MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: Physics	**Topic:** Nuclear	**Duration:** 3 weeks
Teachers: Physics PLC Teachers		

Georgia Standards and Content:
SP6. Obtain, evaluate, and communicate information about nuclear changes of matter and related technological applications.
a. Develop and use models to explain, compare, and contrast nuclear processes including radioactive decay, fission, and fusion.
b. Construct an argument to compare and contrast mechanisms and characteristics of radioactive decay. (Clarification statement: Include alpha, beta, and gamma decays and their effects.)
c. Develop and use mathematical models and representations to calculate the amount of substance present after a given amount of time based on its half-life and relate this to the law of conservation of mass and energy.

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
From 8th grade Physical Science
- Basic algebra
- Atomic structure
- Charges of subatomic particles

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
The laws of physics dictate the interactions of our physical world.

Unit Phenomena (LEARNING PROCESS)
Atomic nuclei are unstable (radioactive) if you do not have the right number of protons and neutrons

MYP Inquiry Statement:
The transformations of atoms follow predictable patterns that can be used for the production of power.

MYP Global Context:
Scientific and Technical Innovation

Approaches to Learning Skills:

Research Skills
Thinking Skills
Collaboration Skills
Communication Skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

Matter & Energy (CC)
Stability & Change (CC & MYP)
Scale, Proportion & Quantity (CC)

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
Cause & Effect (CC)
Stability & Change (CC & MYP)
Systems & System Models (CC & MYP)
Patterns (CC)

MYP Key and Related Concepts:
Select one Key Concept:
Stability & Change (CC & MYP)

Select one or more RC:

Cause & Effect (CC)
Stability & Change (CC & MYP)
Systems & System Models (CC & MYP)

		Patterns (CC) Movement & Energy

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Nuclear reactions always result in explosions
Nuclear reactions are always dangerous

Key Vocabulary: (KNOWLEDGE & SKILLS)

- proton
- neutron
- electron
- alpha decay
- beta decay
- gamma decay
- isotope
- nuclear decay
- half-life
- atomic number
- atomic mass
- strong nuclear force
- electrostatic force

Inquiry Questions:

Factual

What is the composition of an atom?

What are examples of radioactive decay?

How can we calculate the half life of a radioactive isotope?

Can we predict the amount of energy released in a nuclear reaction?

Conceptual

How do the SNF and Electrostatic force work to make an isotope stable or unstable?

Is the decay of radioactive isotopes predictable?

Debatable

Should the use of nuclear power be increased?

MYP Objectives	Summative assessment	
MYP A	Assessment Task: Summative Test: MYP A	Relationship between summative assessment task(s) and statement of inquiry: The assessment measures how well students determine vector quantities using graphical and mathematical analysis.

Unit Objectives: Nuclear Need to Know - https://docs.google.com/document/d/1sBWXAkOsxL29UNJV680ql-LSIHZZUD90xxAW6GWEmKY/edit?usp=sharing			
Learning Activities and Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Week 1/2:	Students observe a PHET simulation showing the radioactive decay of a single isotope and group of isotopes. Students observe a model of half life using skittles and a cup, recording the total mass, mass of stable isotopes and unstable isotopes.	Students will try to predict when a specific isotope will decay. Students create a half life chart to record the "decay" of the skittles and generate a graph showing the exponential curve associated with half life and radioactive decay. .	Students will post a response in a discussion board addressing the predictability of decay of a single isotope vs a group. Students will present their findings on a whiteboard showing their half life charts and the graph generated by their data
Week 2/3:	Students observe different types of radioactive decay using PHET simulations. Students will observe the mass defect of a combustion reaction. Students observe and take notes on 3 videos showing a chain reaction, fission and fusion.	Students analyze the difference in atomic number and mass of an isotope before and after it decays to determine what subatomic particles were emitted from the nucleus. Students will take notes and record the components of a chain reaction, fission reaction, and fusion reaction.	Students create their own nuclear equations with their groups based on the types of decay observed and display them on whiteboards. Students post to a discussion board analyzing a video of ping pong balls as a model for a chain reaction breaking down what each component represents in the reaction and any strengths and weaknesses of the model. Students will create a venn diagram comparing and contrasting fission and fusion reactions.
Week 3:	Students will interact with a simulation/game that walks them through the components and functions of a nuclear power plant. Students will also use given research about the nuclear power plants looking at safety and production. Students complete a review quiz to diagnose strengths and weaknesses in the content.	Students will use their skills developed in previous lessons to generate realistic power outputs of a nuclear power plant and analyze the safety of nuclear power plants. Students complete review activities based upon quiz results.	Students will work in groups to display their nuclear equations and calculate mass defect and energy production on whiteboards. Students will write a cost benefit analysis essay on the use of nuclear power.

Resources (hyperlink to model lessons and/or resources): (click here for description)
Discovery Education Science Techbook

Nuclear Schoology Unit: https://marietta.schoology.com/group/1606049999/materials#/group/1606049999/materials

Alpha Decay Simulation

Beta Decay Simulation

Radioactive decay simulation: https://phet.colorado.edu/en/simulation/legacy/alpha-decay

Chain Reaction Video: https://youtu.be/vjqIJW_Qr3c

Nuclear power plant - Energy Education

NUCLEAR 101: How Does a Nuclear Reactor Work? …

Nuclear Reactors | Nuclear Power Plant | …

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
PLC members planned together and shared resources to prepare for teaching the unit as well as creating CFA and CSA materials before the unit is taught.	PLC members discussed strategies that worked and did not work, discussed CFA and CSA results and the questions where students performed below the set goal (70% passing).	Collaborated on updating information From the unit and how we can Improve next year.