Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Accelerated Physical Science

Unit title	*Nuclear Chemistry*	**MYP year**	*3*	**Unit duration (hrs)**	*15 Hours*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GSE Standards

Standards

SPS1. Obtain, evaluate, and communicate information from the Periodic Table to explain the relative properties of elements based on patterns of atomic structure.

a. Develop and use models to compare and contrast the structure of atoms, ions and isotopes.

SPS4. Obtain, evaluate, and communicate information to explain the changes in nuclear structure as a result of fission, fusion, and radioactive decay.

a. Develop a model that illustrates how the nucleus changes as a result of fission and fusion.
b. Use mathematics and computational thinking to explain the process of half-life as it relates to radioactive decay. (*Clarification statement*: Limited to calculations that include whole half-lives.)
c. Construct arguments based on evidence about the applications, benefits, and problems of nuclear energy as an alternative energy source.

Gifted Standards

- **MCS.Gifted.S4D.** Respectfully collaborate and effectively communicate exchanges of constructive/critical feedback.
- **MCS.Gifted.S4E.** Use a variety of multi-media and innovative technologies as tools to effectively communicate the individual or collaborative group work.

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Students may have some familiarity with nuclear power as an energy source, but do not typically come with the knowledge of how that energy is harnessed (from the nuclei of uranium atoms). Students typically have little to no prior knowledge of radioactive decay and half-life.

These students have not been exposed to the 8th Science GSE that provide the foundation for the high school Physical Science standards.

Concepts/Skills to be Mastered by Students

- Nuclear energy
- Fission and fusion

- Radioactive decay
- Energy transformations

Key Vocabulary: (KNOWLEDGE & SKILLS)
Nuclear structure, nucleus, fission, fusion, radioactivity, radioactive decay, radiation, alpha decay, alpha particle, beta decay, beta particle, gamma decay, gamma emission, gamma rays, half-life, isotope, radioactive isotope, isotopic notation, chain reaction, nuclear energy, alternative energy source, daughter product

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
Operation of a car and/or rocket.

Unit Phenomena (LEARNING PROCESS)
Is nuclear power a viable alternative energy source?
Why might an area that experiences a nuclear disaster be uninhabitable for decades to come?

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
- Students may confuse alpha decay and beta decay, as well as alpha particles and beta particles.
- Students may have difficulty calculating half-life. The formula is not required, but may be used as a strategy for students who are mathematically inclined. A table method of determining half-life is a useful strategy.
- Students may have difficulty recalling the benefits and problems of nuclear energy as an alternative energy source.

Key concept	Related concept(s)	Global context
Change Change is a conversion, transformation or movement from one form, state or value to another. Inquiry into the concept of change involves understanding and evaluating causes, processes and consequences.	Energy (MYP/CCC) Models (MYP/CCC)	**Scientific and Technical Innovation** Students will explore the natural world and its laws; the interaction between people and the natural world; how humans use their understanding of scientific principles; the impact of scientific and technological advances on communities and environments; the impact of environments on human activity; how humans adapt environments to their needs.

Statement of inquiry
Scientific and technical innovations help us to model changes in the nuclei that can be harnessed as sources of energy.

Inquiry questions
Factual

What is the difference between fission and fusion?
What is the difference between alpha decay and beta decay?
What are isotopes?
What is half-life?

Conceptual

How can I use models to represent alpha, beta, and gamma decay?
How can I use a model to demonstrate the change in an atom's nucleus during fission and fusion?
How do I calculate half-life in order to determine the amount of a substance that will remain after a certain number of half-lives?
How are half-life and radioactive decay applicable to real-world situations?
What are the pros, cons, and applications of nuclear energy use?

Debatable

What is the best fuel source for a rocket?
Do the pros of nuclear energy outweigh the cons of its use?

MYP Objectives	**Assessment Tasks**	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Science A: Knowing and Understanding I. describe scientific knowledge Iii. analyze information to make scientifically supported judgments Science C: Processing and Evaluating I. present collected and transformed data Ii. interpret data and results using scientific reasoning	SOI: Scientific and technical innovations help us to model changes in the nuclei that can be harnessed as sources of energy. In the Nuclear Chemistry Unit Assessment, students will be tasked with determining and analyzing models (visual, graphical, and mathematical) designed to represent nuclear fission and fusion, half life, alpha decay, and beta decay. They will make connections between these processes and their role in the transformation of energy and human reliance on that energy. Students will also be challenged to obtain, evaluate, and communicate information as to whether or not the state of Georgia should continue to invest in the construction of nuclear power facilities for the purposes of engaging in a debate. Students will examine the pros and cons, as well as potential impacts, of nuclear energy usage.	**Formative Assessment(s):** Nuclear Chemistry CFA **Summative Assessment(s):** Nuclear Chemistry Unit Assessment Paper I and Paper II

Science D: Reflecting on the Impacts of Science Ii. discuss and analyze the various implications of using science and its application in solving a particular problem or issue Iii. apply scientific language effectively Iv. document the work of others and sources of information used		
Approaches to learning (ATL)		
Category: Thinking **Cluster:** Critical Thinking Skills **Skill Indicator:** Make logical, reasonable judgments and create arguments to support them.		

<table>
<tr><th colspan="3"><u>Learning Experiences</u>
Add additional rows below as needed.</th></tr>
<tr><th>Objective or Content</th><th>Learning Experiences</th><th>Personalized Learning and Differentiation</th></tr>
<tr><td>SPS4. Obtain, evaluate, and communicate information to explain the changes in nuclear structure as a result of fission, fusion, and radioactive decay.
a. Develop a model that illustrates how the nucleus changes as a result of fission and fusion.</td><td>Fission vs. Fusion: Model, Compare, and Contrast</td><td rowspan="3">• Discovery Education High School Chemistry Science Techbook
• Discovery Education High School Physics Science Techbook
• NGSS Case Studies for Differentiated Learners
• Next Generation Science Standards: “All Standards, All Students”
• Extensions – Enrichment Tasks/Projects

All information included by PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB.

Task-Specific Differentiation

• Modeling
• Small Grouping
• Take a Side (Debate)
• Multiple Means of Engagement
• Multiple Means of Content Representation (laboratories, SIM, NearPod, DE Techbook)
• Multiple Means of Action and Expression</td></tr>
<tr><td>SPS4. Obtain, evaluate, and communicate information to explain the changes in nuclear structure as a result of fission, fusion, and radioactive decay.
b. Use mathematics and computational thinking to explain the process of half-life as it relates to radioactive decay.</td><td>Half-Life Simulation & Graphical Analysis (Science A, C)
Half Life Practice Problems</td></tr>
<tr><td>SPS4. Obtain, evaluate, and communicate information to explain the changes in nuclear structure as a result of fission, fusion, and radioactive decay.
c. Construct arguments based on evidence about the applications, benefits, and problems of nuclear energy as an alternative energy source.</td><td>Nuclear Energy Research and Debate (Science D)</td></tr>
<tr><th colspan="3">Content Resources</th></tr>
<tr><td colspan="3">Discovery Education High School Chemistry Science Techbook

Unit 10: The Chemistry Around Us</td></tr>
</table>

- Concept 10.3: Nuclear Chemistry

Discovery Education High School Physics Science Techbook

Unit 7: Properties of Matter

- Concept 7.3: Nuclear Physics

PhET: Isotopes and Atomic Mass

PhET: Nuclear Fission

Holt Science Spectrum Textbook