National MagLab STEM Lesson Plan:

What is Nuclear Energy and Where Can We Find it in Our Everyday Lives?

Lesson Objectives:

- The students will engage in argument from evidence when answering warm up questions as a group.
- The students will construct an argument from evidence that certain materials will block a particular type of radiation.
- The students will develop a model and communicate how radiation changes the structure of a nucleus.

Next Generation Science Standard:

- 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.

STEM Rationale for Lesson:

Nuclear energy is one of the leading renewable energy sources, yet it is one of the most controversial energy sources. Many decisions about where nuclear energy can be used falls upon the constituents of a given area. As future constituents all students need to be well read on all aspects of nuclear energy. Students need to better understand the dangers and benefits of nuclear energy while also being able to explain how radioactive decay occurs.

Culturally responsive connection:

Radioactive decay is an abstract concept with real - world applications and consequences. The abstractness of the topic can make it hard for students to grasp without concrete examples. In this lesson students will find examples from their own lives to represent and model what happens during the process of decay. Students will also use items found in their home as examples of applications or evidence for radiation in everyday life. In this way students see that even though STEM is usually seen as elusive to most groups of people not of the majority; this lesson format will lead them to realize that this subject touches their lives and is embedded in their life in multiple ways. They will also see that the concepts of radioactive decay can be easily understood and modeled.

Materials Needed:

Provided by Teacher:

1. NewsELA Article: Inventors and Scientists: Marie Curie https://newsela.com/read/BHP-U3-4-MarieCurie/id/3562
2. EdPuzzle Video: Radioactive Decay https://edpuzzle.com/media/6261bbe2cda0a942db719654

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3. EdPuzzle Video: Radioactive Decay Guided Notes https://docs.google.com/document/d/14Dg1OMo5DdteX8r4R1j23heQ00pi0MyA7p0XM8r9CbQ/edit?usp=sharing
4. M&M's or Skittles

Materials Students Must Bring in From Home

1. Items/pictures of items that give off radiation such as: smoke detectors, bananas, other foods, glow in the dark watches/clocks, old box TVs, granite countertops
2. Items/pictures of items that can block alpha, beta, or gamma radiation such as: paper, layer of air, skin, aluminum sheet, thin plastic, block of wood, concrete, or lead

Activate Prior Knowledge:

1. Students need to know that all matter is made of atoms.
2. Students need to know that atoms are made up of smaller particles called protons, neutrons, and electrons.
3. Students must be able to explain that the number of protons in an atom gives the atom its identity as a specific element.

Lesson Introduction:

1. Students first read the article Inventors and Scientists: Marie Curie https://newsela.com/read/BHP-U3-4-MarieCurie/id/3562 on NewsELA.
2. Next, students will complete a close read of the article by:
    - Answer: What terms do you not know? Research & define them.
    - Answer: What scientists are mentioned?
    - Answer: Why are these scientists mentioned?
    - Answer: What accolades/rewards did Marie Curie win?
    - Summarize the paragraph that defines radiation.
3. Homework: Research - What items in your home may be giving off radiation or exposing you to radiation?

Lesson Activity:

1. Windows & Mirrors Activity: Students are able to voluntarily share their findings from the homework assignment, "*Research - What items in your home may be giving off radiation or exposing you to radiation?" The teacher can use this to demonstrate to students that all people are exposed to forms of background radiation regardless of where they live.*
2. Students will then gain background knowledge on the different types of radiation while also getting a review of the definition of radiation. They will do this through a guided viewing of the video, Radioactive Decay on EdPuzzle. The teacher can choose to allow students to view the video on their own while answering the questions or as a group. Depending on the needs of the group the teacher can do this with the guided notes as well. For groups that are finding the material to be challenging it may be more beneficial

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to watch the video as a class without the questions and only using the guided notes before allowing students to move through the questions individually or as a whole group.

3. Homework: Construct an Argument from Evidence - Take pictures or bring in items from home that will block alpha particles, or beta particles, or gamma rays. Students can be broken into groups for this activity and tasked to only find items that will block one type of radiation. It may be helpful to have students looking for similar items brainstorm as a group as a closing activity to generate a variety of items being brought in the following day.

Lesson Assessment

Students will design a posterized illustration that models how the nucleus of an atom changes during the three types of radioactive decay discussed in this lesson. They can then choose 1 of 3 ways to present their finished project. This project will be graded using a rubric designed to give points for including correct information and presenting it. In this way, students are only graded for the content, ability to read and understand the content, and presenting the content. All choices for presentation are weighted equally.

**Points are given according to how many boxes are checked. **

Category	Description	+1	+2	+3
Illustration	Illustration includes: ● All 3 types of decay (alpha, beta, & gamma) ● nucleus before and after ● subatomic particles and energy in the nucleus before and after			
Information	Information on poster includes: ● what subatomic particles leave the nucleus during each type of decay ● whether energy is given off during each type of decay ● the names of the elements in each example ● the number of protons, neutrons, and electrons in each element			
Presentation	Presentation is a(n): ● in-person oral presentation ● pre-recorded video presentation ● pre-recorded audio-only presentation			
TOTAL	(*No points awarded for missing parts)*			

Lesson by: Raechel Waddy
Contact info: rmwaddy@hotmail.com

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