Mission



Culminating Performance Task

POTENTIAL BKAPP IDEA - CREATIVITY

Your Task:
Design the most cost-effective device that can protect an object (perhaps an egg) as it drops in freefall to the ground. You will submit a google slide that provides evidence of the materials in the scoring rubric.

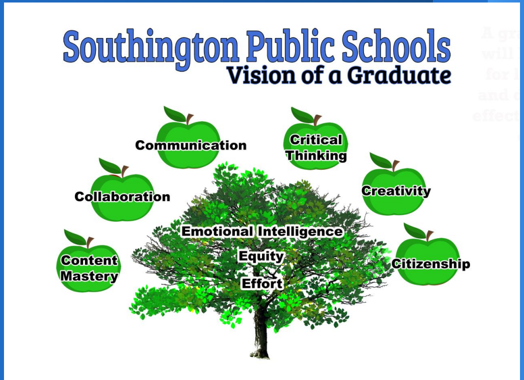
Design Progression:

1. **Blueprint:** You will create a blueprint that shows your proto-type design, including all of the specifications that go into a blueprint (labeling, measurements, multiple profiles, etc.)

2. **Explaining the physics:** You will then describe how your design takes into account the physics principles we've explored throughout our momentum unit. Your explanation must include the following words/phrases:
    a. Impulse
    b. Change in momentum
    c. Force
    d. Time interval
    e. Initial and final velocity
    f. Mass
    g. Inelastic or Elastic Collision

The explanation must also refer and connect back to investigations and readings we've done throughout the unit. For example, if you go into the physics of a crumple one, where did you learn about that? Reference and cite it.

3. **Build and cost analysis:** You will now build your design using the allowed materials. Each material costs a certain amount of money. Once your build is finalized, calculate the total cost of your design.



BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested ______ **Agenda Code** 10 d.

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated Physics – Unit #4 – Work & Energy – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated Physics – Unit #4 – Work & Energy.

Background: ______

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated Physics – Unit #4 – Work & Energy to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

UNIT 4: Energy
Unit Documents: Unit Notes ; Summary Table ; TIPERs & Engagement Points ; Quiz 1 ; Summative

Unit Overview	
Unit Title:	Unit 4: Work & Energy
Teacher:	Ouellette
Grade Level/Course:	11-12 (Accelerated Physics)
Length/Dates:	~ 17 (88 min) instructional periods
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	Students discover various forms of energy and its transformations throughout a physical process. An emphasis is placed on energy systems and the transformation of energy into, out of, or within a system. Students investigate Students build on their understanding of conservation, this time with conservation of energy. Students use energy diagrams to help structure conservation of energy equations.

Standard Bundles

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. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]** • **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 motion of particles (objects) and energy associated with the relative positions of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]**

SEP Implications	DCI Implications	CCC Implications
Using Mathematics and Computational Thinking Mathematical and computational thinking at the 9–12 level builds on K–8 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 a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **Developing and Using Models** Modeling in 9–12 builds on K–8 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 use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2)	**PS3.A: Definitions of Energy** • Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) • At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) • These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves	**Systems and System Models** • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1) **Energy and Matter** • Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2)

	across space. (HS-PS3-2) **PS3.B: Conservation of Energy and Energy Transfer** • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1) • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) • The availability of energy limits what can occur in any system. (HS-PS3-1)	

Transfer Goals (Vision of the Graduate) List the long-term and/or school-wide independent student behaviors that this unit will address.
Collaboration Transdisciplinary Goal: Students flexibly and cooperatively work with others in physical and virtual environments and assume shared responsibility for completing a project or achieving a goal.

Explore Anchoring Phenomenon: Truck Pull ; 007 Bungee Jump
Attempt to Make Sense: Work Investigation ; Energy is Pain Notes ; Work-Kinetic Energy Investigation ;
Identify Related Phenomena: Energy Stations, Popper Toy
Develop Potential Student Questions/Observations:

- How hard are they pulling the truck?
- How fast do the trucks move?
- Are the trucks moving at a constant speed?
- How tall is the bungee dam?
- How fast are they moving before the bungee cord breaks their fall?

Preconceptions:

- Energy is not well defined
- Understanding energy can either be transferred to or from the system or transformed within the system
- Understanding that potential energy is an interaction between two objects
- Internal energy transfers

Sample Student Explanation:

The truck puller has to pull very hard to get the truck to move. The truck has kinetic energy. The bungee cord stretches to slow the jumper down.

Energy Unit Bundle

Day(s)	Target Question(s)	Lesson-level phenomenon	Activities & Assessments	What Students Will Learn/Expected Outcome (Knowledge and Skills)
1 - 4	How does an external force change the motion of a system?	Work	• Work Investigation • Anchoring Phenomenon Launch (in "Notes", students generate observations and questions) • Practicing Work is Hard Work • Work and Motion Investigation • Summary Table • Notes	DCI: HS-PS3-1 **SEP: Using Mathematics and Computational Thinking** • I can create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **CCC: Systems and System Models** • I can define the boundaries and initial conditions of a system. (HS-PS3-1) **Learning Targets:** • I can determine the work done on an object by an external force via an investigation • I can describe how the work done on a system affects the motion of a system. **Connection to Anchoring Phenomenon:** Truck pullers do work on the trucks. This causes the fire trucks to move. When positive work is done on systems, systems speed up. When negative work is done on systems, systems slow down. **What's next?** What exactly is energy?
5 - 7	What is energy?	Various everyday examples to explore different types of energy	• Energy is Pain Notes • Name That Energy • Follow-Up Form • Everything You Need to Know about Energy Reading • Energy Types Problem Set • Summary Table • Notes	DCI: HS-PS3-2 **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can describe the characteristics of kinetic, gravitational potential, spring potential, and chemical potential energies

				Connection to Anchoring Phenomenon: The trucks have kinetic energy when they are in motion. The truck pullers have chemical potential energy from the food they ate previously. Truck pullers also have kinetic energy as they move. **What's next?** How is energy related to work?
8 - 12	How is work related to energy?	Work-Kinetic Energy Theorem	• Work-Kinetic Energy Investigation • Work-Kinetic Energy TIPERs • Summary Table • Notes	**DCI: HS-PS3-2** **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can relate the work done on a system to that system's change in kinetic energy **Connection to Anchoring Phenomenon:** The truck pullers do positive external work on the firetruck system and thus the firetrucks gain kinetic energy (from rest). Chemical potential energy stored in the truck puller is transferred into the firetruck system in the form of kinetic energy. **What's next?** What happens to a system's energy when no external work is done on the system?
13 - 16	How can we visualize energy transfers within systems? Why can't energy be created nor	Energy Stations	• Initial LOL Diagram Practice • Energy Stations and LOL Diagrams • Energy Station Graphic Organizer • LOL Diagrams and	**DCI: HS-PS3-2** **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2)

	destroyed?		[Conservation of Energy Equations](#) • Summary Table • Notes • [Quiz 1](#)	**CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can diagram the conservation of mechanical energy • I can create mathematical expressions that show energy transfer within an open or closed energy system **Connection to Anchoring Phenomenon:** The energy of the fire truck-truck puller-road system is a closed system where energy is constant. **What's next?** The truck pull event is also about beating everyone to the finish line. What does it mean to change the energy of the trucks the smallest amount of time?
16 - 18	What does it mean to be powerful?	Power of different parts of body	• [Power Investigation](#) • Summary Table • Notes	**DCI: [HS-PS3-2](#)** **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can determine how powerful I am via an investigation. **Connection to Anchoring Phenomenon:** The truck puller who wins the competition is the most powerful in terms of physics because power is the rate at which work (or change in energy) is done on a system. **What's next?** How many things can we find out about the truck pull phenomenon?
19 - 20	How can a person	Truck pull	• [Energy Goalless](#)	**DCI: [HS-PS3-2](#)**

	move massive objects?		Problem • Gallery Walk	**SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can use multiple representations to demonstrate my thinking **Connection to Anchoring Phenomenon:** Students solve as many physics problems tied to the anchoring phenomenon as they can. **What's next?** Now that we understand energy, what does this mean for collision types in momentum?
21-22	How is energy related to momentum and collisions?	Collision types and kinetic energy	• Revisiting Momentum with Energy • Summary Table • Notes	**DCI: HS-PS3-2** **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) **Learning Targets:** • I can use kinetic energy to differentiate collision types **Connection to Anchoring Phenomenon:** N/A **What's next?** What is spring potential energy all about?

23 - 26	Why do bungee cords allow us to fall great distances safely?	Hooke's Law 007 Bungee Jump	• Spring Force Investigation • Summary Table • Notes	**DCI:** HS-PS3-1 **SEP: Using Mathematics and Computational Thinking** • I can create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **CCC: Systems and System Models** • I can define the boundaries and initial conditions of a system. (HS-PS3-1) **Learning Targets:** • I can plan and carry out an investigation to determine relationships between variables **Connection to Anchoring Phenomenon:** 007's initial gravitational potential energy is transferred into kinetic energy as they fall. As the bungee cord stretches, some energy is stored in the cord in the form of spring potential energy. This slows down 007 to a safe landing speed. **What's next?** How can we use the principles of conservation of energy to determine unknown properties of a system?
27 - 29	How can we use energy conservation to determine a spring constant?	Emoji popper toy	• Popper Performance Task	**DCI:** HS-PS3-1 **SEP: Using Mathematics and Computational Thinking** • I can create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **CCC: Systems and System Models** • I can define the boundaries and initial conditions of a system. (HS-PS3-1) **Learning Targets:** • I can use the conservation of energy to determine unknown properties of a system **Connection to Anchoring Phenomenon:** N/A **What's next?** Energy exam

30 - 34		Exam Review	• Energy Grudgeball • Energy Problem Set • Energy Exam	**DCI: HS-PS3-1** **SEP: Using Mathematics and Computational Thinking** • I can create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) **CCC: Systems and System Models** • I can define the boundaries and initial conditions of a system. (HS-PS3-1) **DCI: HS-PS3-2** **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2) **CCC: Energy and Matter** • I can describe why energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2)

Evaluative Criteria
Performance Statements (PS3-1, PS3-2)

Observable features of the student performance by the end of the course:			
1	Representation		
	a	Students identify and describe* the components to be computationally modeled, including:	
		i.	The boundaries of the system and that the reference level for potential energy = 0 (the potential energy of the initial or final state does not have to be zero);
		ii.	The initial energies of the system's components (e.g., energy in fields, thermal energy, kinetic energy, energy stored in springs — all expressed as a total amount of Joules in each component), including a quantification in an algebraic description to calculate the total initial energy of the system;
		iii.	The energy flows in or out of the system, including a quantification in an algebraic description with flow into the system defined as positive; and
		iv.	The final energies of the system components, including a quantification in an algebraic description to calculate the total final energy of the system.
2	Computational Modeling		
	a	Students use the algebraic descriptions of the initial and final energy state of the system, along with the energy flows to create a computational model (e.g., simple computer program, spreadsheet, simulation software package application) that is based on the principle of the conservation of energy.	
	b	Students use the computational model to calculate changes in the energy of one component of the system when changes in the energy of the other components and the energy flows are known.	
3	Analysis		
	a	Students use the computational model to predict the maximum possible change in the energy of one component of the system for a given set of energy flows.	
	b	Students identify and describe* the limitations of the computational model, based on the assumptions that were made in creating the algebraic descriptions of energy changes and flows in the system.	

Observable features of the student performance by the end of the course:				
1	Components of the model			
	a	Students develop models in which they identify and describe* the relevant components, including:		
		i.	All the components of the system and the surroundings, as well as energy flows between the system and the surroundings;	
		ii.	Clearly depicting both a macroscopic and a molecular/atomic-level representation of the system; and	
		iii.	Depicting the forms in which energy is manifested at two different scales:	
			a)	Macroscopic , such as motion, sound, light, thermal energy, potential energy or energy in fields; and
			b)	Molecular/atomic, such as motions (kinetic energy) of particles (e.g., nuclei and electrons), the relative positions of particles in fields (potential energy), and energy in fields.
2	Relationships			
	a	Students describe* the relationships between components in their models, including:		
		i.	Changes in the relative position of objects in gravitational, magnetic or electrostatic fields can affect the energy of the fields (e.g., charged objects moving away from each other change the field energy).	
		ii.	Thermal energy includes both the kinetic and potential energy of particle vibrations in solids or molecules and the kinetic energy of freely moving particles (e.g., inert gas atoms, molecules) in liquids and gases.	
		iii.	The total energy of the system and surroundings is conserved at a macroscopic and molecular/atomic level.	
		iv.	Chemical energy can be considered in terms of systems of nuclei and electrons in electrostatic fields (bonds).	
		v.	As one form of energy increases, others must decrease by the same amount as energy is transferred among and between objects and fields.	
3	Connections			
	a	Students use their models to show that in closed systems the energy is conserved on both the macroscopic and molecular/atomic scales so that as one form of energy changes, the total system energy remains constant, as evidenced by the other forms of energy changing by the same amount or changes only by the amount of energy that is transferred into or out of the system.		
	b	Students use their 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 on both the macroscopic and microscopic scales.		

Accelerated Physics:

Unit 4: Work and Energy Unit

Unit Overview

- Students discover various forms of energy and its transformations throughout a physical process. An emphasis is placed on energy systems and the transformation of energy into, out of, or within a system.
- Students build on their understanding of conservation, this time with conservation of energy.
- Students use energy diagrams to help structure conservation of energy equations.
- Students will also study how changes in energy can be made via work

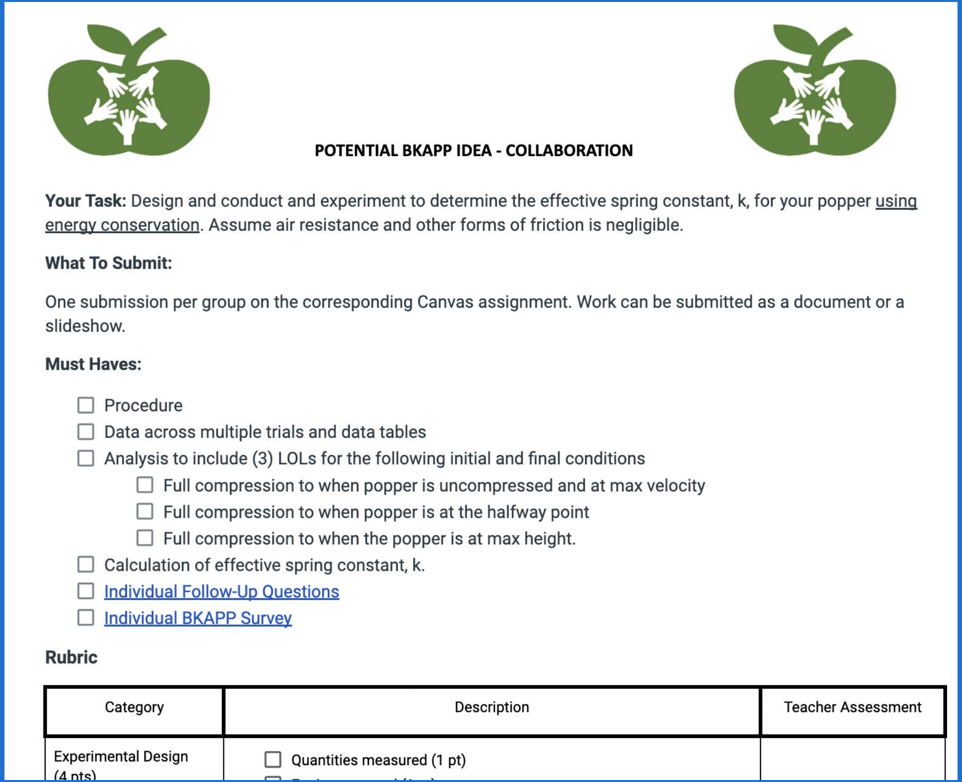
Performance Expectations

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. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.] • 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 motion of particles (objects) and energy associated with the relative positions of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]

Anchoring Phenomenon

Truck Pull & 007 Bungee Jump

Culminating Performance Task



POTENTIAL BKAPP IDEA - COLLABORATION

Your Task: Design and conduct and experiment to determine the effective spring constant, k, for your popper using energy conservation. Assume air resistance and other forms of friction is negligible.

What To Submit:

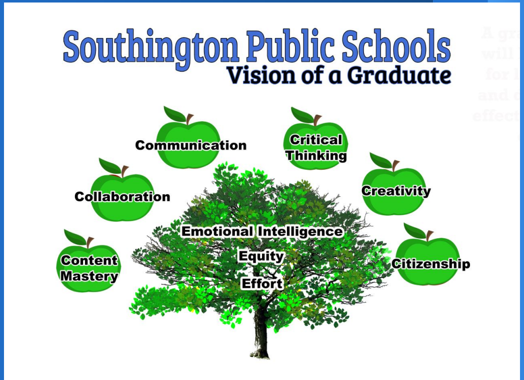
One submission per group on the corresponding Canvas assignment. Work can be submitted as a document or a slideshow.

Must Haves:

- ☐ Procedure
- ☐ Data across multiple trials and data tables
- ☐ Analysis to include (3) LOLs for the following initial and final conditions
    - ☐ Full compression to when popper is uncompressed and at max velocity
    - ☐ Full compression to when popper is at the halfway point
    - ☐ Full compression to when the popper is at max height.
- ☐ Calculation of effective spring constant, k.
- ☐ Individual Follow-Up Questions
- ☐ Individual BKAPP Survey

Rubric

Category	Description	Teacher Assessment
Experimental Design (4 pts)	☐ Quantities measured (1 pt)	



BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested ______ **Agenda Code** 10 e.

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated Physics – Unit #5 – Simple Harmonic Motion – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated Physics – Unit #5 – Simple Harmonic Motion.

Background: ______

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated Physics – Unit #5 – Simple Harmonic Motion to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Frank Pepe
Signature of Staff Member Submitting Report

Steven Madancy
Signature of Superintendent of Schools

UNIT 5: Simple Harmonic Motion (SHM)
Unit Documents: Unit Notes ; Summary Table ; TIPERs & Engagement Points ; Summative

Unit Overview	
Unit Title:	Unit 5: Simple Harmonic Motion (SHM)
Teacher:	Ouellette
Grade Level/Course:	11-12 (Accelerated Physics)
Length/Dates:	~ 10 (88 min) instructional periods
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	Students encounter a new type of motion, simple harmonic motion, which describes some repetitive motion seen in nature. Students apply the physics they have learned to this point to make sense of oscillating motion. Students explore the kinematics, forces, momentum, and energy of two oscillating systems: the spring-mass system and a pendulum. SHM serves as a bridge between mechanics and wave motion.

Standard Bundles

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.** [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.] [Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.]

SEP Implications	DCI Implications	CCC Implications
Analyzing and Interpreting Data Analyzing data in 9-12 builds on K-8 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. **Using Mathematics and Computational Thinking** Mathematical and computational thinking at the 9–12 level builds on K–8 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 representations of phenomena to describe explanations.	**PS2.A: Forces and Motion** • Newton's Second Law accurately predicts changes in the motion of macroscopic objects.	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and makes claims about specific cause and effects • Systems can be designed to cause a desired effect.

Transfer Goals (Vision of the Graduate) List the long-term and/or school-wide independent student behaviors that this unit will address.
Transdisciplinary Goal: **Critical Thinking Transdisciplinary Goal:** Students inquire, identify, and ethically solve real-world problems through reasoning and a reflection on the challenges and benefits of the process and/or solution(s).

Explore Anchoring Phenomenon: Russian Car Bounce ; Mesmerizing Pendulums
Attempt to Make Sense: Spring-Mass System Investigation, Period of a Pendulum Investigation
Identify Related Phenomena: Dancing Pendulums
Develop Potential Student Questions/Observations:

- The car bounces up and down because something is pushing on it
- There is something wrong with the car
- The potholes are making it bounce
- The pool balls are start with the same amplitude
- The pool balls have different periods
- The string lengths are different
- The mass of each pool ball is probably the same

Preconceptions:

- A significant fraction of students don't really understand sines and cosines as oscillatory functions
- Many students don't know the term *sinusoidal function* and think it refers only to the specific function sin(x)
- Understanding that sine and cosine functions are the same oscillatory function with different phase constants
- Small angle approximation
- Some new terminology

Sample Student Explanation:
The car bounces because there's something wrong with it. This could be due to the springs (shock absorbers) not working properly. The car bounces even when it is on a flat surface.

The pendulums move the way they do because each pendulum is set up slightly differently.

SHM Unit Bundle				
Day(s)	**Target Question(s)**	**Lesson-level phenomenon**	**Activities & Assessments**	**What Students Will Learn/Expected Outcome (Knowledge and Skills)**
1	How can we model motion that repeats itself?	Russian Car Bounce	• SHM Unit Launch	**DCI:** **HS-PS2-1** **SEP: Asking Questions and Defining Problems** • I can ask questions that challenge the premise(s) of an argument, the interpretation of a physical phenomenon, or the suitability of a design. **CCC: Structure and Function** • I can investigate or design new systems or structures by detailed examination of the properties of that system **Learning Targets:** • I can ask questions that challenge the premise(s) of an argument, the interpretation of a physical phenomenon, or the suitability of a design. **Connection to Anchoring Phenomenon:** N/A **What's next?** How can we model the bouncing car?
2 - 7	How can we describe the physics of the spring-mass system?	Spring - Mass System	• Spring-Mass System Investigation • Follow-up Form • Energy of a Spring-Mass Investigation • Notes • Summary Table	**DCI:** **HS-PS2-1** **SEP: Planning and Carrying Out Investigations** • I can 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. **CCC: Cause and Effect** • I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and

				effects. **Learning Targets:** ● I can carry out an investigation of an oscillating system to determine its properties **Connection to Anchoring Phenomenon:** The car oscillates with a given period or frequency. The car can be modeled as a spring-mass system. Plotting the motion of this oscillation would look like a sine or cosine graph. The car experiences a maximum vertical velocity, momentum, and kinetic energy at the equilibrium point of the oscillation. The car experiences a maximum restoring force and acceleration at the amplitude of its motion. **What's next?** The repetitive motion of the car's bounce is related to the period. How can we find the period of a spring-mass system?
8 - 10	What factors affect the period of a spring-mass system?	Spring-mass system	● Period of a Spring-Mass System Investigation ● Notes ● Summary Table	**DCI: HS-PS2-1** **SEP: Planning and Carrying Out Investigations** ● I can 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. **CCC: Cause and Effect** ● I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. **Connection to Anchoring Phenomenon:** The car's period of oscillation and frequency of the bouncing depends on the mass of the object and the value of the spring constant **What's next?** What physics properties of our anchoring phenomenon could we solve for and describe?

11 - 12	How can we apply our physics knowledge to the bouncing car?	• Russian Bouncing Car	• SHM Goalless Problem	**DCI:** [HS-PS2-1] **SEP: Developing and Using Models** • I can develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. **CCC: Cause and Effect** • Systems can be designed to cause a desired effect. **Learning Targets:** • I can use multiple representations to analyze a system in simple harmonic motion **Connection to Anchoring Phenomenon:** Students explore the physics of the anchoring phenomenon. **What's next?** Are there other systems that can be considered to be in simple harmonic motion?
13 - 15	How can we apply our physics knowledge to a pendulum?	• Mesmerizing Pendulums	• [Period of a Pendulum Investigation] • [Pendulum Problem Set] • Notes • Summary Table	**DCI:** [HS-PS2-1] **SEP: Planning and Carrying Out Investigations** • I can 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. **CCC: Cause and Effect** • I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. **Learning Targets:** • I can carry out an investigation of an oscillating system to determine its properties **Connection to Anchoring Phenomenon:** The pendulums move the way they do by affecting the period of each

				pendulum. For a simple pendulum released from a small angle, the period only depends on the length of the pendulum and the local gravitational field strength. **What's next?** What are some applications of pendulums?
16	How can we determine Earth's gravitational field strength value using a pendulum?	• Pendulum in SHM	• Determining "g" with a Pendulum Performance Task	DCI: **HS-PS2-1** **SEP: Planning and Carrying Out Investigations** • I can 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. **CCC: Cause and Effect** • I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. **Learning Targets:** • I can carry out an investigation of an oscillating system to determine its properties **Connection to Anchoring Phenomenon:** A local value for gravitational field strength can be worked out if the length and period of a simple pendulum is known. **What's next?** What are some more applications of pendulums?
17 - 18	How can a pendulum keep a building upright in a storm? How can a pendulum be made to match the tempo of a song?	• Tuned Mass Dampers • "Lights" that match the beat of a song	• How a Skyscraper Stays Upright In a Typhoon Reading ○ Tuned Mass Damper • Dancing Pendulums	DCI: **HS-PS2-1** **SEP: Planning and Carrying Out Investigations** • I can 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. CCC: **Cause and Effect** • I can use empirical evidence to differentiate between cause and correlation and make claims about specific causes and effects. **Learning Targets:** • I can carry out an investigation of an oscillating system to determine its properties **Connection to Anchoring Phenomenon:** N/A **What's next?** Unit exam
19 - 20		Exam review	• SHM Grudgeball • SHM Exam	

Evaluative Criteria
Performance Statements (PS2-1)

Observable features of the student performance by the end of the course:			
1	Organizing data		
	a	Students organize data that represent the net force on a macroscopic object, its mass (which is held constant), and its acceleration (e.g., via tables, graphs, charts, vector drawings).	
2	Identifying relationships		
	a	Students use tools, technologies, and/or models to analyze the data and identify relationships within the datasets, including:	
		i.	A more massive object experiencing the same net force as a less massive object has a smaller acceleration, and a larger net force on a given object produces a correspondingly larger acceleration; and
		ii.	The result of gravitation is a constant acceleration on macroscopic objects as evidenced by the fact that the ratio of net force to mass remains constant.
3	Interpreting data		
	a	Students use the analyzed data as evidence to describe* that the relationship between the observed quantities is accurately modeled across the range of data by the formula $a = F_{net}/m$ (e.g., double force yields double acceleration, etc.).	
	b	Students use the data as empirical evidence to distinguish between causal and correlational relationships linking force, mass, and acceleration.	
	c	Students express the relationship $F_{net}=ma$ in terms of causality, namely that a net force on an object causes the object to accelerate.	

Accelerated Physics:

Unit 5: Simple Harmonic Motion Unit

Unit Overview

- Students encounter a new type of motion, simple harmonic motion, which describes some repetitive motion seen in nature.
- Students apply the physics they have learned to this point to make sense of oscillating motion.
- Students explore the kinematics, forces, momentum, and energy of two oscillating systems: the spring-mass system and a pendulum.
- SHM serves as a bridge between mechanics and wave motion.

Performance Expectations

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.** [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.] [Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.]

Anchoring Phenomenon

Russian Car Bounce & Mesmerizing Pendulums

Culminating Performance Task

POTENTIAL BKAPP IDEA - COMMUNICATION

Determining "g" with a Pendulum Performance Task

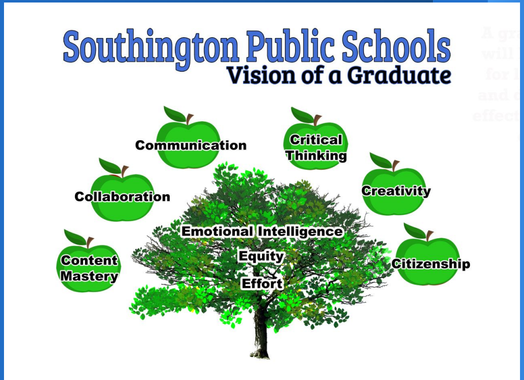
Your Task: Individually, Design a pendulum and experiment, collect data, and experimentally verify the gravitational field strength of Earth. Use anything around to act as the pendulum bob.

What to Submit:

- A procedure. Detailed enough so another student could follow your experiment. Include a detailed diagram which shows the dimensions of your pendulum. Include how you plan to address experimental error and uncertainty.
- Data table with relevant data, to include all titles and units. A friend may help you start and stop a timer, if needed.
- Use of your experimental data to calculate and verify Earth's gravitational field strength
- Percent Difference between your experimental value and the known value of Earth's gravitational field strength (g = 9.81 N/kg)
- A paragraph reflection on how the process went: what went well, what was challenging, what would you change if you could do it again?
- A BKAPP Google Form
- **This can be submitted on a Google Doc or Google Slide**
  - This is an individual performance task. Each student is to submit their own document.

Rubric:

Criteria	Description	Points



BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested ______ **Agenda Code** 10 f..

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated Physics – Unit #6 – Electrostatics & Circuits – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated Physics – Unit #6 – Electrostatics & Circuits.

Background: ______

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated Physics – Unit #6 – Electrostatics & Circuits to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

UNIT 6: Electrostatics and Circuits
Unit Documents: Unit Notes ; Summary Table ; Quiz

Unit Overview	
Unit Title:	Unit 6: Electrostatics and Circuits
Teacher:	Ouellette
Grade Level/Course:	11-12 (Accelerated Physics)
Length/Dates:	15 (88 min) class periods
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	This unit is broken up into two parts: Electrostatics and Circuits. Students will learn about charge, forces between charges, moving charge, and applications of current, resistance, and potential difference (voltage). Students will construct basic circuits and investigate their properties. Students conclude the unit with investigating a solar panel, its properties, and a performance task where they wire a “house.”

Standard Bundles	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. [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]**
- **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. [Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.] [Assessment Boundary: Assessment is limited to systems containing two objects.]**
- **HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.* [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]**
- **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.* [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.]**

SEP Implications	DCI Implications	CCC Implications
Using Mathematics and Computational Thinking Mathematical and computational thinking at the 9–12 level builds on K–8 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 representations of phenomena to describe explanations. **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems 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. **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 9–12 builds on K–8 and progresses to evaluating the validity and reliability of the claims, methods, and designs. • Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	**PS2.B: Types of Interactions** • Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. • Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. **PS3.D: Energy in Chemical Processes** • Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy. *(secondary)*	**<u>Patterns</u>** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

Transfer Goals (Vision of the Graduate) List the long-term and/or school-wide independent student behaviors that this unit will address.
Transdisciplinary Goal: **Creativity/Innovation Transdisciplinary Goal:** Students work creatively to design and refine implementation of ideas by taking risks, persevering, and exploring possibilities.

Explore Anchoring Phenomenon: Electrostatic Stations & How Do Solar Panels Work?
Attempt to Make Sense: Coulomb's Law Investigation, Ohm's Law Circuit, Resistors in Series and Parallel Investigation
Identify Related Phenomena: Coulomb's Law, Ohm's Law, Circuits
Develop Potential Student Questions/Observations:

- Do solar panels absorb the energy from the sun?
- Do solar panels reflect sun rays?
- What does a battery do?
- How can we get energy from the sun to a battery?
- Why is solar energy renewable and sustainable(ish)?
- Is getting solar energy with your house worth it?
- How do solar panels work?
- What is a solar panel made of?
- How effective/efficient are solar panels?
- How can we make solar panels better?

Preconceptions:

- Students do not distinguish between charge and current
- Students think of charge as a object rather than a property of matter
- Student's don't recognize charge conservation
- Most students think there is a fundamental reason that electrons have to be negative
- Most students think that a positively charged object has received an excess of protons
- A majority of students think that batteries are a source of constant current, delivering the same current to any circuit, rather than as voltage sources
- Student's don't acquire a conceptual model of potential or potential difference
- Students are unable to relate the electric potential to the electric field
- Students do not differentiate between the concepts of current, voltage, energy, and power, it's all "electricity"
- Students have no micro/macro understanding of circuits. They do not see any connection between macroscopic quantities, such as current or resistance, and their previous study of charges, forces, and fields. To students, circuits are a subject entirely independent of electrostatics

Electrostatics and Circuits Unit Bundle				
Day(s)	**Target Question(s)**	**Lesson-level phenomenon**	**Activities & Assessments**	**What Students Will Learn/Expected Outcome (Knowledge and Skills)**
1 -2	What is charge?	Electrostatics	• Electrostatics and Circuit Stations • Station Graphic Organizer • Notes	DCI: **HS-PS2-4** SEP: **Planning and Conducting Investigations** CCC: **Systems and System Models** **Learning Targets:** • I can make observations of and ask questions about a physical phenomenon to determine properties of charged systems **Connection to Anchoring Phenomenon:** Electrons (charge) flow in a photovoltaic cells, which are arranged to make solar panels **What's next?** We find that charges can be distributed in different ways, which lead to repulsive or attractive interactions. These interactions cause accelerations, and Newton's laws suggest there must be a net force. What's up with the electrostatic force?
3 - 7	How can we interact with objects without contact?	Coulomb's Law	• Coulomb's Law Investigation • Coulomb's Law Problem Set • Electric Field Investigation • Notes • Electrostatics Quiz	DCI: **HS-PS2-4** SEP: **Using Mathematics and Computational Thinking** CCC: **Patterns** **Learning Targets:** • I can conduct an investigation and analyze data to determine the mathematical properties of the electrostatic force between two charges **Connection to Anchoring Phenomenon:** A charge produces an electric field. Fields model non-contact interactions between charges. **What's next?** Electrostatics is the study of charges when they are not in motion. Coulomb's Law describes the force charges exert onto one another. What is moving charge? Can we control it?
	END OF ELECTROSTATICS			

June 2023

8 - 15	What is moving charge? What is electrical resistance? What is electric potential?	Current & Resistance Voltage	• Current • Resistance and Resistivity Investigation • Electric Potential and Potential Mapping Investigation • Notes	**DCI: HS-PS2-6** **SEP: Obtaining, Evaluating, and Communicating Information** **CCC: Structure and Function** **Learning Targets:** • I can describe how the material and physical properties of a resistor affect its resistance. **Connection to Anchoring Phenomenon:** Free electrons as a result of the photoelectric effect flow in a photovoltaic cell to produce a current. That current can be controlled with resistors, which prevent the flow of charge. Charge can be stored in a battery, which has a certain voltage. **What's next?** A potential difference moves charge (current) through wires and resistors. What's the relationship between these variables?
16 - 22	What is the relationship between current, resistance, and potential difference? How do resistors behave in different circuit configurations?	Ohm's Law / Circuits	• Ohm's Law Investigation • Ohm's Law Problem Set • Notes • Kirchhoff Loop and Current Rules • Series and Parallel Circuits Investigation • Series and Parallel Circuits Problem Set • How Do Solar Panels Work? Jigsaw Reading and Whiteboard	**DCI: HS-PS4-5** **SEP: Obtaining, Evaluating, and Communicating Information** **CCC: Cause and Effect** **Learning Targets:** • I can obtain and communicate information on how solar panels work and some of their basic properties **What's next?** Circuit Building Performance Task

23 - 28	How can circuits be made to do certain tasks?	Home Wiring	Lighting a Home Performance Task	DCI: **HS-PS2-6** SEP: **Obtaining, Evaluating, and Communicating Information** CCC: **Structure and Function** **Learning Targets:** ● I can wire a "home" to perform real world applications with simple materials

Evaluative Criteria
Performance Statements:

		Observable features of the student performance by the end of the course:
1		Representation
	a	Students clearly define the system of the interacting objects that is mathematically represented.
	b	Using the given mathematical representations, students identify and describe* the gravitational attraction between two objects as the product of their masses divided by the separation distance squared $\left(F_g = -G\frac{m_1 m_2}{d^2}\right)$, where a negative force is understood to be attractive.
	c	Using the given mathematical representations, students identify and describe* the electrostatic force between two objects as the product of their individual charges divided by the separation distance squared $\left(F_e = k\frac{q_1 q_2}{d^2}\right)$, where a negative force is understood to be attractive.
2		Mathematical modeling
	a	Students correctly use the given mathematical formulas to predict the gravitational force between objects or predict the electrostatic force between charged objects.
3		Analysis
	a	Based on the given mathematical models, students describe* that the ratio between gravitational and electric forces between objects with a given charge and mass is a pattern that is independent of distance.

	b	Students describe* that the mathematical representation of the gravitational field $\left(F_g = -G\frac{m_1 m_2}{d^2}\right)$ only predicts an attractive force because mass is always positive.
	c	Students describe* that the mathematical representation of the electric field $\left(F_e = k\frac{q_1 q_2}{d^2}\right)$ predicts both attraction and repulsion because electric charge can be either positive or negative.
	d	Students use the given formulas for the forces as evidence to describe* that the change in the energy of objects interacting through electric or gravitational forces depends on the distance between the objects.

			Observable features of the student performance by the end of the course:
1			Communication style and format
	a		Students use at least two different formats (including oral, graphical, textual and mathematical) to communicate scientific and technical information, including fully describing* the structure, properties, and design of the chosen material(s). Students cite the origin of the information as appropriate.
2			Connecting the DCIs and the CCCs
	a		Students identify and communicate the evidence for why molecular level structure is important in the functioning of designed materials, including:
		i.	How the structure and properties of matter and the types of interactions of matter at the atomic scale determine the function of the chosen designed material(s); and
		ii.	How the material's properties make it suitable for use in its designed function.
	b		Students explicitly identify the molecular structure of the chosen designed material(s) (using a representation appropriate to the specific type of communication — e.g., geometric shapes for drugs and receptors, ball and stick models for long-chained molecules).
	c		Students describe* the intended function of the chosen designed material(s).
	d		Students describe* the relationship between the material's function and its macroscopic properties (e.g., material strength, conductivity, reactivity, state of matter, durability) and each of the following:
		i.	Molecular level structure of the material;
		ii.	Intermolecular forces and polarity of molecules; and
		iii.	The ability of electrons to move relatively freely in metals.
	e		Students describe* the effects that attractive and repulsive electrical forces between molecules have on the arrangement (structure) of the chosen designed material(s) of molecules (e.g., solids, liquids, gases, network solid, polymers).
	f		Students describe* that, for all materials, electrostatic forces on the atomic and molecular scale results in contact forces (e.g., friction, normal forces, stickiness) on the macroscopic scale.

			Observable features of the student performance by the end of the course:
1			Components of the model
	a		Students develop a model in which they identify and describe* the relevant components to illustrate the forces and changes in energy involved when two objects interact, including:
		i.	The two objects in the system, including their initial positions and velocities (limited to one dimension).
		ii.	The nature of the interaction (electric or magnetic) between the two objects.
		iii.	The relative magnitude and the direction of the net force on each of the objects.
		iv.	Representation of a field as a quantity that has a magnitude and direction at all points in space and which contains energy.
2			Relationships
	a		In the model, students describe* the relationships between components, including the change in the energy of the objects, given the initial and final positions and velocities of the objects.
3			Connections
	a		Students use the model to determine whether the energy stored in the field increased, decreased, or remained the same when the objects interacted.
	b		Students use the model to support the claim that the change in the energy stored in the field (which is qualitatively determined to be either positive, negative, or zero) is consistent with the change in energy of the objects.
	c		Using the model, students describe* the cause and effect relationships on a qualitative level between forces produced by electric or magnetic fields and the change of energy of the objects in the system.

Accelerated Physics:

Unit 6: Electrostatics and Circuits

Unit Overview

- This unit is broken up into two parts: Electrostatics and Circuits.
- Students will learn about charge, forces between charges, moving charge, and applications of current, resistance, and potential difference (voltage).
- Students will construct basic circuits and investigate their properties.
- Students conclude the unit with investigating a solar panel, its properties, and a performance task where they wire a “house.”

Performance Expectations

Standard Bundles	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. [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]** • **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. [Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.] [Assessment Boundary: Assessment is limited to systems containing two objects.]** • **HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.* [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]** • **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.* [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.]**

Anchoring Phenomenon

Electrostatic Stations & How Do Solar Panels Work?

Culminating Performance Task

POTENTIAL BKAPP IDEA - CREATIVITY

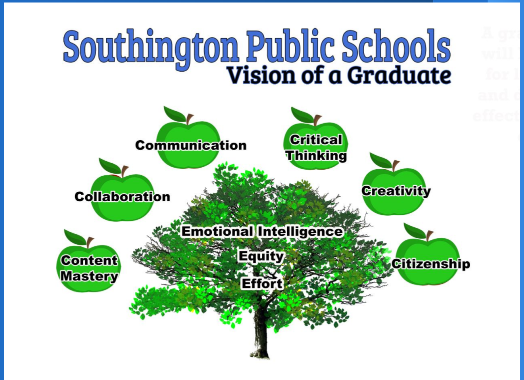
Your Task: You will design and construct series and parallel circuits to light your “home”

Requirements:

- Your project must have at least (4) rooms, or definitive spaces, connected by a doorway or hallway
- Your project must be close to the size of the cardboard given to you
- You must show at least (2) examples of a series circuit
- You must show at least (2) examples of a parallel circuit
- 3D objects must be added to your rooms to add interest

Construction:

- Cardboard, foamboard, shoeboxes, insulated wire, paper clips, pins, and aluminum foil
    - Switches can be made from pins and paper clips
- Your project house will be powered by a 9V battery
- Each circuit must be able to work independently from the other as well as well as both circuits on at the same time without moving the battery
- Furniture may **not** be premade toys. Everything must be made for this project. Furniture can include, but not limited to, origami, modeling clay, plastic, wood, etc.



BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested ______ **Agenda Code** 10 g.

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated General Chemistry – Unit #3 – Matter & Energy Changes – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated General Chemistry – Unit #3 – Matter & Energy Changes.

Background: ______

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated General Chemistry – Unit #3 – Matter & Energy Changes to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

Unit Overview	
Unit Title:	Bundle 3: Matter and Energy Changes
Teacher:	Lisa Daigle
Grade Level/Course:	9-12/Accelerated General Chemistry
Length/Dates:	6 Weeks
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	Students learn about fuels in cars and explore hydrogen as a possible fuel source. Throughout the unit, students discover the different types of chemical reactions and apply one to the chemical reaction of fuels as well as understanding that mass is conserved in a reaction through balancing equations. Students will be able to calculate their carbon footprints using stoichiometry. Finally, students will compare and contrast exothermic and endothermic reactions and apply thermochemistry to the chemical reactions of the different fuel sources for cars.

Performance Expectations
• HS-PS1-7. **Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.** [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*] • HS-PS1-4. **Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy**. [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*] • 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). [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.] [*Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students.*]

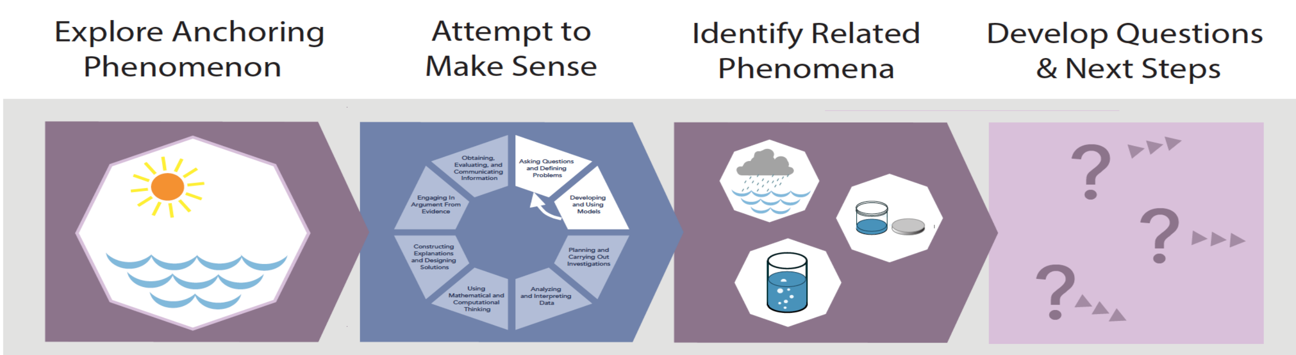
SEP Implications	DCI Implications	CCC Implications
Using Mathematics and Computational Thinking Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, 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 representations of phenomena to support claims. **Developing and Using Models** Modeling in 9–12 builds on K–8 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 a model based on evidence to illustrate the relationships between systems or between components of a system. **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems 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.	**PS1.A: Structure and Properties of Matter** The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. **PS1.B: Chemical Reactions** The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. **PS1.A: Structure and Properties of Matter** A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. **PS1.B: Chemical Reactions** Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. **PS3.B: Conservation of Energy and Energy Transfer** Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). **PS3.D: Energy in Chemical Processes** Although	**Energy and Matter** The total amount of energy and matter in closed systems is conserved. Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. **Connections to Nature of Science Scientific Knowledge** Assumes an Order and Consistency in Natural Systems Science assumes the universe is a vast single system in which basic laws **Systems and System Models** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.

	energy cannot be destroyed, it can be converted to less useful forms — for example, to thermal energy in the surrounding environment. **PS1.B: Chemical Reactions** Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	

Transfer Goals (Vision of the Graduate)
List the long-term and/or school-wide independent student behaviors that this unit will address.

Critical Thinking Transdisciplinary Goal:
Students inquire, identify, and ethically solve real-world problems through reasoning and a reflection on the challenges and benefits of the process and/or solution(s).
Communication Transdisciplinary Goal:
Students effectively communicate and use interpersonal skills in a range of formal and informal contexts.

Phenomenon



TIMING: 5-6 weeks (25-30 days)

July 2023

Explore Anchoring Phenomenon: Why do we use gasoline as fuel instead of liquid hydrogen in cars?

Attempt to Make Sense: Students will create a model to define the system and begin to construct an explanation.

Identify Related Phenomena: Rocket fuel, campfires, airplane fuel, natural gas vs. coal

Develop Potential Student Questions

- Why does gasoline catch on fire?
- What reaction happens when gas is used as fuel?
- When you put it on a fire, why do the flames get bigger?
- Why don't we fuel cars with methane?

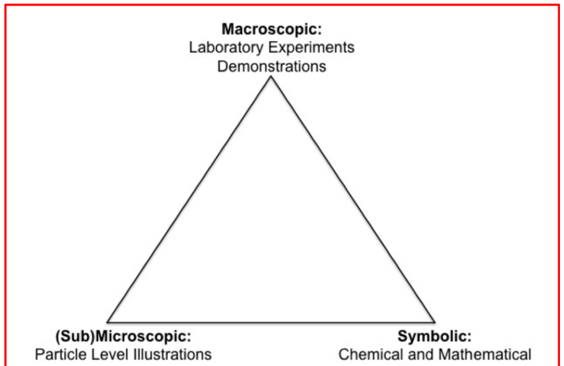
Possible Unit Level Phenomena: Students should be able to create an explanation using chemistry and real world hindrances to explain why we use gasoline instead of liquid hydrogen. Chemical reactions, using the mole and stoichiometry, and thermochemistry will be the key components to their final explanation. At the end of the entire bundle, students will write a CER to construct a researched and well thought out explanation to decide what our best alternative to gasoline would be in the real world.

Sample Explanation: A wax candle is first looked at with the conservation of mass and is our example of a combustion reaction. Next, Gasoline is a hydrocarbon that reacts with oxygen, producing water and carbon dioxide. Carbon dioxide is a greenhouse gas contributing to global warming, and students calculate their approximate carbon footprint using stoichiometry. On the other hand, hydrogen combusts with oxygen to make just water. Burning hydrogen fuel results in no carbon emissions, which makes it "green". The balanced chemical equations ($2C_8H_{18} + 25O_2$---> $16H_2O + 18CO_2$) and ($2H_2 + O_2$ ---> $2H_2O$) can be used to calculate how much product is formed or how much reactant is needed using stoichiometry. The mass of a mole of hydrogen is calculated to be 2 g/mol, which is a lot less than C_8H_{18} which is calculated to be 114.23 g/mol. This means we probably need a lot more hydrogen to fuel our cars than octane because of its much lower molar mass. However, when stoichiometry is used to calculate our carbon footprints, we find that each individual person contributes to CO_2 emissions, which is a greenhouse gas contributing to global climate change. Because of this, it looks like hydrogen fuel can be a good alternative. Unfortunately, when calculating the bond energies and evaluating the thermodynamics of the chemical equations, we find that the chemical reaction using hydrogen produces significantly less energy than octane. $2C_8H_{18} + 25O_2$---> $16H_2O + 18CO_2$ ΔH is about -8,554 kJ/mol while the $2H_2 + O_2$ ---> $2H_2O$ ΔH is about -498 kJ/mol.Therefore, using octane produces about 17 times more energy in our balanced chemical equations. Therefore, we use gasoline instead of hydrogen. There is also not a lot of hydrogen in our environment, so we don't have enough of it to power everything. This means we probably need an alternative fuel source that is not hydrogen to be more efficient and to stop using gasoline to help our environment.

General Resources:

- Driving Question Board
- Question Formulation Technique (QFT)
- KQL
- Talk Activities
- Summary Table
- Final Scientific Modeling
- Final Scientific Modeling
- CCC Discussion Cards

July 2023



- 321 Strategy active viewing
- 60 Formative Assessment Ideas
- CER

General Resources:
- https://www.rechargenews.com/energy-transition/hydrogen-car-sales-almost-doubled-last-year-after-drivers-were-offered-50-65-discounts/2-1-1168221

POSSIBLE RESOURCES:
- Hub: Fuels Unit: https://docs.google.com/document/d/1EMElxY7eY1rHQjSy1UCNZAOl6K_OXA-SnzlfNZj1tHM/view
- https://www.nextgenscience.org/resources/high-school-interactions-unit-2-how-does-small-spark-trigger-huge-explosion
- NGSS Integrated Bundle 2: (Chemistry and Earth & Space Science: https://www.nextgenscience.org/sites/default/files/HS%20Domains%20Course%201%20Bundle%202_0.pdf
- OLD STORYLINE: **Counting things that we can't see: Mole and Basic Stoichiometry**

Learning Sequence 1: Why do substances react?			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
EXPLORE *What happens to the candle when it burns?*	Burning Candle (Fuel)	• Candle Experiment	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Plan and carry out an investigation** to describe any **patterns** noticed when burning a candle. **Learning Target:** I can plan and carry out an investigation to describe any patterns I notice during the experiment. **Success Criteria:** • Develop a procedure • Collect quantitative and qualitative data • Differentiate between quantitative and qualitative data • Ask questions

			What's next? *Students are wondering why the candle shrunk in size and what the smoke is that formed. They understand the differences between quantitative and qualitative data when observing a chemical reaction. They may be wondering what happened to the candle they started with.*
What happens when something seems to lose mass like when the candle gets smaller?	Candle (Fuel)	• Law of Conservation of Mass	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Analyze and interpret data** to find **patterns** in the simulation to determine that mass is always conserved. **Learning Target:** I can analyze and interpret data and find patterns to describe the Law of Conservation of Mass. **Success Criteria:** • Explain the Law of Conservation of Mass • Apply this law to the burning candle ***What's Next?*** *Students now know that the law of conservation of mass explains that mass was never lost. Students are now wondering what the differences between melting the candle and the appearance of smoke.*

EXPLORE
What's the difference between melting and the smoke that was made when the candle burned?
	Candle (fuel)	• Chemical Reactions in a Bag
		  ○ *Adapted from: Chemical reactions in a bag*
		  • Takes about 45 mins)
		
		Resources
		• Chemical Reactions Summary Table
		  ○ Ongoing assignment through learning sequence 1
			DCI/SEP/CCC: SWBAT…
			• **HS-PS-1-7**
			• **Plan and carry out an investigation** to describe the difference in **patterns** between a chemical change and a physical change.
			
			Learning Target
			• I can plan and carry out an investigation to find patterns and describe physical and chemical changes.
			
			Success Criteria
			• Carry out an investigation to differentiate between physical and chemical changes
			• Be able to describe a chemical reaction
			
			What's next?
			Students now know that the production of heat or light, formation of a gas, formation of a precipitate, and/or color change are possible evidence of a chemical reaction. A chemical change transforms substances into new substances with different chemical and physical properties and compositions (smoke formation from the candle). A physical change causes a substance to undergo a change in

			properties, but not a change in composition (wax of the candle melting). Next, Students will investigate how matter/atoms change during chemical changes.
EXPLAIN *Are there different kinds of chemical reactions or similar ones to the candle burning?*	Candle (fuel)	• Classifying chemical reactions POGIL ○ Answers • Practice classifying Resources • Class Notes	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Analyze and interpret data** to find **patterns** in chemical reactions in order to classify the type of chemical reaction. **Learning Target** • I can classify chemical reactions by analyzing and interpreting chemical equations by finding patterns in chemical equations. **Success Criteria:** • Be able to identify synthesis, decomposition, single replacement, double replacement, and combustion reactions when given a chemical equation. ***What's next?*** *Students learn how to classify the 5 major types of reactions by comparing the reactants and products. They are able to classify the candle burning as a combustion reaction. Students will now be wondering how those superscripts and subscripts play a*

			role in the balanced chemical equation.
EXPLAIN *How do we show our inputs and outputs in a chemical change like when the candle makes smoke?*	Candle (Fuel)	• Balancing Equations Phet Simulation • Balancing Equations Practice Worksheet • Balancing and Classifying Practice Worksheet • Balancing Combustion Equations OpenStax • 7.1 Writing and Balancing Chemical Reactions Resources: • Class Notes	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Develop and use models** to develop a microscale view of matter flow in chemical reactions to find **patterns** to balance equations demonstrating the conservation of matter. **Learning Target** • I can balance chemical reactions by using models to find patterns in chemical equations. **Success Criteria:** • Understand that matter is conserved in a chemical reaction • Be able to make sure the different elements are balanced on each side of the chemical equation by changing the coefficients ***What's next?*** *Students learn to balance chemical equations at the atom/molecule/compound scale to demonstrate the conservation of matter. Students will be able to balance the chemical equation of the candle burning. Next, students will be wondering how we can predict what products form if only*

			the reactants are given in different chemical reactions.
ELABORATE *How can we figure out all of the outputs in a chemical reaction?*	Candle (Fuel)	• Predicting Products Practice Worksheet **Lab Choices:** • Predicting Products Demo (1 of each type of reaction) OR • Predicting Products Lab ○ *Adapted from: Exploring Chemical Reactions Lab* OpenStax • 7.1 Writing and Balancing Chemical Reactions	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Analyze and interpret data** (reactants) to determine **patterns** in what products form based on the type of chemical reaction. **Learning Target** • I can analyze and interpret reactants and predict products of chemical reactions by recognizing patterns. **Success Criteria:** • Predict the products by determining the type of chemical reaction occurring and balance that equation ***What's next?*** *Students learn that the type of reaction and the available reactants determine the products that are formed in a chemical reaction. Students may be wondering what happens if we have larger quantities. In other words, we focused here on the atoms/molecules/compounds level, but scientists don't work with singular compounds- we can't even really see that!*

EVALUATE **LS1 Assessments** ● HS-PS1-7 Chemical Reactions Quiz version-A Chemical Reactions Quiz version B (same as A, but some different compounds to balance) Study Guide			
Learning Sequence 2: How is matter conserved in a chemical reaction and how do we represent this conservation?			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
ENGAGE *What is my carbon footprint?*	**Video Clip**: Watch "New York City's Greenhouse Gas Emissions as One-Ton Spheres of Carbon Dioxide Gas" until minute 2:35. **Watch video** **Presentation on Fuel Sources (see activities)** **Adapted from iHub: Fuels**	● Slides Lesson 1 Fuels ○ Lesson 1 Fuels Student Activity Sheet Engage ● Show video clip ● What do we notice? Students should write down any observations that they have. It is recommended to play the video a second time for students to write down observations. ● Have students work through the activity sheet and look at these graphs in small groups. ● Have students make sense of what happens during a chemical reaction. ● Identify related phenomena: ● Campfires ● Any kind of combustion reactions (answers may vary)	**DCI/SEP/CCC: SWBAT…** ● **HS-PS-1-7** ● **Ask questions** to find **patterns** to understand what a carbon footprint is. **Learning Target:** I can ask questions about a carbon footprint after looking at patterns of different graphs and figures. **Success Criteria:** ● Analyze graphs ● Make sense of a carbon footprint ● Understand greenhouse gasses are not good for the environment ● Asking questions about how to find out your carbon footprint ***What's next?***

			Students wonder how we can figure out our own carbon footprints. If molecules like CO_2 are really small, how can we even count these molecules?

EXPLORE
Since molecules like carbon dioxide are so small, how do we count them?
	Fuel	• The mole TedTalk
		Pick 1 Activity:
		• Mole Lesson Activity
		• POGIL: Relative Mass and the Mole
		    ○ Answers
		
		Notes
		• Mole Class notes
		• Stoichiometry Summary Table
		    ○ Ongoing assignment throughout learning sequence 2
			DCI/SEP/CCC: SWBAT…
			• **HS-PS-1-7**
			• **Using mathematics and computational thinking** to find **patterns** to understand what the mole is and why it's used.
			
			Learning Target
			• I can use mathematical and computational thinking to use a mole as a counting unit.
			
			Success Criteria:
			• Be able to define a mole of objects
			
			What's next?
			Students are introduced to the new unit, the mole. They now know how to count very small molecules like CO_2. Students are now wondering how to use the mole in chemistry.

EXPLAIN *How does the mole relate to figuring out how much carbon dioxide we produce?*	Fuel	• Calculating Molar Mass Student Version ○ With Answers • Moles Conversion	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Using mathematics and computational thinking** to use the mole to make

		Worksheet • Mole Roadmap Worksheet CK-12 • More 2 step calculations practice • Lab: Calculating Moles in Daily Life Optional: • Mass to Moles Carousel (AW) • Calculating Moles Lab • Conversions Between Moles and Mass CK-12 (Homework) • The Mole and Mole Conversions- Chapter 10 on CK-12 • Molar Mass "March" madness OpenStax • 7.3 Reaction Stoichiometry	conversions to grams, liters, and particles of the same substance by observing **patterns** in these calculations. **Learning Target** • I can use mathematical and computational thinking to calculate the molar mass of a compound using the periodic table. • I can convert between moles, grams, particles, or liters. **Success Criteria:** • Calculate molar mass • Use molar mass to convert from mass to moles or moles to mass • Use Avogadro's number to calculate the number of moles or particles when given the other value • Use the Liter conversion to convert from moles to liters or liters to moles ***What's next?*** *Students learn basic mole conversions. They can now convert between essential units and understand how they relate to the mole. For example, students can know the number of moles of CO_2 and use that to convert to grams. Students may be wondering how this relates to*

			chemical reactions, like the chemical reactions we saw with the different fuels.

EXPLAIN
How do we compare the amount of carbon (or hydrogen) in a fuel?
	Fuel	Optional Introduction Activity:
		• Optional intro activity
		Activities:
		• POGIL: Percent Composition and Empirical & Molecular Formula
		  ○ Practice WS
		Elaborate: Hydrates Lab
		• Hydrates Lab $CuSO_4$
		  ○ Calculations Intro
		
		• Another hydrate lab $CuSO_4$
		• Alternate hydrate lab $MgSO_4$
		
		Optional support activity for weaker math groups:
		• POGIL: Percent Composition
		OpenStax
		• 7.3 Reaction Stoichiometry
		• 6.2 Determining Empirical and Molecular Formulas
		Resources
		• Percent composition CK-12
		• Stoich Notes
			DCI/SEP/CCC: SWBAT…
			• **HS-PS-1-7**
			• **Using mathematical and computational thinking** to find **patterns** in order to calculate percent composition and use that to find an empirical formula of a chemical reaction.
			• **Carrying out an investigation** to calculate the **proportion** of water in a hydrate using stoichiometry.
			
			Learning Target
			• I can use mathematical and computational thinking to determine the percent composition and empirical formulas of chemical reactions.
			• I can carry out an investigation to calculate the percent composition of water in a hydrate by using mole conversions.
			
			Success Criteria:
			• Determine the percent composition of different elements/compounds in a chemical formula
			• Use percent composition to determine the empirical

			formula of a chemical reaction ● Carry out an investigation using mole conversions and other lab techniques to figure out the percent composition of water in a hydrate ***What's next?*** *Students learn to calculate percent composition of different substances that make up a chemical reaction and apply it to making an empirical formula of a chemical equation like the burning of fuels. Students may be wondering how the empirical formula relates to the mole calculations.*
LS2 Mid Assessment ● Mid Assessment ○ **HS-PS1-7** ○ Make-Up Assessment ○ Study guide ○ Study guide w/practice problems and answer key			
EXPLAIN *How do we incorporate conservation of matter into our models of chemical reactions?*	Fuels	● Mole Ratios POGIL ○ POGIL answer key ○ Mole Ratio Worksheet ● Mass to Moles Worksheet ○ Another Mass to Moles Worksheet ● ***Elaborate:*** Analyzing the reaction between baking soda and citric acid lab	**DCI/SEP/CCC: SWBAT…** ● **HS-PS-1-7** ● **Using mathematical and computational thinking** by finding **patterns** in the process to make stoichiometry calculations. ● **Carry out an investigation** to figure out the **proportion** needed of

		• Stoichiometry Worksheet • ***Elaborate:*** Stoichiometry Lab with baking soda and amount of gas to predict ○ Airbag Worksheet Optional extension: • Real World Stoichiometry OpenStax • 7.3 Reaction Stoichiometry	baking soda and citric acid using stoichiometry in the chemical equation **Learning Target** • I can use mathematical and computational thinking stoichiometry to calculate quantities in chemical reactions. • I can carry out an investigation to analyze a chemical reaction to determine the amount of baking soda and citric acid needed using stoichiometry ***What's next?*** *Students learn how to use a chemical reaction to make conversions between different substances in a chemical reaction. Students will now be able to calculate their carbon footprints based on the amount of fuel they use. Students are probably wondering how much product can be made when both reactants have given amounts. In terms of our fuel equations, students may be wondering why we have to keep filling up our cars with fuel.*

EXPLAIN
PERFORMANCE TASK
	Carbon Footprint	• Calculating your Carbon Footprint
		  ○ Open notes
		  ○ rubric
		  ○ Only parts 4 and
			DCI/SEP/CCC: SWBAT…
			• **HS-PS-1-7**
			• **Using mathematical and computational thinking** and **constructing an**

		analysis questions are graded ◦ Critical thinking assignment	**explanation** for personal fossil fuel use by finding **patterns** in the calculations and provided data. **Learning Target:** I can use mathematical and computational thinking to determine my carbon footprint using stoichiometry. **Success Criteria:** • Use stoichiometry to calculate your carbon footprint ***What's next?*** *Students learn how to use stoichiometry in a real world calculation, which is calculating their carbon footprint. Students are wondering what happens in a chemical reaction when a reactant runs out, like gas in cars.*
ELABORATE *Why do we need to keep adding gas to our cars, but we don't have to add oxygen?*	Fuels	• Limiting Reactants Worksheet • POGIL: Limiting Reactants ◦ Answers • ***Elaborate:*** Percent yield • Limiting Reactant and Percent Yield (homework or exit ticket suggestion) • ***Elaborate:*** The determination of mass of a product of a chemical reaction Lab Optional extension:	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-7** • **Using mathematical and computational thinking** to find **patterns** in limiting reactant problems and how to calculate percent yield in a lab (apply theory to experimental data). **Learning Target** • I can use mathematical and computational thinking to determine the limiting

		• Incomplete combustion OpenStax • 7.4 Reaction Yields	reactant by using stoichiometry. • I can use mathematical and computational thinking determine the percent yield produced in a lab experiment. **Success Criteria:** • Be able to determine the limiting reactant with stoichiometry • Be able to determine the percent yield of a product ***What's next?*** *Students learn to calculate limiting reactants and percent yield. They can now determine that the excess reactant is oxygen while the limiting reactant is gas. Now that they learned all about the matter, they are probably wondering about the energy that actually makes the cars move.*

EVALUATE

LS2 Assessment:

- **Chemical Reactions and Stoichiometry (without answer key)**
- Chemical Reactions and Stoichiometry (w/ Answer Key)
  - **HS-PS1-7**

Learning Sequence 3: Why is energy released or absorbed from a chemical process?

Driving Questions	Lesson Level Phenomena	Activity	What Should They Learn/Expected Outcome

ENGAGE
Why don't we use a different fuel in our cars?
	Hydrogen and gasoline	• Hydrogen vs. Gasoline
		  ○ Liquid Hydrogen Article
		  ○ Activity sheet
			DCI/SEP/CCC: SWBAT…
			• **HS-PS-1-4**
			• **HS-PS-3-4**
			• Attempt to **construct an explanation** to describe **energy flow** for a chemical reaction
			
			Learning Target
			• I can ask questions and try to make sense of the energy produced in two chemical reactions.
			
			Success Criteria:
			• Describe similarities and differences between octane and hydrogen combustion reactions
			• Make an attempt to explain heat flow
			
			What's next?
			Students are able to compare and contrast the similarities and differences of the two combustion reactions and fuel types. Students will be wondering why hydrogen produces more energy and why we can't use it instead of gasoline.

ENGAGE *Why do combustion reactions make heat?*	Hot and cold packs	• Hot and Cold Packs Simulation OR • Barium Hydroxide and ammonium chloride ○ Demo	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-4** • **HS-PS-3-4** • **Constructing an explanation** to describe **energy flow** for endothermic and

		Resource: • Thermochemistry Summary Table	exothermic reactions. **Learning Target** • I can construct an explanation to describe the energy flow between two objects. **Success Criteria:** • Describe the differences between hot and cold packs with a focus on energy ***What's next?*** *Students learn that in terms of heat energy, there are endothermic and exothermic reactions. They are thinking about why the reactions produce energy (heat).*
EXPLORE *Do bonds have something to do with it?*	Fuel	• POGIL: Bond Energy ○ Answer Key • Bond Energy Practice • Energy Changes in Chemical Reactions Simulation Option: • Magnets Activity (iHub) • Magnets Presentation (iHub) Notes: • Bond Energy OpenStacks • 9.4 Strengths of Ionic and	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-4** • **Using mathematics and computational thinking** to describe the **energy flow** of endothermic and exothermic reactions in a chemical reaction. **Learning Target** • I can use mathematical and computational thinking to calculate bond energy in a chemical reaction • I can explain energy flow changes in chemical

		Covenant Bonds ○ Covers bond energy	reactions. **Success Criteria:** • Calculate bond energy • Describe energy changes in chemical reactions • Analyze endothermic and exothermic graphs and note the differences between them ***What's next?*** *Students learn how to calculate bond energy in a chemical reaction to determine the flow of heat energy and classify it as an endothermic or exothermic reaction. Students will now need to understand how temperature relates to heat in a system.*
EXPLAIN *Why do some things get hotter faster?*	Fuel	• Exothermic and Endothermic Lab • ***Elaborate:*** Vegetable Oil and Water lab comparison **OR** Heat Capacity Stations **OR** Specific Heat Simulation ○ Asks students to use significant figures. (one decimal place) ○ Answers • Specific Heat Calculations WS • Thermochemistry Notes	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-4** • **HS-PS-3-4** • **Using mathematics and computational thinking** to describe **system and system models of energy flow** in a chemical reaction. • **Carry out an investigation** to describe **system and system modes of energy flow** in chemical reactions. **Learning Target:** • I can conduct an experiment to show energy

		OpenStax ● 9.1 Energy Basics ● 12.3 The Second and Third Laws of Thermodynamics ○ Focus only on second law	flow in a system. ● I can use mathematical and computational thinking to calculate the specific heat capacity of an object. **Success Criteria:** ● Understand how temperature relates to heat energy ● Be able to conduct a lab experiment to determine the heat flow ● Use the formula to calculate specific heat of an object. ***What's next?*** *Students learn about specific heat capacity and how it applies to how quickly or slowly substances can heat up. They also learn how temperature is related to heat energy. Students learn how to use math to illustrate endothermic and exothermic reactions. They will be able to fully explain exothermic reactions like fuels combusting and back them up with mathematical calculations. Students may be wondering what happens during a phase change because we have only seen one state of matter up until now.*
EXPLAIN *How can we figure out if a physical change is making or absorbing energy?*	Fuel	● Phase change diagrams ○ Answers ● Heat of Fusion of Ice Lab ○ *Adapted from: Heat*	**DCI/SEP/CCC: SWBAT…** ● **HS-PS-1-4** ● **HS-PS-3-4** ● **Analyzing and**

		of Fusion of Ice Notes: Phase change notes OpenStax • 10.3 Phase Changes • 10.4 Phase Diagrams Resource: • More phase change diagram practice	**interpreting data** to determine the **energy flow** between phase changes of substances. • **Use computational thinking** to determine the **energy flow** and calculate the heat of fusion of ice. **Learning Target:** • I can analyze and interpret a phase change diagram • I can carry out an experiment to determine the heat of fusion of ice using a phase change diagram. **Success Criteria:** • Interpret phase change diagrams • Determine the heat of fusion of ice in a lab ***What's next?*** *Students learn how to interpret phase change graphs and understand that heat energy and pressure helps determine what phase a substance is in. Students may be wondering how we can directly measure energy with more than one substance.*
ELABORATE *How do we measure energy changes between two substances?*	Fuel	• Calorimetry Math Worksheet ○ Answers Choose 1: • Specific Heat of a Metal	**DCI/SEP/CCC: SWBAT…** • **HS-PS-1-4** • **HS-PS-3-4** • **Using mathematical and computational thinking** to

		Lab: Calorimetry ○ *Adapted from: Calorimetry Lab* *OR* ● Calorimetry Lab Simulation ● Heat of Solution OpenStax ● Calorimetry	mathematically determine the **energy flow** between two substances in a system. **Learning Target:** ● I can use calorimetry (use mathematical and computational thinking) to determine the specific heat of a substance with heat transfer between two objects. **Success Criteria:** ● Use calorimetry to perform calculations of specific heat, temperature change, or mass of an object ***What's next?*** *Students learn to calculate variables between two different substances understanding that q=-q. They see that within a system, there is an endothermic process and an exothermic process. Students may now want to use what they learned to apply energy as to why we can't use liquid hydrogen as a fuel source.*
EVALUATE *Performance Task CER: How can we reduce our transportation carbon footprint?*	Reducing carbon footprint (fuel)	**Performance Task** ● Link to Supplements for Research ● Research Final CER	**DCI/SEP/CCC: SWBAT…** ● **HS-PS-1-4** ● **HS-PS-3-4** ● **Obtaining, evaluating,**

		• CER document if having students type • Enrichment: Why can't we use hydrogen as our fuel source PearDeck	**and communicating information** and **engaging in argument from evidence** to find **patterns** to explain an alternative fuel to reduce our carbon footprint. ***What's next?*** *Based on evidence, students write a CER explaining how we can reduce our transportation carbon footprint.*

EVALUATE

LS3 Assessments -

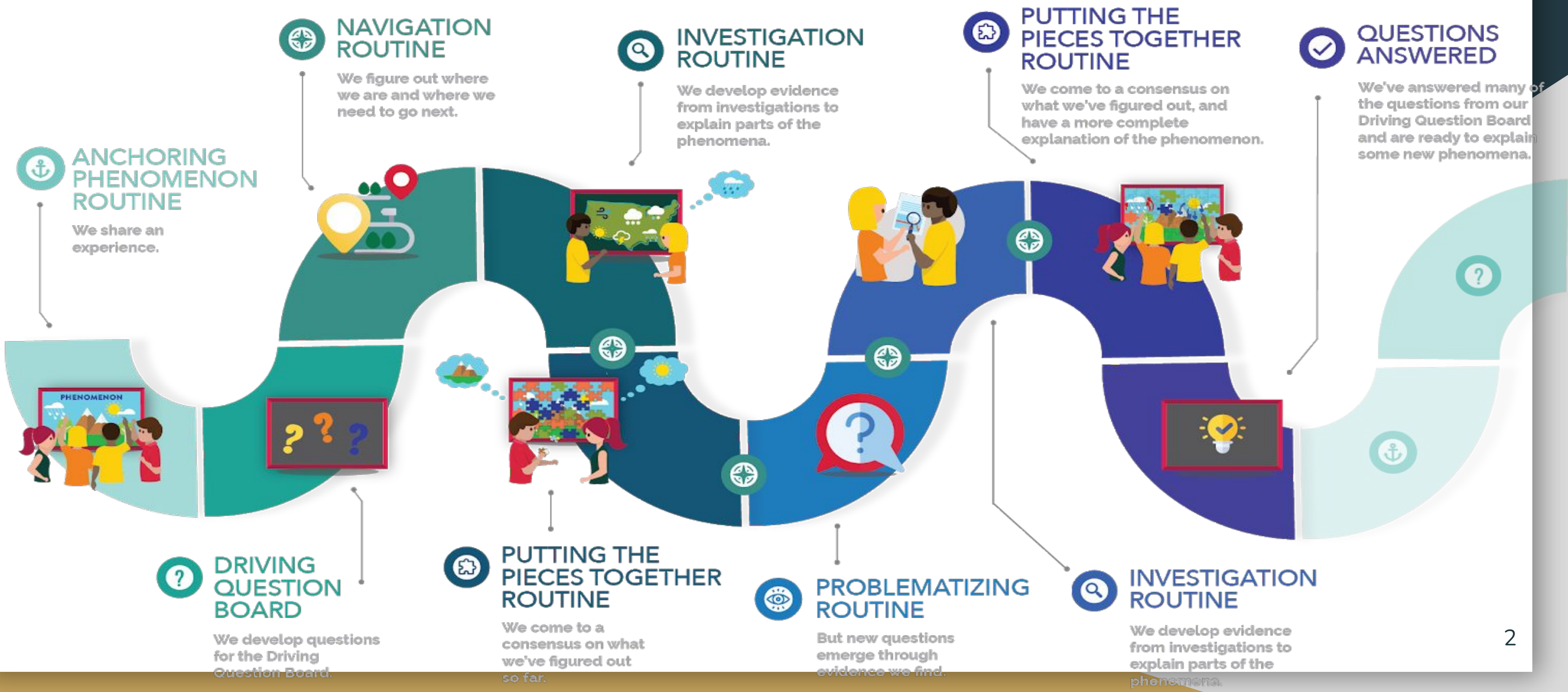
- Paper & Pencil Test ; Answer Key
  - **HS-PS1-4**
  - **HS-PS3-4**
  - Study Guide

Accelerated General Chemistry

Bundle 3

Lisa Daigle

Curricular Sequence for Each Bundle



Bundle 3: Matter and Energy Changes

Composed of 3 Learning Sequences:

Burning a Candle

What happens to a candle when it burns?

Focus on classifying and balancing chemical equations and predicting products with known reactants

Carbon Footprint

What is my carbon footprint?

Focus on mole conversions and stoichiometry

Liquid Hydrogen

Why don't we use a different fuel in our cars?

Focus on endothermic and exothermic reactions, bond energy, thermochemistry, and calorimetry.

What happens to a candle when it burns? First Steps

What do we notice?

Students burn a candle and take the mass before and after 10-15 minutes

Students write down observations

Attempt to Make Sense

Students attempt to explain why the candle shrinks, why it seems to lose mass, and figure out what molecules/elements are in the smoke

Identify Related Phenomenon

Campfires
Roasting Marshmallows
Anything with fire/flames or smoke

Ask Questions

What is my Carbon Footprint? First Steps

What do we notice?

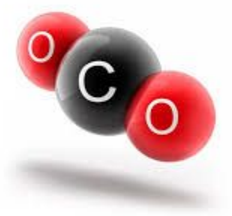
Students analyze graphs of carbon dioxide emissions and watch a video that conceptualized the amount of CO_2 emitted on a block in NYC

Attempt to Make Sense

Students attempt to explain how there are so much CO_2 emissions

Identify Related Phenomenon

Fires
Combustion Reactions



Ask Questions

Why don’t we use a different fuel in our cars?
First Steps

What do we notice?

Read and annotate a liquid hydrogen article
Compare and contrast gasoline to liquid nitrogen

Attempt to Make Sense

Students attempt to explain why we don’t use liquid hydrogen since it releases energy like gasoline when it’s used

Identify Related Phenomenon

Fires
Combustion Reactions
Other fuel sources like propane

Ask Questions

Criti

4C Activities: Performance Tasks

Critical Thinking

Calculating your Carbon Footprint

Students use a variety of balanced equations, unit conversions, and stoichiometry to calculate their carbon footprints

Communication

Find an Alternative Fuel Source

Students write a CER and research other fuel sources and back up why their choice is better than gasoline using thermochemistry to explain their choices

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** October 12, 2023

Decision Requested__________ **Agenda Code** 10 h.

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated General Chemistry – Unit #4 – Gas Law & Kinetics – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated General Chemistry – Unit #4 – Gas Law & Kinetics.

Background: __________

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated General Chemistry – Unit #4 – Gas Law & Kinetics to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

HS-PS1 Gas Laws and Kinetic Molecular Theory

Unit Overview	
Unit Title:	Bundle 4: Gas Laws and Kinetics
Teacher:	Lisa Daigle
Grade Level/Course:	9-12/Accelerated General Chemistry
Length/Dates:	4 Weeks
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	Students learn about kinetic molecular theory and how it relates to the behavior of gasses. Students learn the relationships between different variables that affect gas particles. Finally, students learn how the temperature or concentration affects the rate at which a chemical reaction occurs. Students will explore the phenomena of a tanker car implosion and elephant toothpaste.

Performance Expectations
PE(s) to be addressed (include assessment boundaries and clarification statements).

Bundle

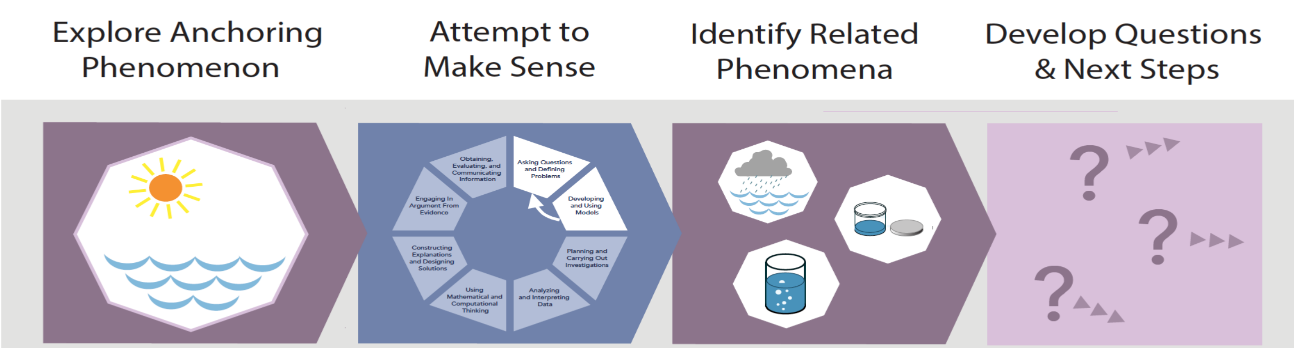
- HS-PS1-5. **Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.** [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [*Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*]

SEP Implications	DCI Implications	CCC Implications
Science and Engineering Practices **Constructing Explanations and Designing Solutions** 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. • Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.	**Disciplinary Core Ideas** **PS1.B: Chemical Reactions** • Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	**Crosscutting Concepts** **Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Transfer Goals (Vision of the Graduate)
List the long-term and/or school-wide independent student behaviors that this unit will address.

Creativity/Innovation Transdisciplinary Goal:
Students work creatively to design and refine implementation of ideas by taking risks, persevering, and exploring possibilities.

Phenomenon



TIMING: 4 weeks
Explore Anchoring Phenomenon: **Tanker Car Implosion**

Attempt to Make Sense: Students will create a model to create an explanation on how the tanker car imploded.

Identify Related Phenomena: Crushing the Can Experiment

Develop Potential Student Questions

- Does the weather play a role in making this happen?
- Does the pressure increase or decrease?
- Is the temperature something that causes the implosion?
- Why does it implode instead of explode?

Possible Unit Level Phenomena: Students should be able to create an explanation of the tanker car implosion by using gas laws. Students use the different gas laws in their explanation for the tanker car. Students only learn about ideal gasses, not real gasses in this learning sequence.

Sample Explanation: The conditions had to be just right for the implosion to happen. The temperature affects the pressure directly while the volume is affected indirectly. The pressure inside and outside of the tanker car also wants to be equal, but since the tanker car is not a flexible container, the implosion occurs to allow the pressures to be equal when the tanker car cannot withstand the difference in pressures. Inside the tanker car, the temperature of the water vapor decreased rapidly, which decreased the pressure but only in the tanker car. The external pressure was left unaffected. The tanker car collapses in on itself to make the volume smaller to accommodate the higher external pressure so that the internal pressure increases and can be equal to the external pressure.
Explore Anchoring Phenomenon: Elephant Toothpaste (decomposition of hydrogen peroxide)

Attempt to Make Sense: Students contribute to a discussion board on Canvas to synthesize their thinking to come up with an idea of what they think is happening.

Identify Related Phenomena: Decomposition reactions, reactions that produce a gas

Develop Potential Student Questions

- What makes the elephant toothpaste thick?
- What happens when we use less reactants?
- How can we make it faster?

Possible Unit Level Phenomena: Students learn gas stoichiometry to incorporate gas laws into chemical reactions. Chemical reactions are discussed further with different variables like temperature and catalysts can affect the rate of reaction. Finally, collision theory is discussed to figure out why elephant toothpaste is possible to make. At the end, students should be able to apply this knowledge to not only the elephant toothpaste reaction, but also the iodine clock reaction to make the reaction happen as quickly as possible.

Sample Explanation: Elephant toothpaste is possible because a chemical reaction happens, the decomposition of hydrogen peroxide. We can use the equation, $2\ H_2O_2(l) \rightarrow 2\ H_2O(l) + O_2(g)$. Because of the oxygen, it makes the elephant toothpaste expand. Since oxygen is a gas, gas stoichiometry can be used to help us calculate the volume or pressure of the gas as well as the amount of oxygen gas that is produced when the conditions of the oxygen gas change. The reaction is possible because of the catalyst, which can be potassium iodide (KI) to speed up the chemical reaction. Yeast can also be used as a catalyst. The catalyst causes the rapid decomposition of hydrogen peroxide. Collision theory states that there needs to be sufficient energy to break bonds, so the activation energy is lowered by the catalyst. This all makes elephant toothpaste's chemical reaction possible.

General Resources:

- Driving Question Board
- Question Formulation Technique (QFT)
- KQL
- Talk Activities
- Summary Table
- Final Scientific Modeling
- Final Scientific Modeling
- CCC Discussion Cards
- 321 Strategy active viewing
- 60 Formative Assessment Ideas
- CER

Learning Sequence 1: How did the Tanker Car Implode? Gas Laws (2 Weeks)				
Driving Questions	**Lesson Level Phenomena**	**Activity**	**???**	**What Should They Learn/Expected Outcome**
ENGAGE *How did the tanker car implode?*	Video Clip: Tanker Car Implosion	Engage • Show video clip ○ Tanker car slides • What do we notice? Students write down observations that they see.		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Developing a model** to determine the **cause and effect** of the implosion. **Learning Target:** I can formulate an explanation by developing a

		• Attempt to make sense: Students will create a model to show why and how they think the tanker car implodes OR create a discussion board. • Identify related phenomena: Demo crushing the can • Develop questions and next steps Students will ask questions related to both phenomena. • This is a great time to introduce the tanker car summary table. As topics and questions are answered, have students complete that particular section of the summary table. Can be done for homework with periodic check-ins. General Resources: • Driving Question Board ○ Question Formulation Technique (QFT)		model about the tanker car implosion to illustrate the cause and effect. **Success Criteria:** • Ask questions about the tanker car • Create an explanation about the implosion • Think of related phenomena to make sense of the implosion ***What's next?*** *Students know that matter is made up of particles and know the properties of gasses. However, they are wondering how and why gasses can cause an implosion and what external and internal factors play a role in the phenomenon. They may wonder if this is a chemical reaction inside the tanker car or if it is just a physical change.*
EXPLORE & EXPLAIN *What factors caused the tanker car to collapse on itself in that manner?*	Tanker car	• POGIL Kinetic Molecular Theory ○ Answers Ongoing Assignment (homework) • Tanker car summary		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Constructing explanations** to recognize **patterns** with gas molecules using kinetic molecular theory.

		table OpenStax • 8.5 Kinetic Molecular Theory Resources: • Gas Laws PhET • Kinetic Molecular Theory Notes • Kinetic molecular theory google slides • CK-12 Kinetic Molecular Theory		**Learning Target:** I can use kinetic molecular theory to construct an explanation of the behavior of gasses. **Success Criteria:** • Describe the 5 components of kinetic molecular theory • Be able to use kinetic molecular theory to explain the behavior of gasses when a variable changes ***What's next?*** *Students learn the 5 components of kinetic molecular theory. They also learned that catalysts can speed up the rate of reactions. They may be wondering whether or not to classify the implosion as a chemical reaction or just the gasses being affected by internal/external factors. Is the implosion a chemical reaction or something else?*
EXPLORE & EXPLAIN *Why did it implode instead of explode?*	Tanker car	(Pick 1 activity) • Understanding gas laws animation ○ Requires AACT membership • Understanding gas		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Constructing explanations** and recognizing **patterns** between manipulating different variables to

		laws pHet simulation • Gas variables POGIL Ongoing Assignment (homework) • Tanker car summary table		determine what happens within a system containing gas particles. **Learning Target:** I can use gas laws to construct an explanation for the behavior of gasses when different variables are changed. **Success Criteria:** • Describe Boyle's Law, Charles's Law, and Gay-Lussac's Law conceptually and mathematically (does not include calculations) ***What's next?*** *Students learn that there are multiple variables that can affect the gas's behavior. They learn the basic relationships between volume, pressure, moles (amount), and temperature and how they are all related. Now they know that there are multiple variables that are associated with the implosion of the tanker car. They may be wondering if these relationships can be mathematically proven, which will then bring them to the different gas law calculations.*
EXPLAIN *Did the pressure make it*	Tanker car	• Boyle's Law Lab ○ Version II		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5**

collapse?		• Pressure Conversions • Boyle's Law Calculations ○ More practice (optional) Ongoing Assignment (homework) • Tanker car summary table OpenStax • 8.1 Gas Pressure • 8.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law Resources • Boyle's Law Notes • Boyle's Law CK-12 Chapter		• **Using mathematics and computational thinking** to find the **patterns** between two systems when pressure or volume is changed. **Learning Target:** I can use mathematics and computational thinking with Boyle's Law to calculate an unknown volume or pressure when temperature remains constant. **Success Criteria:** • Use Boyle's Law to solve for an unknown variable (pressure or volume) ***What's next?*** *Students learn the mathematical relationship between pressure and volume when temperature and the amount of particles is held constant. They learned how the volume and pressure can play a role in an implosion: If the pressure increases, the volume decreases which is what happened in the tanker car. Students are probably wondering where temperature plays a role with gasses.*
EXPLAIN *Was there a temperature change that made the*	Tanker car	• Charles's Law Calculations		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and**

metal (tanker car) compress?		Ongoing Assignment (homework) • Tanker car summary table • Tanker car final model OpenStax • 8.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law Resources • Charles's Law Notes • Charles's Law CK-12		**computational** thinking to find **patterns** between two systems when temperature or volume is changed. **Learning Target:** I can use mathematics and computational thinking with Charles's Law to calculate an unknown volume or temperature when pressure remains constant. **Success Criteria:** • Use Charles's Law to solve for an unknown variable (temperature or volume) ***What's next?*** *Students learn the mathematical relationship between temperature and volume when pressure and the amount of particles are held constant. Students can make the connection that the weather, specifically the temperature, played a role with the change in volume of the tanker car. Students are probably wondering how temperature affects the other learned variable, pressure.*
EXPLAIN *Did the temperature change cause the gas*	Tanker car	• Gay-Lussac's Law Calculations		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and**

inside the tank to compress?		Ongoing Assignment (homework) ● Tanker car summary table OpenStax ● 8.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law Resources ● Notes ● Gay-Lussac's Law CK-12		**computational thinking** to find **patterns** between two systems when pressure or temperature is changed. **Learning Target:** I can use mathematics and computational thinking with Gay-Lussac's Law to calculate an unknown temperature or pressure when volume remains constant. **Success Criteria:** ● Use Gay-Lussac's Law to solve for an unknown variable (pressure or temperature) ***What's next?*** *Students learn the mathematical relationship between pressure and temperature when volume and amount of particles are held constant. Students can now connect back to the tanker car and claim that pressure is also affected by temperature. They are now wondering what happens if all 3 variables (temperature, pressure, and volume) are not held constant. They may also wonder how chemical reactions are affected by these gas laws or even if gas laws applies to them.*

EXPLAIN ***Performance Task***	• Students choose a real world phenomenon • Relate to Tanker Car	• *Gas Laws One-Pager- can be assigned for homework or give time in class to complete*		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Develop and use a model** to explain gas law **patterns** in a real world example. **Learning Target:** I can research a real world phenomenon and apply one of the 3 gas laws to describe the behavior of gasses by developing and using a model to find patterns between my real world phenomenon and the tanker car. **Success Criteria:** • See One-Pager directions
ELABORATE *What environmental factors made the tanker car collapse?*	Tanker car	• Combined Gas Laws Calculations Ongoing Assignment (homework) • Tanker car summary table • Homework worksheet Resources • Notes • Combined Gas Laws CK-12		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and computational thinking** to find the **patterns** between two systems when pressure, temperature, or volume is changed. **Learning Target:** I can use mathematics and computational thinking combined with the combined gas law to solve for a variable when all 3 variables change.

				Success Criteria: • Use the combined gas law to solve for a variable (temperature, pressure, or volume) ***What's next?*** *Students learn how to calculate any of the three variables (pressure, temperature, volume) when comparing a "before" and "after" scenario when the amount of moles (n) are held constant. They see the mathematical relationship between each variable is still held true despite pressure, volume, and temperature not being held constant. Students can now use the combined gas law to explain the tanker car's volume (the crushing) is affected by the pressure (internal and external) and temperature. Students are now wondering what if the amount of particles or n is not held constant.*
ELABORATE *How does the amount of particles affect the other variables we talked about?*	Tanker car	• Ideal Gas Laws Calculations • Ideal Gas Law Lab OR • Deriving the gas laws lab Ongoing Assignment (homework) • Tanker car summary		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and computational thinking** to find **patterns** between two systems when pressure, temperature, volume, or moles (amount) is changed. **Learning Target:** I can use

		table OpenStax • 8.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law Resources • Notes • Ideal Gas Law CK-12		mathematics and computational thinking with the ideal gas law to calculate an unknown variable. **Success Criteria:** • Use the ideal gas law to calculate pressure, temperature, volume, or moles of gas. ***What's next?*** *Students learn how to calculate an unknown between two comparable scenarios when all four variables are not held constant. They learn the constant, R, which allows for the mathematical calculations to take place when all 4 variables are different. Students can utilize the ideal gas law to show that the amount of gas in the tanker car contributed to the implosion. Students may be wondering what happens to the pressure if there are more gasses in a mixture.*
ELABORATE *What happens to the pressure of a gas when gasses in a mixture have different pressures?*	Tanker car	• Partial Pressures Calculations (Dalton's Law) Ongoing Assignment (homework) • Tanker car summary table OpenStax		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and computational thinking** to determine **patterns** of adding gasses to a gas mixture. **Learning Target:** I can use mathematics and computational

		• 8.3 Stoichiometry of Gaseous Substances, Mixtures, and Reactions ○ Dalton's Law Resources • Notes • Partial Pressure CK-12		thinking with Dalton's Law of Partial Pressure to calculate the total pressure of a mixture of gasses. **Success Criteria:** • Use Dalton's Law to calculate the total pressure of a mixture of gasses ***What's next?*** *Students learn Dalton's Law of partial pressures and find out that each gas exerts a unique pressure, and when added together, they make the total pressure of the gas mixture. Students learned that there is a mixture of gasses contributing to the external pressure, which has an effect on the tanker car when other conditions are met. They now wonder what happens when there are chemical reactions involving gasses- do gas variables also affect chemical reactions with glasses?*
EVALUATE ***Quiz on Gas Laws through Ideal Gas Laws*** ***Study guide***				
Learning Sequence 2: Hydrogen Peroxide Decomposition 2 $H_2O_2(l) \rightarrow 2 H_2O(l) + O_2(g)$ Kinetics (1 Week)				

Driving Questions	Lesson Level Phenomena	Activity		What Should They Learn/Expected Outcome
ENGAGE *How does elephant toothpaste work?*	Hydrogen peroxide	Engage • Demo: Teacher Directions • Student worksheet for Demo and Video • What do we notice? Students write down observations that they see. • Attempt to make sense: Discussion board on Canvas: Based on your knowledge of chemical reactions, what do you think is happening here? ○ Have students make a comment of what they think and have them reply to other students. • Identify related phenomena: Class discussion • Develop questions and next steps Students will ask questions related to the demo. General Resources: • Driving Question Board ○ Question Formulation Technique (QFT)		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Asking questions** to determine the **cause and effect** of the overall chemical reaction. **Learning Target:** I can attempt to make sense and ask questions about the elephant toothpaste chemical reaction. **Success Criteria:** • Ask questions about how elephant toothpaste works • Attempt to make sense of the chemical reaction at the particle level ***What's next?*** *Students understand the gas laws and how they apply to gas particles in general. Now they are wondering how they apply to chemical reactions.*

EXPLORE *Why is the reaction so fast?*	Hydrogen peroxide	(Pick one lab or simulation) • Rate of Chemical Reaction Lab • Updated above lab to allow Google sheets graphs OR • Rate of Chemical Reaction Simulation Ongoing Assignment (homework) • Elephant toothpaste summary table Optional Demo • Catalyst in motion demo OpenStax • 17.2 Factors Affecting Reaction Rates Class Notes		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Analyzing and interpreting data** with a simulation to determine the **cause and effect** of increasing/decreasing temperature, concentration, surface area or adding a catalyst. • **Planning and carrying out investigations** to find **patterns** with changing different variables (temperature, concentration, etc.) in a chemical reaction to qualitatively determine the speed of the reaction. **Learning Target:** I can analyze and interpret data to determine if a reaction speeds up or slows down when temperature, concentration, or surface area increases or decreases. **Success Criteria:** • When temperature, surface area, or concentration increase, describe what happens to the rate of reaction • When temperature, surface area, or concentration decrease,

				describe what happens to the rate of reaction • Adding a catalysts speeds up the reaction rate ***What's next?*** *Students learn how temperature, catalysts, concentration, and surface area can play a role in how quickly or slowly chemical reactions occur. They figure out that a catalyst plays a role (the yeast) is why the chemical reaction occurs so quickly.They are now wondering how collisions play a role in how chemical reactions occur based on what they learned about kinetic molecular theory.*
EXPLAIN *How does the catalyst (yeast) make it so a lot more gas is produced?*	Hydrogen peroxide	• POGIL: Collision Theory OR • Collision Theory (with Key) OpenStax • 17.5 Collision Theory Ongoing Assignment (homework) • Elephant toothpaste summary table Class Notes		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Developing and using models** to find **patterns** to predict the behavior of gas molecules in terms of reaction rate. **Learning Target:** I can develop and use models to find patterns to identify the requirements needed for a successful reaction to occur between reactant particles. **Success Criteria:**

				- Explain the meaning of an effective collision. - Explain the requirements needed for a reaction to occur between reactant particles. ***What's next?*** *Students are able to apply what they learned in thermochemistry and apply the graphs to collision theory. Students now know that…* 1. *Sufficient energy to break bonds* a. *Activation energy is at a higher temperature and* ***catalysts*** *lower activation energy* 2. *Proper orientation* a. *More effective collisions means a faster reaction. So, more reactants/concentration= faster reaction* *Students may be wondering how we can mathematically figure out how much elephant toothpaste is made based on how much hydrogen peroxide we used.*

ELABORATE *Can I mathematically calculate these gas variables when given a balanced chemical equation?* *How does the rate of gas formation (or removal) by a chemical reaction affect the pressure and volume?*	Hydrogen peroxide	• Gas Stoichiometry • Mg and HCl Lab Ongoing Assignment (homework) • Elephant toothpaste summary table OpenStax • 8.3 Stoichiometry of Gaseous Substances, Mixtures, and Reactions Resources • Gas Stoichiometry CK-12		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Using mathematics and computational thinking** to find **patterns** of a chemical reaction affected by gas laws. • **Analyzing and interpreting data** to determine **patterns** to determine the rate of gas formation. **Learning Target:** I can use mathematics and computational thinking using stoichiometry and the ideal gas law to apply to chemical reactions and calculate the amount of gas produced. **Success Criteria:** • Use stoichiometry for conversions in a chemical reaction • Use the ideal gas law to calculate an unknown variable ***What's next?*** *Students learn how to apply gas laws to stoichiometry and are able to make calculations using gas laws equations and balanced chemical reactions to show that the rules can apply to chemical reactions as well.*

				Students can now confidently explain the chemical reaction of elephant toothpaste and how it relates to gas laws and kinetics.
EVALUATE **Performance Task (Lab)** • HS-PS1-5	Dissolving Sugar Lab	*Kinetics Assessment - Performance Task (Lab)* • *Creativity Assignment*		**DCI/SEP/CCC: SWBAT…** • **HS-PS1-5** • **Constructing explanations and designing solutions** by using **patterns** related to the rate of reaction of gasses by designing their experiment.

EVALUATE

- HS-PS1-5

Gas Laws and Kinetics Assessment

Resources:
Possible Assessment Questions
Study guide

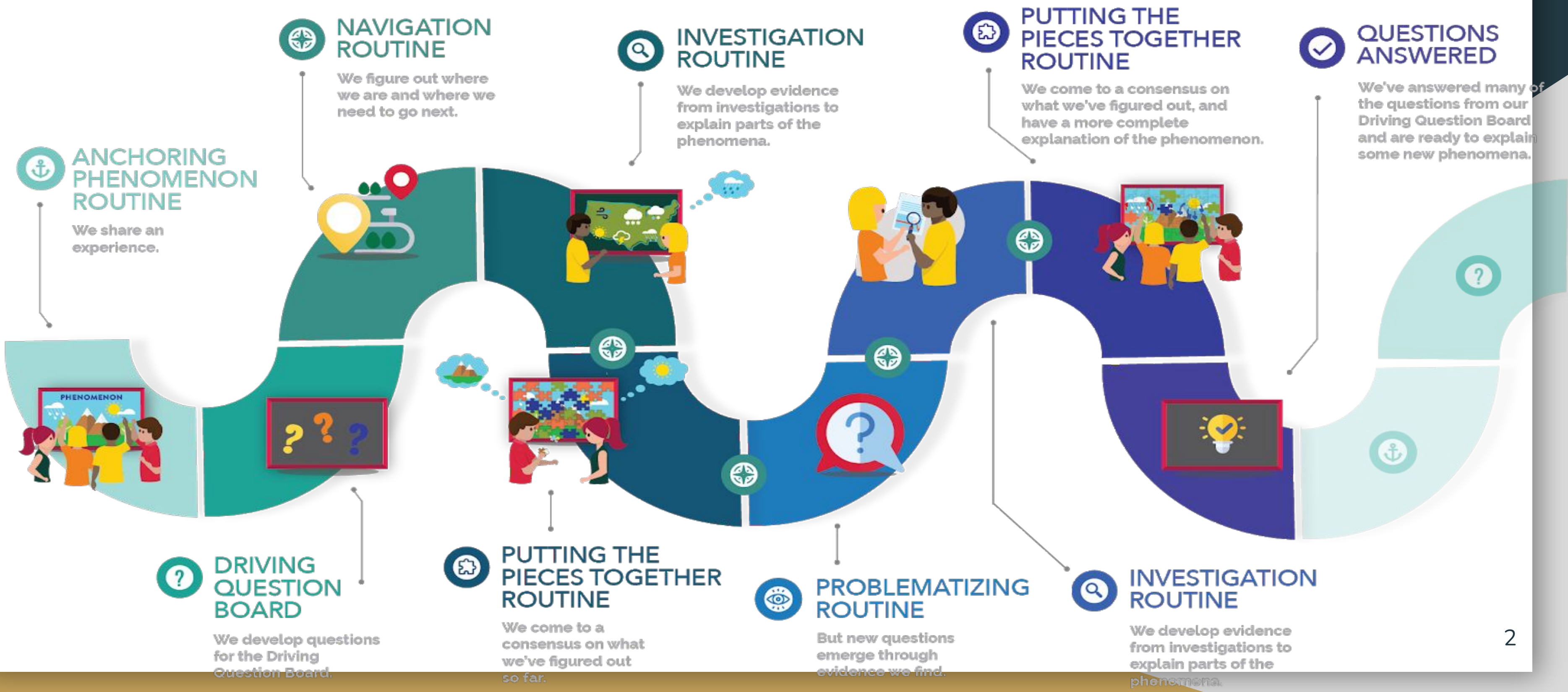
- Review gasses WS
- Gasses google slides

Accelerated General Chemistry

Bundle 4

Lisa Daigle

Curricular Sequence for Each Bundle



Bundle 4: Gas Laws and Kinetics

Composed of 2 Learning Sequences:

Tanker Car

How did the tanker car implode?

Focus on Kinetic Molecular Theory and Gas Laws (includes Ideal Gas Law)

Elephant Toothpaste

How does elephant toothpaste work?

Focus on gas stoichiometry, reaction rate of chemical reactions, and collision theory

How did the tanker car implode? First Steps

What do we notice?

Students watch a video of a tanker car implosion and make observations based on what they saw.

Attempt to Make Sense

Students use what they know to make a scientific explanation by making a model or contributing to a class discussion board with their ideas (focus on molecular level)

Identify Related Phenomenon

Crushing the can experiment (implosion)

Ask Questions

How does elephant toothpaste work? First Steps

What do we notice?

Students observe the elephant toothpaste demonstration and make observations.

Attempt to Make Sense

Students may explain the chemical reaction, but they need to be able to explain what is happening at the molecular level and why it happens so quickly.

Identify Related Phenomenon

Another chemical reaction that happens quickly

Ask Questions

4C Activity: Performance Task

Creativity

Kinetics Performance Task

In a lab where students design a procedure, students connect the rate of dissolving sugar to what they know about reaction rates in a chemical reaction. Students then apply the kinetics of reactions to elephant toothpaste.

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only X **Board Meeting Date** **October 12 2023**

Decision Requested **Agenda Code** **10 i.**

AGENDA REPORTING FORM

Agenda Topic: SHS – Accelerated General Chemistry – Unit #5 – Flint Water Crisis – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the SHS – Accelerated General Chemistry – Unit #5 – Flint Water Crisis.

Background:

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the SHS – Accelerated General Chemistry – Unit #5 – Flint Water Crisis to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Frank Pepe
Signature of Staff Member Submitting Report

Steven Madancy
Signature of Superintendent of Schools

HS-PS1 Flint Water Crisis

Unit Overview	
Unit Title:	Bundle 5: Flint Water Crisis
Teacher:	Lisa Daigle
Grade Level/Course:	9-12/Accelerated General Chemistry
Length/Dates:	5 Weeks
Unit Summary: 2-4 sentences describing the main ideas, content and skills of the unit.	By exploring the Flint Water Crisis in Flint, Michigan, students learn about solutions, equilibrium, and acids and bases in chemistry. Students will be able to describe how the water was contaminated in Flint, Michigan and why people can't drink it by describing the chemistry behind it.

Explanation
Select PEs that work together (bundle) to promote proficiency in using ideas expressed. Often a bundle will include PEs from a single NGSS topic or DCI, but a bundle could draw in PEs from other topics or DCIs.
PE(s) to be addressed (include assessment boundaries and clarification statements). **Bundle** ● HS-PS1-6. **Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*** [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]

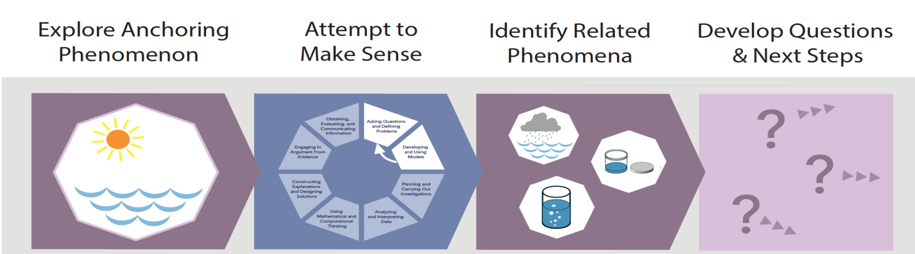
Unpack DCI(s), SEPs, and CCCs coded to the PEs to identify implications for instruction.

SEP Implications	DCI Implications	CCC Implications
Science and Engineering Practices **Constructing Explanations and Designing Solutions** 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. • Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.	**Disciplinary Core Ideas** **PS1.B: Chemical Reactions** • In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary)*	**Crosscutting Concepts** **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable.

Transfer Goals (Vision of the Graduate)
List the long-term and/or school-wide independent student behaviors that this unit will address.

Communication Transdisciplinary Goal:
Students effectively communicate and use interpersonal skills in a range of formal and informal contexts.

Phenomenon



Explore Anchoring Phenomenon: Flint Water Crisis

Attempt to Make Sense: Explore through the Google Slides presentation to make sense of how the water became so toxic.
Identify Related Phenomena: Pollution

Develop Potential Student Questions

- How did Pb (lead) get in the water?
- Why is the water so toxic to people?
- What's in the water?
- How much lead is in the water?

Possible Unit Level Phenomena: Students should be able to determine why the Flint water is so deadly based on understanding solutions, chemical equilibrium, and acids and bases. They will be able to construct an explanation at the chemical level on how this unfortunate phenomenon was able to occur.

Sample Explanation: The Flint water is made up of a solution of water and toxic lead (Pb) ions. This means that Pb is uniform throughout the water available to Flint residents and they can't really see the Pb because of this homogenous mixture. The solution was created due to the corrosion of the lead pipes. Oxygen, an oxidizing agent present in water, reacts with exposed lead, which makes the Pb^{2+} ions in the water. The full reaction is $2Pb + O_2 + 2H_2O$---> $Pb(OH)_2$. To stop the lead ions from being present in the water, the city should add in PO_4^{3-} (phosphate) to stop the lead from leaching into the water and create lead II phosphate. Theoretically over time, this should stop the lead from leaching into the water and stop the previous chemical reaction from happening. When the water source was switched to the Flint river, it was not treated with phosphate ions! This allowed the other reaction to happen, which means that lead would always be in the water. Another protective layer, $PbCO_3$, is also breaking down due to the poor pH of the water. The chemical equilibrium equation is as follows: $PbCO_{3-}$<---> $Pb^{2+} + CO_3^{2-}$ The pH should be around 10, but the Flint water is around 7 or 8, so the solubility of the $PbCO_3$ decreases. Also, because the water has a lower pH than it should, this means there are more $H^{+,}$ ions for the CO_3^{2-} to react with, which means our equilibrium equation would be out of balance. The negligence of the correct authorities to treat the water with phosphate ions as well as not maintain the pH made both protective layers break down over time, and therefore, the water became toxic with lead.

Background Research

- https://www.acs.org/content/acs/en/education/resources/highschool/chemmatters/past-issues/2016-2017/december-2016/flint-water-crisis.html#:~:text=A%20 few%20months%20later%2C%20 Flint,chlorine%2C%20bromine%2C%20or%20iodine.
- https://cen.acs.org/articles/94/i7/Lead-Ended-Flints-Tap-Water.html
- https://cen.acs.org/search.html?q=flint&sortBy=relevance&rpp=10&startYear=1998&startMonth=08&startDay=01&endYear=2022&endMonth=05&endDay=26&topics=all
- https://www.materialsperformance.com/articles/material-selection-design/2016/06/the-science-behind-it-corrosion-caused-lead-tainted-water-in-flint-michigan
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5353852/

- https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1044&context=tdr
- https://www.chemistryworld.com/opinion/inside-flints-water-crisis/4011316.article
- https://www.pbs.org/newshour/science/study-confirms-lead-got-flints-water
- https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know
- https://www.acsh.org/news/2022/01/04/flint-water-dept-failed-its-chemistry-test-16034
- https://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/issues/2016-2017/December%202016/chemmatters-dec2016-flint-water-crisis.pdf

POPULAR MEDIA

- https://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a-crisis
- https://apnews.com/article/us-news-health-michigan-rick-snyder-flint-7295d05da09d7d5b1184b0e349545897
- https://www.consumernotice.org/environmental/water-contamination/flint-michigan/
- https://www.vox.com/2016/2/15/10991626/flint-water-crisis

Bundle 5: Flint Water Crisis			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
ENGAGE *What is the issue with Flint's water?*	Presentation	Engage • • What do we notice? Show this: Flint Google Slides • Attempt to make sense: Have students write down observations of the google slides and try to answer the initial question. • Identify related phenomena: Pollution • Develop questions and next steps General Resources: • Driving Question Board ○ Question Formulation Technique (QFT)	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Asking questions** and determining the **cause and effect** of the Flint Water Crisis **Learning Target:** I can ask questions about the chemistry behind the Flint Water. **Success Criteria** • Ask questions about Flint Water at the particle level ***What's next?*** *Students already know the different properties of water, but what they don't know is how it can become so toxic.*

			Students will explore solutions, equilibrium, and acids and bases in order to figure out why the Flint water is so toxic.
Learning Sequence 1: Solutions			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
EXPLORE *How did the lead dissolve in the water?*	Flint Water	• Solutions Basics • Solutions Lab OpenStax • 11.3 Solubility • 6.3 Molarity • 6.4 Other Units for Solutions Resources • Solutions CK-12 • Class Notes	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Constructing an explanation** of the basics of solutions by understanding the **structure and function** of solutions. • **Planning and carrying out an investigation** to determine the **cause and effect** of dissolving a solute in a solvent. **Learning Target:** • I can construct an explanation by naming the solute and solvent in the Flint Water Crisis to describe the solution. • I can carry out an investigation to see the cause and effect of dissolving salt in a solution. **Success Criteria**: • Define and name the solute and solvent in the solution • Make a saltwater solution and follow the directions on calculating mole fraction, molarity, molality, and density.

			What's next? *Students learn the components of a solution. They learn that the Flint water must be a solution, identifying the solute and solvent. Students then explore through a lab and create a saltwater solution. They are exposed to the math behind solutions, but don't have a full understanding yet that will be explained later in the unit. They may be wondering how the Flint water became a solution in the first place.*
EXPLAIN *How much lead can "fit" in the water?*	Flint Water	• POGIL: Solubility OR POGIL: Saturated and Unsaturated 1. Solubility Curve or 2. Solubility Curve • KNO3 solubility curve lab OpenStax • 11.3 Solubility • 6.3 Molarity • 6.4 Other Units for Solutions Resources • Notes • Class Notes • Saturated and Unsaturated Solutions CK-12 • Supersaturated Solutions CK-12 • Solubility Curves CK-12	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Analyzing and interpreting data** to determine the **stability and change** (unsaturated, saturated or supersaturated) of solutions. **Learning Target:** I can analyze and interpret data to determine unsaturated, saturated, and supersaturated solutions. **Success Criteria:** • Use a solubility curve to determine an unsaturated, saturated, or supersaturated solution. ***What's next?*** *Students learn how much solute can be dissolved in a solution. They learn what saturated, unsaturated, and supersaturated solutions are and can classify solutions based on a solubility curve graph. But they may be wondering if we can actually measure solute that's in a*

			solution and how we can figure that out.
EXPLAIN *How much lead is in the water?*	Flint Water	• Molarity Worksheet • Molarity/molality Calculations worksheet ○ Answer Key • Molarity Lab OpenStax • 11.3 Solubility • 6.3 Molarity • 6.4 Other Units for Solutions Resources • Molarity CK-12 • Class Notes • POGIL: Molarity	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Using mathematical and computational thinking** to mathematically explain the **structure and function** of solutions. **Learning Target:** I can use mathematical and computational thinking to calculate molarity and molality of a solution. **Success Criteria:** • Calculate molarity • Calculate molality ***What's next?*** *Students learn how to measure solute in a solution by doing molarity and molality calculations. They will need to figure out the solution chemistry behind Flint's water.*
ELABORATE *What is the solution chemistry behind Flint Water Crisis?*	Flint Water	**Flint Water Crisis Connection 1** ENRICHMENT: 11 Year old girl invents lead detecting device	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Constructing explanations** to explain the **stability and change** of the Flint water solution. **Learning Target:** I can construct an explanation for Flint's water using solution chemistry. **Success Criteria** • Analyze the solution chemistry

			behind the crisis ***What's next?*** *Solutions are now understood, but now students may be wondering what chemical reaction may be happening with the Flint water.*
EVALUATE **LS1 Assessment:** Quiz on Solutions Study guide • **HS-PS1-6**			
Learning Sequence 2: Equilibrium			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
ENGAGE *What does it mean when a solution reaches equilibrium?*	Flint Water	• Dynamic Equilibrium Introduction • Soda Straw Lab ○ Analysis questions for electronic submission	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Analyzing and interpreting data** to determine the **stability and change** when a solution is in equilibrium. **Learning Target:** I can analyze and interpret data to figure out what equilibrium means. **Success Criteria** • Describe what equilibrium means ***What's next?*** *Students learn that equilibrium does not mean that both sides are equal but rather the amounts removed or added are the same when something reaches equilibrium. Now that they know what equilibrium means, they are ready to*

			explore chemical reactions. They may be wondering how this applies to the lead pipes.
EXPLORE *Is there a chemical reaction?*	Flint Water	 • POGIL: Equilibrium ○ Answers • Graphing Equilibrium OpenStax • 13.1 Chemical Equilibria Resources: • Chemical Equilibrium CK-12	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Analyzing and interpreting data** to determine the **stability and change** of chemical equilibrium. **Learning Target:** I can analyze and interpret data to quantify equilibrium. **Success Criteria** • Determine what equilibrium means mathematically ***What's next?*** *Students learn that some chemical reactions are in equilibrium and dynamic. They also learn how to quantify equilibrium. Students are probably wondering what different factors affect the chemical reaction.*

EXPLAIN
What factors can affect equilibrium?
	Flint Water	• Le Chatelier's POGIL OR Influencing Reaction Equilibrium
		    ○ Le Chatelier's Principle POGIL answers
		• Pick a couple for practice:
		    ○ Practice worksheet
		    ○ Equilibrium and Breathing
		• Le Chatelier's Principle Worksheet with answers
		    ○ Same worksheet without answers
			DCI/SEP/CCC: SWBAT…
			• **HS-PS1-6**
			• **Analyzing and interpreting data** to find the **stability and change** in a chemical reaction when variables are manipulated.
			
			Learning Target: I can analyze and interpret data to describe shifts in equilibrium using Le Chatelier's Principle.

		• Le Chatelier's Principle Lab OpenStax 13.3 Shifting Equilibria: Le Chatalier's Principle Resources • Notes • Notes Google slides • Le Chatelier's Principle CK-12 • Effect of Concentration CK-12 • Effect of Temperature CK-12 • Effect of Pressure CK-12	**Success Criteria** • Use Le Chatelier's Principle to describe shifts in equilibrium with changes to pressure/volume, concentration, and temperature. ***What's next?*** *Students learn Le Chatelier's Principle describes changes in a chemical reaction when there is a disturbance. Students understand that there are different factors that can affect equilibrium. They are now wondering what the reversible reaction is inside the lead pipes and how it plays a role in the toxic lead levels in the water.*
ELABORATE Why is there a lot of lead in the water?	Flint Water	• Equilibrium expressions packet • Equilibrium Expressions practice problems OpenStax 13.4 Equilibrium Calculations	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Use mathematical and computational thinking** to find the **stability and change** in a chemical reaction. **Learning Target:** I can use mathematical and computational thinking to calculate K_{eq} in a reversible chemical reaction to determine if reactants or products are favored. **Success Criteria** • Calculate the K_{eq} of a balanced chemical equation. ***What's next?*** *Students learn how to mathematically calculate if more products or reactants are made in a reversible reaction. They can now apply this to the Flint Water chemical equation to see if the*

			reactants or products are favored in the reversible reaction.
ELABORATE *What is solubility equilibrium and how does it relate to the Flint Water crisis?*	Flint Water	• **Flint Water Crisis Connection 2** ○ Teacher Resource: From this article	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Constructing an explanation** by looking at the **stability and change** of the contaminated water in Flint. **Learning Target:** I can construct an explanation for the equilibrium chemistry behind the Flint Water Crisis. **Success Criteria** • Apply equilibrium chemistry to Flint Water Crisis ***What's next?*** *Students learn that solubility equilibrium relates to the Flint water crisis because of the lead corrosion in the pipes. Next, students will be introduced to acids and bases.*
EVALUATE Quiz on Equilibrium • **HS-PS1-6**			

Learning Sequence 3: Acidity in the Water: Acids and Bases			
Driving Questions	**Lesson Level Phenomena**	**Activity**	**What Should They Learn/Expected Outcome**
ENGAGE *What makes a solution acidic or basic?*	Flint Water	• Determining acids and bases lab OR pH of Soil Lab	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Analyzing and interpreting data**

		○ For pH of Soil lab, use the pH sensors we have and be sure to charge them up a day or so before you use them. OpenStax • 14.1 Bronsted-Lowry Acids and bases Resources • Acids CK-12 • Bases CK-12	to find **patterns** with acids and bases. **Learning Target:** I can analyze and interpret data to classify a base and an acid. **Success Criteria:** • Find the pH of soil OR different substances • Analyze the data to draw conclusions ***What's next?*** *Students learn the differences between acids and bases. They may be wondering what makes something acidic or basic.*
EXPLAIN & EXPLORE *What's happening at the molecular level?*	Flint Water	• POGIL: Acids & Bases • Equations for Acids and Bases • Conjugate acid-base pairs Extension • Naming Acids	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Analyzing and interpreting data** to find **patterns** with acids and bases. **Learning Target:** I can analyze and interpret data to classify a base and an acid. **Success Criteria:** • Determine an acid or a base • Describe and explain a Bronsted-Lowry acid/base • Describe and explain an Arrhenius acid • Figure out the conjugate acid and base in a chemical equation

EXPAIN *How do we describe the acidity (or basicity) of a solution?*	Flint Water	• Calculations for acids and bases **Extension**: • Hydrolysis of Salts Lab • Strong vs Weak Acid Calculations For students who may need more support with math: • POGIL: pH ○ Answers OpenStax • 14.2 pH and pOH Resources • Notes • Calculation pH CK-12 • pOH Scale and Calculations	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Using mathematical and computational thinking** to find **patterns** when calculating pH. **Learning Target:** I can use mathematical and computational thinking to determine the pH and pOH or concentration H_3O^+ or OH^- in an acid and a base. **Success Criteria** • Determine the concentration of H_3O^+ or OH^- in an acid or a base • Determine the pH or pOH when given the concentration of H_3O^+ or OH^- • Determine the pH or pOH when given the other value • Determine the pH or pOH when provided the concentration of H_3O^+ or OH^- ***What's next?*** *Students get a better understanding of acids and bases and it has to do with H^+ and OH^- ions in solution. They may be wondering how we measure how acidic or basic something is in a solution.*

EXPLAIN *How do we accurately determine the amount of acid (or base) in a solution?*	Flint Water	• Titration Lab • Titration calculations OpenStax • 14.7 Acid-Base Titrations Resources • Notes • Titration Experiment CK-12 • Titration Calculations CK-12	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Planning and carrying out an investigation** to determine the **stability and change** of a solution through a titration experiment. **Learning Target:** I can plan and carry out an investigation to perform a titration. **Success Criteria:** • Be able to successfully perform a titration experiment • Use the dilution equation to calculate the molarity of a solution ***What's next?*** *Students learn how to measure the amount of acid or base in a solution through a titration. The next step would be to apply what we learned about acids and bases to the Flint water crisis because the water is acidic.*
ELABORATE *How does the pH affect the water quality?*	Flint Water	• **Flint Water Crisis Connection 3** ○ Teacher Resource: From this article	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Constructing an explanation** of how the basic water affects the chemistry of Flint by looking at the **patterns** of acids and applying it to acidic water. **Learning Target:** I can construct an explanation behind the acid/base chemistry in the Flint Water. **Success Criteria:**

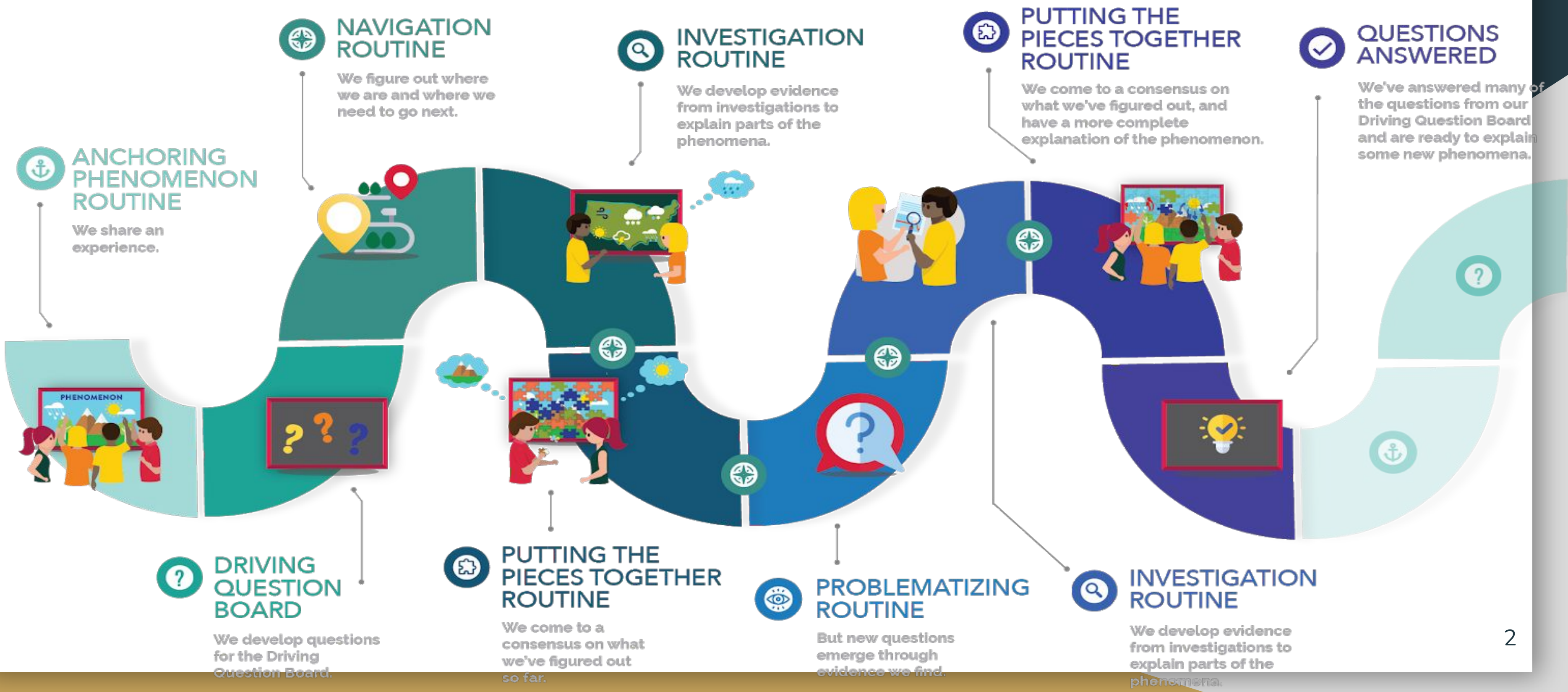
			Gather information to describe the acid/base chemistry of the Flint water. ***What's next?*** *The students learn how acidic the water in Flint is and are able to apply what they learned about acids to the Flint water.*
EVALUATE Quiz on Acids-Bases • **HS-PS1-6**			
EVALUATE *SOCIAL JUSTICE*	Flint Water	• "Social Media" Post ○ Students are not required to post on actual social media but rather to make a social media-like post ○ Social Media Tips ■ Students can have access as a guide. ■ Teachers can also use as a guide to make sure students use their chosen platform correctly ○ 4C assignment: Communication	**DCI/SEP/CCC: SWBAT…** • **HS-PS1-6** • **Obtaining, evaluating, and communicating information** by discussing the **stability and change** of the Flint water. **Learning Target:** I can obtain, evaluate, and communicate information to describe the chemistry behind the Flint Water Crisis. **Success Criteria:** *See Rubric*

Accelerated General Chemistry

Bundle 5

Lisa Daigle

Curricular Sequence for Each Bundle



Bundle 5: Flint Water Crisis

Composed of 3 Learning Sequences:

Solutions

What's in the Flint Water?

Focus on components of a solution, solubility curves, molarity and molality calculations

Chemical Equilibrium

What does it mean when solutions reach equilibrium?

Focus on chemical equilibrium, Le Chatelier's Principle, and equilibrium expressions

Acids and Bases

What makes a solution acidic or basic?

Focus on acids and bases including pH and concentration calculations and titrations

What's in the Flint Water? First Steps

What do we notice?

Students read about what's in the Flint Water and write down observations from the interactive google slides

Attempt to Make Sense

Students try to explain why there is lead in the water at the molecular/atomic level

Identify Related Phenomenon

Pollution

Ask Questions

What does it mean when solutions reach equilibrium? First Steps

What do we notice?

Students know about solutions and what is in the water, but now they notice there must be something going on to make this solution possible

Attempt to Make Sense

Students try to explain why the lead water is soluble in the water sample

Identify Related Phenomenon

Pollution, potential chemical reactions that cause pollution

Ask Questions

What makes a solution acidic or basic? First Steps

What do we notice?

Students understand that the chemical equilibrium plays a role, but now they need to further explain the solubility of lead in the water beyond the chemical reaction

Attempt to Make Sense

Students make an explanation at the molecular/atomic level to describe why lead is soluble in the water and add to their explanation

Identify Related Phenomenon

Acids and bases

Ask Questions

4C Activity: Performance Task

Communication

Create A Social Media Post

Students create a fake social media post in their groups in any format they choose to communicate the information appropriately about the chemistry behind the Flint Water.

BOARD OF EDUCATION
SOUTHINGTON, CONNECTICUT

Informational Only ________X__________________ **Board Meeting Date** October 12, 2023

Decision Requested______________________ **Agenda Code**________10 j.______________

AGENDA REPORTING FORM

Agenda Topic: Middle School Needs Assessment – First Reading.

Summary of Issue: The Curriculum & Instruction Committee has reviewed the Middle School Needs Assessment.

Background: ____

____

Alternative Strategies: N/A

Cost (if applicable): N/A **Funding Source:** N/A

Beginning Date of Program or Project: N/A

Ending Date of Program or Project: N/A

Recommendation or Comment: The Board of Education Curriculum & Instruction Committee is bringing the Middle School Needs Assessment to the full Board for a First Reading.

Titles of Attachments:

1. Course Proposal

Signature of Staff Member Submitting Report

Signature of Superintendent of Schools

You are viewing Naviance Student as [redacted]

EN

6th Grade Needs Survey

Note: You will be logged out of the survey after one hour if you have not changed the page.

This is a short questionnaire about you and what you need. Please take it seriously and answer honestly. This information will be used by your school counselor to determine the programs that are necessary and will be available for 6th grade. Thank you!

* 1.

I need help/to talk about making friends/fitting in

- ◯ Yes
- ◯ No

Please provide an answer

* 2.

I need help/to talk about dealing with peer pressure

- ◯ Yes
- ◯ No

Please provide an answer

* 3.

I need help/to talk about getting involved with school activities

◯ Yes

◯ No

⚠ Please provide an answer

* 4.

I need help/to talk about anxiety/worrying about school

◯ Yes

◯ No

⚠ Please provide an answer

* 5.

I need help/to talk about anxiety/worrying about home

◯ Yes

◯ No

⚠ Please provide an answer

* 6.

I need help/to talk about concerns with drug/alcohol use (me or someone else)

○ Yes

○ No

⚠ Please provide an answer

* 7.

I need help/to talk about concerns with helping myself (gaining more self confidence, feeling better about myself, expressing my thoughts/feelings)

○ Yes

○ No

⚠ Please provide an answer

* 8.

I need help/to talk about concerns with feeling sad or depressed

○ Yes

○ No

⚠ Please provide an answer

* 9.

I need help/to talk about wanting to hurt myself (self harm) in some way

◯ Yes

◯ No

⚠ Please provide an answer

* 10.

I need help/to talk about concerns with handling teasing, mean-spirited or bullying behaviors

◯ Yes

◯ No

⚠ Please provide an answer

* 11.

I need help/to talk about concerns with sadness over the loss of a loved one or pet

◯ Yes

◯ No

⚠ Please provide an answer

* 12.

I need help/to talk about concerns with dealing with anger

◯ Yes

◯ No

⚠ Please provide an answer

* 13.

I need help/to talk about concerns with parent divorce or separation

◯ Yes

◯ No

⚠ Please provide an answer

* 14.

I need help/to talk about concerns with feeling stressed (from home or school)

◯ Yes

◯ No

⚠ Please provide an answer

* 15.

I need help/to talk about concerns with skills for resolving conflicts/problems with others

◯ Yes

◯ No

⚠ Please provide an answer

* 16.

I need help with something not listed. Please write what you need help with below.

⚠ Please provide at least one answer.

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