Physical Science

2020 - 2021 Course Outline

**Course outlines are updated annually. Please request the current year's outline from your HST.*

SUGGESTED BREAKDOWN

- Semester 1 - Units 1, 2, and 3
- Semester 2 - Units 4 and 5, and the portfolio

COURSE OVERVIEW

This physical science course addresses overarching ideas of two branches of science, chemistry and physics, in accordance with the Next Generation Science Standards (NGSS), which emphasize critical thinking and engineering practices. Students will develop strong communication skills to communicate their questions, hypotheses, methods, and findings. Students will incorporate graphs and tables to represent their quantitative and qualitative data and use this evidence to support their claims. Upon completing the class, students will have foundational scientific knowledge of the laws and theories regarding matter and energy that encourages the application of science to real-life contexts.

COURSE REQUIREMENTS

To earn credit for the course, students must complete the following:

1. **Unit Assignment(s)**
2. **Demonstrated evidence of learning** course content/skills
3. **End of year portfolio (a portfolio check will be completed at the end of the first semester)**
    a. The end of year portfolio includes a copy of this outline, with the demonstrated evidence of learning options filled in.
4. **Presentation of student portfolio** to HST at the end of the year.

Specific details and directions for items 1-3 are below and embedded within the units. Directions and a grading rubric for the portfolio are at the end of the outline, as well as a suggested grading breakdown for each semester. It is highly encouraged that the HST and the student review the End of Semester Portfolio guidelines together at the start of the semester.

DEMONSTRATED EVIDENCE OF LEARNING

Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments. The HST will review the evidence of learning and determine if it shows proficiency. Evidence of mastery can be shown by completing:

- Curriculum chapter/unit questions
- Content worksheets
- Labs and Lab Reports
- Projects/presentations
- Discussions

STUDENT COURSE NOTES

Students may utilize the format of their choice to take notes within their selected curriculum. Notes can be handwritten or typed. To earn completion for this course requirement, notes must be included in the student portfolio, detailed, and organized in a way that shows student understanding and synthesis of information. A suggested notetaking method can be found HERE.

ACADEMIC INTEGRITY & MLA FORMAT

Academic Integrity is the moral code or ethical policy of academia. This includes values such as avoidance of cheating or plagiarism; maintenance of academic standards; honesty and rigor in academic work. HSTs should review Academic Integrity expectations with their students each year. This is a great resource for review.

All research assignments and essay responses must follow MLA format (typed, double spaced, 12 pt font). They should include an introduction with appropriate background information and a thesis statement. Assignments of this nature must also cite a minimum of two sources. A works cited page must also be included. *Here is a link to MLA formatting guidelines: https://owl.purdue.edu/owl/research_and_citation/mla_style/mla_formatting_and_style_guide/mla_general_format.html*

To access documents for the course click here.

Unit 1: Introduction to Matter: Atoms, Elements, and the Periodic Table Focus of the unit is on learning the scientific method, the different types of matter and the periodic table.	
Date	**SKILL TO BE DEMONSTRATED** Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments, such as chapter questions, worksheet, assessment, report, lab, presentation, discussion, etc.
	Students will understand scientific methods; including an introduction to different ways of setting up an experiment using the necessary variables, determining bias, using various tools for measurement, converting units, and analyzing data using graphs. **In what way did you demonstrate your learning?**
	Students will learn to use basic tools to measure data, such as tape and metric ruler, calculator, balance, graduated cylinder, beaker and thermometer. **In what way did you demonstrate your learning?**

	Students will learn to differentiate between atoms, elements, molecules, and compounds, and use patterns in the periodic table to identify and explain atomic number, atomic mass and predict properties of metals, nonmetals, and metalloids. **In what way did you demonstrate your learning?**
	Students will understand the physical and chemical properties of the three states of matter, and differentiate between physical and chemical properties. **In what way did you demonstrate your learning?**
	Students will learn to calculate mass, volume, and density. **In what way did you demonstrate your learning?**

Unit 1 Assignment Options **In this unit, students will complete one total key assignments:**	
	Assignment: ● **Option 1:** Periodic Table Project - Students will research the periodic table and select an element of their choice from the periodic table. Using reference materials, articles, videos, Internet sites, etc., they will collect information about the periodic table and element, specifically: ○ Characteristics of periodic table and element, i.e., family group vs period ○ Physical and chemical properties of the element ○ Radioactivity, isotopes, electronegativity and ionization of the element ○ Discovery of the element, information about the location of the element and how it is obtained, and its uses. ■ The final model may be presented as: ● **Option 1:** Essay ● **Option 2:** Video ● **Option 3:** Poster Presentation ● **Option 4:** Students may submit an alternative option to the teacher for approval ● **Option 2:** Students will present an educationally equivalent option to the teacher for approval.

Unit 1 Lab Options **Students will complete one of the labs below: Lab Write-up**

	Option 1: Density of Solids Lab - Students will calculate the density of several solid objects. They will learn to use a variety of tools to measure the mass and volume of various solid objects. They will then use density to identify an unknown substance. Students will determine that two objects are roughly the same volume but have significantly different densities. To access the lab go to Density Sweet Density (https://newyorkscienceteacher.com/sci/files/download.php?id=1021&file=CandyBarDensity.zip) and click Download Lab.
	Option 2: Students will complete a virtual Ionic and Covalent Bond Lab.
	Option 3: Students will complete the Intermolecular Forces and Molecules Model Lab Project

Unit 2: Bonding, Chemical Reactions, Solutions and Mixtures Focus of the unit is on the different types of chemical reactions, bonding and reaction product prediction.	
Date	**SKILL TO BE DEMONSTRATED** Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments, such as chapter questions, worksheet, assessment, report, lab, presentation, discussion, etc.
	Students will learn to determine the number of atoms of each element in a chemical formula, use formulas to represent compounds, complete electron dot diagrams, explain why atoms bond, and identify the three types of bonds. **In what way did you demonstrate your learning?**
	Students will learn how to describe evidence that a chemical reaction has occurred, balance chemical reactions, distinguish among the types of chemical reactions as they learn to predict the product of each type of reaction. **In what way did you demonstrate your learning?**
	Students will understand how to compare the properties of acids and bases, classify them based on strength, and explain what happens during a neutralization reaction. **In what way did you demonstrate your learning?**

Unit 2 Assignment Options	
Choose one assignment option below and submit the completed and graded work to your HST.	
	Assignment 1: ● **Option 1:** Balancing Chemical Equations Assignment- Students will demonstrate how to balance chemical equations and explain what it means for a chemical equation to be balanced.

	They will be provided with a series of unbalanced chemical equations, which they will have to complete and balance. Through this guided practice students will be provided with educational materials and equations to balance, that will help them in developing a model for two reactions. They will produce balanced chemical equations to the law of conservation of mass, and explain how mass is conserved in chemical equations.
	• **Option 2:** Students will present an educationally equivalent option to the teacher for approval.

Unit 2 Lab Options **Students will complete one of the labs below: Lab Write-up**	
	Option 1: Acids and Bases Hands-on Lab - Students will determine the pH of various solutions using an indicator. They will explain the relationship between pH and the properties of a substance, which they will support with reasoning and evidence from their experimental data.
	Option 2: Acids and Bases Hands-on Lab - Students will determine the pH of various solutions using an pH simulation. They will explain the relationship between pH and the properties of a substance, which they will support with reasoning and evidence from their experimental data.
	Option 3: Students will present an educationally equivalent option to the teacher for approval.

Unit 3 Motion, Forces, Work and Energy Focus of the unit is on the role of forces, motion and energy in the natural world.	
Date	**SKILL TO BE DEMONSTRATED** Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments, such as chapter questions, worksheet, assessment, report, lab, presentation, discussion, etc.
	Students will understand movement, forces, energy, work, and machines. **In what way did you demonstrate your learning?**
	Students will be able to describe how energy is stored, moves, and changes form. They will use a reference point to calculate distance and time, and evaluate the speed and velocity of an object. **In what way did you demonstrate your learning?**
	Students will learn how to solve problems involving momentum, acceleration, net force, gravity, friction, unbalanced forces, and balanced forces in a given diagram. **In what way did you demonstrate your learning?**

	Students will understand how to calculate examples of potential and kinetic energy, as well as work and power while they calculate work, power, and the mechanical advantage of simple machines. **In what way did you demonstrate your learning?**
	Students will be able to explain Newton's three laws of motion, recognize examples of each, and calculate the force of an object using Newton's second law (F=ma). **In what way did you demonstrate your learning?**

Unit 3 Assignment Options	
Choose one assignment option below and submit the completed and graded work to your HST.	
	Assignment: ● **Option 1:** Momentum Assignment - Students will research Newton's third law of motion to understand what happens to momentum when two objects collide. Focus of research should also include defining and calculating momentum, along with how momentum is conserved using scientific reasoning. Using the research gathered, students will then create a model of Newton's third law of motion. Each component of the model should be labeled, along with a written description of how the model depicts Newton's third law of motion. The final product will be evaluated with grading rubric. ● **Option 2:** Students may submit an alternative option to the teacher for approval.

Unit 3 Lab Options **Students will complete one of the labs below: Lab Write-up**	
	Option 1: Motion Lab - Students will measure changes in motion of moving objects, interpret data to determine acceleration, and measure distance and time to determine speed. They will create and interpret graphs to investigate the relationships between speed, velocity, and acceleration. Students will learn to use, predict, and interpret calculations using the following formulae: ● Speed = distance / time ● Velocity = displacement / time ● Acceleration = change in speed / time Students will compare graphs that show speed as a function of time to determine whether the acceleration is constant or changing.
	Option 2: Students will research the egg drop lab and develop their own lab to complete. Students will need to include a hypothesis, materials and procedures list and a data table.
	Option 3: Go to Newton's 2nd Law of Motion Virtual Lab and download the Forces and Motion-Basics work document. Complete the lab and submit to HST.
	Option 4: Students will present an educationally equivalent option to the teacher for approval.

Unit 4: Temperature and Heat Focus of the unit is on thermal energy and heat.	
Date	**SKILL TO BE DEMONSTRATED** Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments, such as chapter questions, worksheet, assessment, report, lab, presentation, discussion, etc.
	Students will understand temperature in terms of average kinetic energy of atoms and molecules, and contrast it with heat, a method of energy transfer in matter. **In what way did you demonstrate your learning?**
	Students will learn not to think of thermal energy in terms of "hot" or "cold," but to recognize that thermal energy is a type of molecular kinetic energy and that when thermal energy increases, molecular motion increases. **In what way did you demonstrate your learning?**
	Students will learn to convert temperature readings between Fahrenheit, Celsius, and Kelvin scales. **In what way did you demonstrate your learning?**
	Students will understand real world examples of how energy is transferred by conduction, convection, and radiation. **In what way did you demonstrate your learning?**
	Students will understand the concept of specific heat, and be able to explain the Laws of Thermodynamics as heating and cooling systems. **In what way did you demonstrate your learning?**

Unit 4 Assignment Options

Choose one assignment option below and submit the completed and graded work to your HST.

Assignment 1:

- **Option 1:** Thermal Energy Assignment - Students will research thermal energy using various resources: textbooks, online articles, videos and websites to gather information. Focus of research should be on:
    - What specific heat is and how it is calculated
    - What is the specific heat of water and two other substances (i.e., gold, silver, mercury, iron, copper, ice, etc.)
    - How is thermal energy produced, transferred and measured
    - Describe the differences between heat and thermal energy
    - Explain why some substances change temperature more easily than others
        - The project will be evaluated using a project rubric. The final model may be presented as:
            - **Option 1:** Essay
            - **Option 2:** Video
            - **Option 3:** Poster Presentation
            - **Option 4:** Students may submit an alternative option to the teacher for approval
- **Option 2:** Renewable Energy Project: Students will conduct research on renewable energy sources: wind, solar, geothermal and biomass. Students may use various resources: textbooks, online articles, videos (i.e., NOVA) and websites to gather information. Research should focus on:
    - What renewable energy is
    - How the different renewable energy sources work and what they are used for
    - Compare and contrast the costs and benefits of the different types of renewable energy sources
    - What areas of the country do the renewable energies are most successful in energy production

  After completing their research students will select a city, a renewable energy source and create a model of their renewable energy system. Each component of the model should be labeled and describe how the renewable energy source will benefit the energy needs of the residents in their selected city. The final product will be evaluated by using a project rubric.
- **Option 3:** Students will present an educationally equivalent option to the teacher for approval.

Unit 4 Lab Options Students will complete one of the labs below: Lab Write-up	
	Option 1: Complete the Thermal Energy Transfer Lab. Follow the procedures provided within the simulation and submit the completed lab to HST.
	Option 2: Complete the Thermal Energy Virtual Lab. Follow the procedures provided within the simulation and submit the completed lab to HST.
	Option 3: Complete the Energy Forms and Changes Virtual Lab**.** Follow the procedures provided within the simulation and submit the completed lab to HST.
	Option 4: Students will present an educationally equivalent option to the teacher for approval.

Unit 5: Sound, Light, Electricity and Magnetism Focus of the unit is on the flow of energy through waves.	
Date	**SKILL TO BE DEMONSTRATED** Students may utilize the format of their choice to show mastery of course content/skills outside of the key assignments, such as chapter questions, worksheet, assessment, report, lab, presentation, discussion, etc.
	Students will learn about how the structure of the waves, such as amplitude, wavelength, period and frequency, determines their characteristics while examining sound waves and light waves. **In what way did you demonstrate your learning?**
	Students will be able to explain how charges flow through conductors and insulators. **In what way did you demonstrate your learning?**
	Students will examine Ohm's Law, electrical circuits, and electric current. **In what way did you demonstrate your learning?**
	Students will learn about Earth's magnetic field in relation to electromagnetism and its applications. **In what way did you demonstrate your learning?**
	After this unit, students will be able to contrast current and alternating current and explain how a generator works. **In what way did you demonstrate your learning?**

Unit 5 Assignment Options
Choose one assignment option below and submit the completed and graded work to your HST.
Assignment: **Option 1:** Magnets and Magnetism - Students will describe the Earth's magnetic field and the properties of magnets and produce a model that illustrates the magnetic field around Earth. Students will research using various resources: textbooks, online articles, videos and websites to gather information. Focus of research should be on: ● The different scales of magnets and magnetism at different scales ● How magnetic poles interact with each other ● The magnetic field around Earth, how it was formed, why it was formed and how it helps sustain life The project will be evaluated using a project rubric. **Option 2:** Electromagnetic Spectrum - Students will research the electromagnetic spectrum and describe its properties. Students will research using various resources: textbooks, online articles, videos and websites to gather information. Focus of research should be on: ● What is the electromagnetic spectrum and its regions? ● How is the electromagnetic spectrum used for science applications? ● What are the everyday applications of the electromagnetic spectrum? ● What are the differences between low frequency and high frequency waves? ● What speeds do electromagnetic waves travel at? ● What are the harmful waves? How can these negatively affect humans? ● What is visible light? ○ The project will be evaluated using a project rubric. The final model may be presented as: ■ **Option 1:** Essay ■ **Option 2:** Model ■ **Option 3:** Poster Presentation ■ **Option 4:** Students may submit an alternative option to the teacher for approval **Option 3:** Students will present an educationally equivalent option to the teacher for approval.

Unit 5 Lab Options Students will complete one of the labs below: Lab Write-up
Option 1: Waves Assignment - The purpose of this activity to experience different types of waves and observe their amplitude, frequency, wavelength and velocity through a slinky or similar object. In this lab, students will model and differentiate between transverse and longitudinal waves according to the direction of their movements as they experiment with the relationship between energy input, amplitude, and interference. Students will produce a written and illustrated report to clarify proper

	terminology used to describe the structure of waves and demonstrate how their properties are measured.
	Option 2: Go to Wave on a String Virtual Lab and download the Wave on a String Learning Guide. Complete the lab and submit to HST.
	Option 3: Go to Radio Waves & Electromagnetic Fields Virtual Lab and download the Wave on a String Learning Guide. To access the simulation click here. Complete the lab and submit to HST.
	Option 4: Students will present an educationally equivalent option to the teacher for approval.

END OF COURSE PORTFOLIO REQUIREMENT:

Students will complete a portfolio for the end of course project. This portfolio will be a survey of their best work and will be presented to the student's HST. In the presentation the student will share both orally and visually the portfolio's contents, and reflect on what they have learned. The portfolio may be digital or hard copy.

HSTs will complete a portfolio check at the end of semester 1. At that time, the portfolio format should be decided, and the draft should include a draft of the cover sheet, table of contents, and letter of introduction, as well as half of the key assignments.

Required Contents:

1. Cover Sheet
2. Table of Contents
3. Letter of Introduction
    a. *In this reflective essay, the student will introduce him/herself and discuss the major learning from the semester. It should address what topics the student would like to learn more about and why and the significance of the scientific method.*
1. Copy of Course outline with demonstrated evidence of learning sections completed
4. Key assignments (five total: one selected from each unit and two additional selected by the student)
5. Science Fair Project
6. Course Notes
7. HST Evaluation & Grading Rubric

Option for Final Submission:

- Online Blog
- Website: students may use Weebly.com
- PPT or Prezi Presentation
- iMovie
- Required items may be put into a binder or book or presented as a newspaper

Suggested Grading Breakdown:

Assignment Type	% of Grade
Key Assignment	30
Lab	30

Article Readings/Notes	10
Final Project	30

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