

**Kenai Peninsula Borough School District**  
**Science; Chemistry**  
**Unit 9: SOLUTIONS, ACIDS AND BASES**

**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-ESS2-5.** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

**HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

**HS-ESS3-3.** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

**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.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)

**RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)

**WHST.9-12.2** Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. (HS-ESS3-1)

**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) (HS-ESS3-1)

**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-ESS3-1)

- 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), (HS-ESS3-1) (HS-ESS3-3)

**HSN-Q. 2** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8)

**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-ESS3-1)

**HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1),(HS-ESS3-4),(HS-ESS3-5),(HS-ESS3-6)

#### **ESSENTIAL QUESTIONS:**

1. Describe the characteristics of a solution and identify the various types.
2. What is solubility? Describe two factors that affect solubility.
3. Distinguish between a dilute solution and a concentrated solution.
4. Compare and contrast five quantitative ways to describe the composition of solutions.
5. Explain the nature of colligative properties.
6. Describe four colligative properties of solutions.
7. Distinguish between suspensions and colloids.
8. Compare the properties of acidic solutions and basic solutions.
9. How do the concentrations of hydrogen ion and hydroxide ion determine the acidity of a solution?
10. Identify the acid- base pairs based on the following equations .....
11. What is the relationship between PpH and the concentration of hydrogen ions?
12. If you know the pOH of a solution how do you determine the pH?
13. Write the formula equation and net ionic equation for the neutralization reaction between hydroiodic acid and potassium hydroxide.
14. Explain the difference between equivalence p[point and end point.

**BIG IDEAS:**

1. What are solutions?
2. Every substance has a characteristic solubility in a given solvent.
3. Henry's Law.
4. Solution concentration based on mass, volume percentage, molarity, molality and mole fraction.
5. Colligative properties of solutions.
6. Differences between solutions, colloids and suspensions.
7. Definition of acid and base based on the Arrhenius and Bronsted- Lowry models.
8. Strength of acids and bases
9. Determination of pH and pOH mathematically and in the lab.
10. Neutralization reactions and their products.

**Vocabulary:** Boiling point elevations, Colligative property, Colloid, Concentration, Freezing point depression, Heat of solution, Henry's law, Immiscible, Insoluble, Miscible, Molarity, Molality, Mole fraction, Saturated solution, Solubility, Soluble, Solvation, Supersaturated solution, Suspension, Unsaturated solution, Vapor pressure lowering, Acid base indicator, Acidic solution, Amphoteric, Arrhenius model, Basic solutions, Bronsted- Lowry model, Buffer, Conjugate acid and base, End point, Neutralization reaction, pH, pOH, Salt, Titration