

**Kenai Peninsula Borough School District**  
**Science: Chemistry**  
**Unit 7: STOICHIOMETRY**

**Pacing:**

**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-LS1-5.** Use a model to illustrate how photosynthesis transforms light energy into stored chemical 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)

**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)

**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)

**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)

**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)

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

**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)

#### **MATHEMATICS:**

**MP.2** Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)

- 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)

- a. apply mathematics to solve problems in everyday life, society, and workplace
- b. identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas

- c. consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- d. apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- e. make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- f. identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- g. analyze quantitative relationships to draw conclusions
- h. improve the model if it has not served its purpose

**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)

**HSN-Q.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7)

**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)

**Essential Questions:**

1. What is stoichiometry?
2. List three ways a balanced chemical reaction can be interpreted.
3. What is a mole ratio?
4. Why is a balanced chemical reaction needed in solving stoichiometric calculations?
5. List the four steps used in solving stoichiometric problems.
6. What is meant by the limiting reactants? Why is it necessary to identify the limiting reactant when you want to determine the amount of product formed?
7. Describe how the mass of the product can be calculated when one reactant is in excess.
8. Distinguish between theoretical yield and actual yield.
9. Explain how percent yield is calculated.

**Big Ideas:**

1. What is stoichiometry?
2. Balanced equations can be interpreted in terms of representative particles, moles and mass.
3. The law of conservation of mass and chemical reactions.
4. Stoichiometric calculations
5. Stoichiometric calculations must be based on the amount of the limiting reactant.
6. Percent yield is the ration of actual yield to theoretical yield expressed as a percent.

**Vocabulary:** Actual yield, Excess reactant, Limiting reactant, Mole ration, Percent yield, Stoichiometry, Theoretical yield