Standard 10: Modern Physics

Students who demonstrate understanding can:

HS-PSII-10.1.* **Describe the Standard Model and explain the composition and decay of subatomic particles using the Standard Model and Feynman diagrams.**

HS-PSII-10.2.* **Explain the stability of the nucleus considering the electromagnetic repulsion in the nucleus and how forces govern binding energy and radioactive decay for different elements.**

HS-PSII-10.3.* **Qualitatively compare and contrast how particle interactions, fission, and fusion can convert matter into energy and energy into matter and calculate the relative amounts of matter and energy in such processes.**

HS-PSII-10.4.* **Apply the conservation of mass, conservation of charge, and conservation of linear momentum principles to describe the results of a radioactive particle undergoing either alpha or beta decay.**

HS-PSII-10.5.* **Know and describe how a particle accelerator functions and how current high energy particle physics experiments are being used to develop the Standard Model.**

Science and Engineering Practices

SEP.5: Using Mathematics and Computational Thinking

- Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis; a range of linear and nonlinear functions including trigonometric functions, exponentials, and logarithms; and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
- Use mathematical representations of phenomena to describe explanations.

SEP.2: Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

Disciplinary Core Ideas

PS1.C: Nuclear Processes

- Nuclear Processes, including fusion, fission, and radioactive decays or unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.

Crosscutting Concepts

CC.5: Energy and Matter

- Energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. When evaluating the energy of a system, students could describe how they take into account that energy cannot be created or destroyed.

CC.1: Patterns

- Mathematical representations are needed to identify some patterns. Students could use mathematical representations of data to identify patterns [caused by] the transfer of energy.