

Chemistry: Structure and Properties of Matter

Stage 1 Desired Results

ESTABLISHED GOALS:

Competencies:

- **Patterns:** Students will demonstrate the ability to observe and describe patterns in natural and human designed phenomena and use those patterns to support claims about the observed or predicted relationships among phenomena.
- **Scale, Proportion, & Quantity:** Students will demonstrate the ability to describe and represent the significance of changes in observable and non-observable phenomena in terms of relative scale, proportion, and quantity.
- **Nature of Science:** Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in a various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions.
- **Structure and Function:** Students will demonstrate the ability to use evidence to support claims about the relationship among structure and function of natural and human designed objects.
- *Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.*
- *Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.*
- *Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.*

Content 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-PS1-3. 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-PS1-8. 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-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Transfer

*Students will be able to independently use their learning to **make determinations about matter based on how it is categorized.***

Meaning

ENDURING UNDERSTANDINGS

Students will understand that...

- different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
- in nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
- the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.
- the functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.
- the total amount of energy and matter in closed systems is conserved.

ESSENTIAL QUESTIONS

- *How can science measure what can't be seen?*

Acquisition

Students will know...

- that each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
- that the periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.
- that the structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
- that nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.
- that attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.
- that Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.
- that atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.
- that the study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.
- that other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.
- that the abundance of liquid water on Earth's

Students will be skilled at...

- using the periodic table as a model for predictions.
- planning and conducting investigations.
- developing models to illustrate change..
- communicating scientific and technical information.
- using a chemical reference book and MSDS.
- quantifying results.
- performing basic statistical analysis.

	surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. <u>vocabulary:</u> element, compound, mixture, precision, accuracy, SI units, atom, molecule, symbols, formulas, physical changes, chemical changes, nucleus, proton, energy level, orbital, charge, probability, quantum, wave, isotope, element, electron, neutron, sublevel, electron, spin, quantum number, light, particle, element, chart, periodic, metal, conduct, melting point, metalloid, group, valence electron, ionization energy, electronegativity, atomic size, table, nonmetal, insulate, boiling point, metal, period, energy level, electron affinity, trend, atomic radius, atomic mass, physical property, chemical property, pure, impure, homogeneous, heterogeneous,	
Content Area Literacy		21st Century Skills
• 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. • 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. • RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. • RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. • WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. • WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • WHST.11-12.7 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. • 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		• <i>use systems thinking</i> • <i>solve problems</i>

selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. • WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Stage 2 - Evidence

<i>Evaluative Criteria</i>	<i>Assessment Evidence</i>
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

<i>Science and Engineering Practices</i>	<i>Mathematics Integration</i>
•	• HSN-Q.A.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. • HSN-Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling. • HSN-Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. • MP.4 - Model with mathematics. • HSA-CED.A.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1) (HS-ESS1-2) • HSA-CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1) (HS-ESS1-2) • HSA-SSE.A.1 - Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1) •
<i>Technology Integration</i>	<i>District Materials</i>

Science and Engineering Practices	
S&EP 2. Developing and using models S&EP 3. Planning and carrying out investigations S&EP 4. Analyzing and interpreting data S&EP 5. Using mathematics and computational thinking S&EP 6. Constructing explanations (for science) and designing solutions (for engineering) S&EP 8. Obtaining, evaluating, and communicating information	