

Kenai Peninsula Borough School District
Science: Chemistry
Unit 12: NUCLEAR CHEMISTRY

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-PS1-7. 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-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-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.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-PS3-4)

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-PS4-4)

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

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-PS3-3) (HS-PS3-4)

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-PS4-4)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (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-PS3-1)

MATHEMATICS STANDARDS:

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. (HS-PS3-1).

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-1),(HS-PS3-3)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-1)

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-PS3-3)

MP.2 Reason abstractly and quantitatively. HS-PS3-3)(HS-PS1-7)

MP.4 Model with mathematics. (HS-PS3-3) (HS-PS1-8)

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. (HS-PS3-3) (HS-PS1-2) (HS-PS1-7), (HS-PS1-8)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-3) (HS-PS1-7), (HS-PS1-8)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-3) (HS-PS1-2)(HS-PS1-7), (HS-PS1-8)

ESSENTIAL QUESTIONS:

1. Describe the contributions of Roentgen, Becquerel, Rutherford and Curies to the field of nuclear chemistry.
2. What subatomic particles are involved in nuclear reactions?
3. Qualitatively compare and contrast alpha, beta and gamma radiation in terms of composition, energy, mass and penetrating power.
4. Write the nuclear equation for the alpha decay of astatine – 213.
5. Describe the process of transmutation. Give two examples.
6. Compare and contrast fission and fusion reactions in terms of the particles involved and the changes they undergo.
7. Describe the process that occurs during a nuclear chain reaction.
8. Explain how a nuclear power works.
9. Describe several methods used to detect and measure radiation.
10. Explain one way in which nuclear chemistry is used to diagnose or treat disease.

BIG IDEAS:

1. History of nuclear radiation
2. Radioactive decay equations
3. The conversion of an atom of one element into an atom of another element by radioactive decay is transmutation.
4. A half-life is the time required for half the atoms in a radioactive sample to decay.
5. Difference between fission and fusion.
6. Applications and effects of nuclear reactions.

Vocabulary: Band of stability, Breeder reactor, Critical mass, Electron capture, Half life, Induced transmutation, Ionizing radiation, Mass defect, Nuclear fission, Nuclear fusion, Nucleon, Position, Radioactive decay, Radioisotope, Transmutations, Trans-uranium element, Gamma ray, Alpha particle, Beta particle