

**Kenai Peninsula Borough School District**  
**Science: Physical Science**  
**Unit Title 6: STRUCTURE OF MATTER**

**NGSS Standards:**

**HS-PS1-1.** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

**HS-PS1-2.** Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

**HS-PS1-3.** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

**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.

**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.

**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.

**HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

**HS-PS1-8.** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

**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-PS2-4.** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

**HS-PS2-5.** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

**HS-PS2-6.** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

**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.

**HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

**HS-PS3-3.** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

**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).

**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.

**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-PS4-2.** Evaluate questions about the advantages of using a digital transmission and storage of information.

**HS-PS4-3.** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

**HS-PS4-4.** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

**HS-PS4-5.** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

**ELA/LITERACY:**

**RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1) (HS-PS2-1) (HS-PS3-3) (HS-PS3-4)(HS-PS3-5)

**RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3) (HS-PS1-5) (HS-PS2-1) (HS-PS2-6) (HS-PS3-3)

**WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2) (HS-PS1-5) (HS-PS2-6)

**WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)

**WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3) (HS-PS1-6) (HS-PS2-5)

**WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3) (HS-PS2-5) (HS-PS3-4) (HS-PS3-5)

**WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3) (HS-PS3-4) (HS-PS3-5)

**SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4) (HS-PS3-1) (HS-PS3-2) (HS-PS3-5)

## **MATHEMATICS:**

**MP.2** Reason abstractly and quantitatively. (HS-PS1-5) (HS-PS1-7) (HS-PS2-1) (HS-PS2-4) (HS-PS3-1) (HS-PS3-2) (HS-PS3-3) (HS-PS3-4) (HS-PS3-5)

- a. decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- b. reflect during the manipulation process in order to probe into the meanings for the symbols involved
- c. create a coherent representation of the problem
- d. make sense of quantities and their relationships in problem situations
- e. attend to the meanings of quantities
- f. use flexibility with different properties of operations and objects
- g. translate an algebraic problem to a real-world context
- h. explain the relationship between the symbolic abstraction and the context of the problem
- i. compute using different properties

j. consider the quantitative values, including units, for the numbers in a problem

**MP.4** Model with mathematics. (HS-PS1-4) (HS-PS1-8) (HS-PS2-1) (HS-PS2-4) (HS-PS2-6) (HS-PS3-1) (HS-PS3-2) (HS-PS3-3) (HS-PS3-4) (HS-PS3-5)

**HSN-Q.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2) (HS-PS1-3) (HS-PS1-4) (HS-PS1-5) (HS-PS1-7) (HS-PS1-8) (HS-PS2-1) (HS-PS2-4) (HS-PS2-5) (HS-PS2-6) (HS-PS3-1) (HS-PS3-3)

**HSN-Q.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4) (HS-PS1-7) (HS-PS1-8) (HS-PS2-1) (HS-PS2-4) (HS-PS2-5) (HS-PS2-6) (HS-PS3-1) (HS-PS3-3)

**HSN-Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2) (HS-PS1-3) (HS-PS1-4) (HS-PS1-5) (HS-PS1-7) (HS-PS1-8) (HS-PS2-1) (HS-PS2-4) (HS-PS2-5) (HS-PS2-6) (HS-PS3-1) (HS-PS3-3)

**HSA.SSE.1** Interpret expressions that represent a quantity in terms of its context. (HS-PS2-1) (HS-PS2-4)

**HSA.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS2-1) (HS-PS2-4)

**HSA.CED.1** Create equations and inequalities in one variable and use them to solve problems. . Include equations arising from linear and quadratic functions, and simple rational and exponential functions. (HS-PS2-1)

**HSA.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-PS2-1)

**HSA.CED.4** Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-PS2-1)

**HSF-IF.7** Graph functions expressed symbolically and show key features of the graph, by in hand in simple cases and using technology for more complicated cases. (HS-PS2-1)

**HSS-IS.1** Represent data with plots on the real number line (dot plots, histograms, and box plots). (HS-PS2-1)

### **ESSENTIAL QUESTIONS:**

1. How do you determine whether a change is physical or chemical/
2. What causes a phase change?
3. What happens during a phase change?

**BIG IDEAS:**

1. Structure and properties of different phases / types of matter.
2. Determine whether a change is physical or chemical.

**Vocabulary:** Pure , Impure, Solid, Liquid, Gas, Phase change, Physical changes / properties, Chemical changes / properties