Kenai Peninsula Borough School District
Science: Chemistry
Unit 2: PROPERTIES AND CHANGES, STRUCTURE OF THE ATOM

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

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-PS4-3 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.

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.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-PS4-3),(HS-PS4-4)

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)

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-PS4-1),(HS-PS4-4)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.(HS-PS4-3),(HS-PS4-4)

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)

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)

MATHEMATICS STANDARDS:

MP.2 Reason abstractly and quantitatively.(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-PS4-1)

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

N-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-PS1-7)

A.SSE.1 Interpret expressions that represent a quantity in terms of its context. (HS-PS4-1),(HS-PS4-3)
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS4-1),(HS-PS4-3)
a. Factor a quadratic expression to reveal the zeros of the function it defines. For example, x2 + 4x +3 = (x +3)(x +1).
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. For example, x2 + 4x + 3 = (x + 2)2 - 1.
c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

A-CED.4 Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.(HS-PS4-1),(HS-PS4-3)
a. Factor a quadratic expression to reveal the zeros of the function it defines. For example, x2 + 4x +3 = (x +3)(x +1).
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N-Q.2 Define appropriate quantities for the purpose of descriptive modeling. HS-PS1-7)

N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-7)

Essential Questions:

1. Describe the characteristics that identify a sample of matter as being a substance.
2. Classify a list of properties of matter as physical or chemical.
3. Create a table that describes the three common states of matter in terms of their shape, volume and compressibility.
4. Describe the results of a physical change and list three examples of a physical change. (Do the same for a chemical change)
5. Classify a list of changes in matter as physical or chemical.
6. How do mixtures and substance differ?
7. Consider a mixture of water, sand and oil. How many phases are present? How could you separate these three substances?
8. Classify a list of mixtures as either homogenous or heterogeneous.
9. How are elements and compound similar? How are they different?
10. What is the basic organizing feature of the periodic table of elements?
11. Explain how the law of definite proportions applies to compounds.
12. Compare and contrast the early models of the atom.
13. Define atom in your own words.
14. Describe the structure of a typical atom. Be sure to identify where each subatomic particle is located.
15. Make a table comparing the relative charge and mass of each subatomic particle.
16. List and describe the characteristics properties of waves.
17. Explain the difference between the continuous spectrum of light and the atomic emission spectrum of an element.
18. Compare and contrast Bohr's atomic model with the modern atomic model.
19. What is a valence electron? Draw electron dot structures of the first ten elements.

Big Ideas:
1. A substance is a form of matter with a uniform and unchanging composition.
2. Physical properties can be observed without changing a substances composition.
3. Chemical properties describe a substances ability to combine with or change intone or more new substances.
4. The three common states of matter are solid, liquid and gas.
5. In chemical reactions reactants form products.
6. Matter is neither created nor destroyed in a chemical reaction.
7. A mixture is a physical blend of two or more pure substances.
8. Solutions are homogenous mixtures
9. Mixtures can be separated by physical means. Common separation techniques.
10. Elements are substances that cannot be broken down in to simpler substances by chemical or physical means.
11. The elements are organized in the periodic table of elements.
12. A compound is chemical combination of two or more elements.
13. Early theories of matter
14. Subatomic particles and the nuclear atom.
15. The number of protons or atomic number of an atom uniquely identifies an atom.
16. Atoms of equal numbers of protons and electrons, and thus, no overall electrical change.
17. An atom's mass number is equal to its total number of protons and neutrons.

18. Atoms of the same element with different numbers of neutrons and different mass are called isotopes.
19. All waves can be described by their wavelength, frequency, amplitude and speed.
20. Energy is emitted and absorbed by matter in quanta.
21. In contrast to the continuous spectrum produced by white light, and element'' atomic emission spectrum is a series of fine lines.
22. Bohr's model
23. Quantum mechanical model of an atom.
24. Electrons occupy a three dimensional region of space called atomic orbitals.
25. The arrangement of electron in an atom is called the atom's electron configuration.
26. Valence electrons determine the chemical properties of an atom.

Vocabulary: Chemical change and property, Physical change and property, Compound, Element, Mixture: heterogeneous and homogenous, Law of conservation of mass, Law of proportions, Mixture, Percent by mass, Periodic table, States of matter, Reactant, Product, Atom, Atomic mass, Atomic mass unit (amu), Atomic number, Dalton's atomic theory, Electron, Isotope, Mass number, Neutron, Nucleus, Proton, Radioactivity, Amplitude, Atomic orbital, Electromagnetic radiation, Electromagnetic, spectrum, Electron configurations, Electron dot structure, Energy level, Frequency, Ground states, Photon, Principle energy level, Quantum number, Valence electron, Wavelength