Physical Science 2nd Semester Expectations *(Interactions Curriculum: Unit 2 Part 2, Physics Units= 18 Weeks)*

<table>
<tr><th>Unit</th><th colspan="3">Standards addressed in that Unit</th><th>Learning Objectives</th><th>Pacing</th></tr>
<tr><td rowspan="2">Unit 2: Part 2
How does a small spark trigger a huge explosion?

Investigation 3: How can a small spark start a huge explosion?

Energy & Matter</td><td colspan="3">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.</td><td rowspan="2">This investigation focuses on how electric forces and energy are connected to molecules. Students will explore various simulations to build their understanding of the relationships among electric forces, energy, and the relative distance of two atoms. They will also explain the energy transfers that occur when molecules form and break using the concept of conservation of energy (developed in previous investigations).

Pretest (45 min)
Activity 3.1 Why are some materials explosive, while others are not? (80 min)
Activity 3.2 What holds the atoms of a molecule together? (120 min)
Activity 3.3 When atoms get close to each other, what happens to their potential energy? (120 min)
Activity 3.4 Why is a spark needed to start an explosion? (60 min)

Teacher Guide:
https://drive.google.com/file/d/0B3CjsmmlXRF-Uzg0a1JzSUJxSmM/view</td><td rowspan="2">4 Activities

4 Weeks</td></tr>
<tr><td><u>Developing and Using Models</u> 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-PS1-4)</td><td><u>PS1.B: Chemical Reactions</u>
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. (HS-PS1-4)</td><td><u>Energy and Matter</u>
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. (HS-PS1-4)</td></tr>
<tr><td rowspan="2">Unit 2: Part 2
How does a small spark trigger a huge explosion?

Investigation 4: Where does all the energy in an explosion come from?

Energy in Chemical Reactions</td><td colspan="3">*HS-PS1-4*
HS-PS3-2

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.

***BCPS ads in Balancing Equations in 4.2.</td><td rowspan="2">In this investigation, students will construct a model of chemical reactions involving energy and electrostatic interactions. Students learn that a chemical reaction is a process that involves the atoms of substances rearranging to form new substances and that to start any chemical reaction, energy is needed to break bonds in the reactants. Students will compare reactions and changes in energy. Students develop several models to describe observations of reactions.

Activity 4.1 What energy changes occur during an explosion? (90 min)
Activity 4.2 What happens to atoms during a chemical reaction? (200 min)
Activity 4.3 What changes in energy occur when atoms rearrange during a chemical reaction? (120 min)
Activity 4.4 How does a spark trigger an explosion? (20 min)
Post Test (45 min)

Teacher Guide:
https://drive.google.com/file/d/0B3CjsmmlXRF-bDF5VGZZZDR0eXM/view</td><td rowspan="2">4 Activities

4 Weeks</td></tr>
<tr><td><u>Constructing Explanations and Designing Solutions</u>
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. (HS-PS1-5)</td><td><u>PS1.B: Chemical Reactions</u>
*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. (HS-PS1-5)</td><td><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. (HS-PS1-5)</td></tr>
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<tr><td>Unit 3
What powers a Hurricane?

Unit 4
Why is a temperature of 107 so deadly?

(Optional, if time allows)</td><td colspan="3">Unit 3 builds towards NGSS PEs HS-PS1-3 and HS-PS3-2

Unit 4 builds towards PE HS-PS3-5 and PE HS-LS1-6

Unit 3, Activity 1 - Properties of matter
What makes water special?

Unit 3, Acctivity 2 - Energy and Particle Motion
What happens to the energy of water molecules during hurricanes?

Unit 4, Activity 1- Polar interactions and bonding
How are interactions with water important for maintaining my life?

Unit 4, Activity 2 - Non-Polar Interactions and Bonding
Why can't you uncook an egg?</td><td>How are water and other liquids similar and different?
Why is water different from other liquids?
Is Oxygen really that special?
How does electron distribution affect our observations?
What does boiling water do to molecules?
How hot can water get?
How does energy change when evaporation is reversed?
Why don't oil and water mix?
Can a substance dissolve in both nonpolar and polar?
What are proteins and how do they fold into biologically important shapes?
How do polar interactions affect protein structure and properties?
How do nonpolar interactions affect protein structure and properties?
Why can't you uncook an egg?</td><td></td></tr>
<tr><th>Unit</th><th colspan="3">Standards addressed in that Unit</th><th>Learning Objectives</th><th>Pacing</th></tr>
<tr><td>Laws of Motion</td><td colspan="3">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.

HS-PS2-2 Use Mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

<u>Analyzing and Interpreting Data</u>
*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. (HS-PS2-1)

<u>Constructing Explanations and Designing Solutions</u>
* Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3)

<u>PS2.A: Forces and Motion</u>
*Newton’s second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)
*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-PS2-3)

<u>ETS1.A: Defining and Delimiting Engineering</u>
*Problems 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)

<u>ETS1.C: Optimizing the Design Solution</u> *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 (tradeoffs) may be needed. (secondary to HS-PS2-3)

<u>Cause and Effect</u>
*Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2- 1)
*Systems can be designed to cause a desired effect. (HS-PS2-3)</td><td>Students will be able to calculate velocity and acceleration.

Students will demonstrate the effect of balanced and unbalanced forces on an object.

Students will be able to apply Newton’s three laws to everyday situations.

Students will be able to calculate amounts of work and mechanical advantage for simple machines and predict which machine would have the greatest mechanical advantage.

<u>NGSS Backwards Designed BCPS Teacher Created Unit</u>
Lesson Questions
Preteaching:
What does a speedometer measure? and
What is the difference between fast/slow? And
What is the difference between speed and velocity?
What do we call a change in an object’s motion?
How do we measure that?
What is a concussion?
What is a concussion?
Why does it occur?
How does the mass and acceleration affect force on the head?
How does a helmet work?
What is momentum and how does a helmet conserve momentum?
How does a helmet reduce force?
How does time reduce the force?-airbag
What happens to old helmets?
The evolution of a helmet over time: Students can create a timeline
Final Presentation and model</td><td>9 Lessons

5 Weeks</td></tr>
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<tr><td rowspan="2">Waves</td><td colspan="3">HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-5 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.</td><td rowspan="2">What are the characteristics of mechanical and electromagnetic waves?

How do changes in one part of a wave affect other parts of a wave?

How are sound waves affected by changes in amplitude and pitch?

How are sound waves affected by medium? How are characteristics of electromagnetic waves affected by medium?

How are wavelengths detected by the human eye?

<u>Modeling:</u>
https://www.dropbox.com/sh/1z8yce3gge9jbya/AAC0cqnZMmXYBfbFgxCvbfHTa?dl=0

or

<u>Teacher Guide:</u>
http://www.troup.k12.ga.us/userfiles/929/my%20files/science/ms%20science/8th%20science/waves/waves_resources_scholpointe.pdf?id=24178</td><td rowspan="2">3 Weeks</td></tr>
<tr><td><u>Using Mathematics and Computational Thinking</u>
* Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-PS4-1)

<u>Obtaining, Evaluating, and Communicating Information</u>
*Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually , and mathematically). (HS-PS4-5)</td><td><u>PS4.A: Wave Properties</u>
*The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1)
*Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-5)

<u>PS4.B: Electromagnetic Radiation</u>
* Photoelectric materials emit electrons when they absorb light of a high-enough frequency . (HS-PS4-5)

<u>PS4.C: Information Technologies and Instrumentation</u>
*Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4- 5)</td><td><u>Cause and Effect</u>
*Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)
* Systems can be designed to cause a desired effect. (HS-PS4-5)</td></tr>
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