STUDENT VERSION

U.S. DEPARTMENT OF ENERGY
ATOMIC LEGACY CABIN

The U.S. Department of Energy Office of Legacy Management Atomic Legacy Cabin presents:

NUCLEAR SCIENCE WEEK

OCTOBER 19-23, 2020

NAME: _____ DATE: _____

THINK CLEAN. THINK SOLUTIONS. THINK NUCLEAR.

Overview

Nuclear Science Week (NSW) is an international, weeklong celebration of the local, regional, and international innovations and careers in nuclear science. Communities from across the nation are encouraged to get involved and host local events during the third week of October. This year, NSW goes virtual as it explores the five pillars of nuclear science: carbon-free energy, global leadership, transformative health care, innovation and technology, and space exploration.

In 2019, staff at the U.S. Department of Energy Office of Legacy Management (LM) participated in NSW by hosting events at local high schools that promoted careers in science, technology, engineering, and mathematics (STEM). LM also provided tours for local educators at the Atomic Legacy Cabin (ALC), an interpretive center, which opened in June 2019, that presents the history of uranium mining and processing on the Colorado Plateau, as well as Grand Junction's unique contribution to the Manhattan Project and the Cold War.

This year, LM encourages students and educators to "Get to Know Nuclear" through its online Radiation — Energy in Motion program. Radiation is an emission of energy that is everywhere and serves as the foundation of nuclear science. Visit the ALC website to learn more about the types of radiation, where it comes from, and how LM protects human health and the environment through radiation control.

Included in this packet:

- Nuclear Science Week schedule.
- Radiation — Energy in Motion video Q&A.
- Nuclear Science & Radiation activity sheet.
- Other resources.

For more information and to explore 2020 virtual events, visit: nuclearscienceweek.org.
For more information about ALC, visit: energy.gov/lm/atomic-legacy-cabin.

ALC remains closed to the public. During the COVID-19 pandemic, the health and safety of our employees and communities are our highest concern. To assure social and physical distancing and compliance with regulatory guidance that limits nonessential activities, the indoor areas of our centers will remain closed until further notice. We will update our webpage if this current status changes. We look forward to the time when we can safely welcome our visitors back inside.

Nuclear Science Week 2020

Virtual Event Schedule, October 19-23

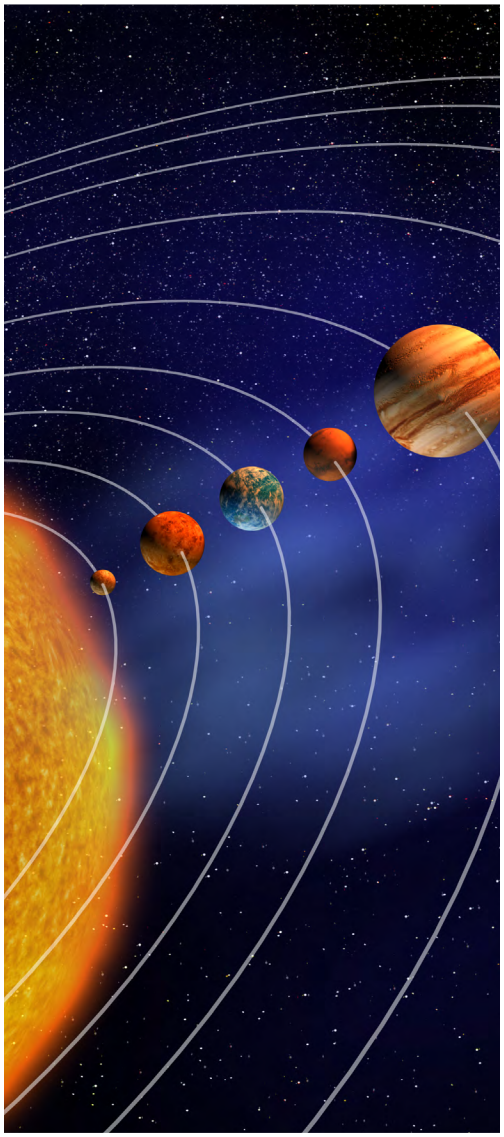
NUCLEAR SCIENCE WEEK

To learn more about how nuclear technologies positively impact American lives, visit nuclearscienceweek.org/watch and explore free virtual content during this year's Nuclear Science Week. Each day of the week, a new 30-minute episode will feature a unique aspect of nuclear technology, kid interviews, and science shorts with STEM professionals.

MONDAY
OCTOBER 19

INTRODUCTION

TUESDAY
OCTOBER 20



WEDNESDAY
OCTOBER 21

SPACE EXPLORATION + GLOBAL LEADERSHIP

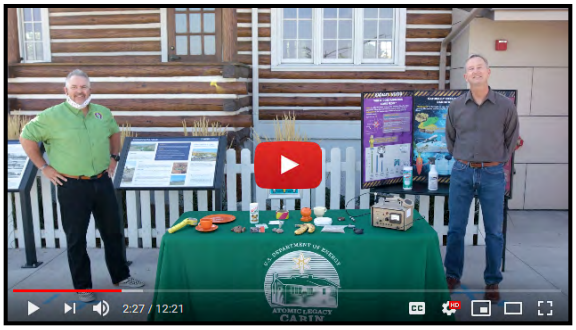
CARBON-FREE ENERGY + TRANSFORMATIVE HEALTH CARE

THURSDAY
OCTOBER 22

INNOVATION AND TECHNOLOGY + NUCLEAR SCIENCE MUSEUM

RADIATION — Energy in Motion

Visit the Atomic Legacy Cabin (ALC) website (https://www.energy.gov/lm/atomic-legacy-cabin) to watch and learn about radiation control from an expert. After watching the video, answer the following questions about radiation.



1. What is radiation?

2. What role does radiation play in nuclear science?

3. How is radiation detected?

4. How is radiation controlled?

5. What things release radiation?

BONUS QUESTION: What does ALARA stand for?

Nuclear Science & Radiation Activity Sheet

All About Atoms

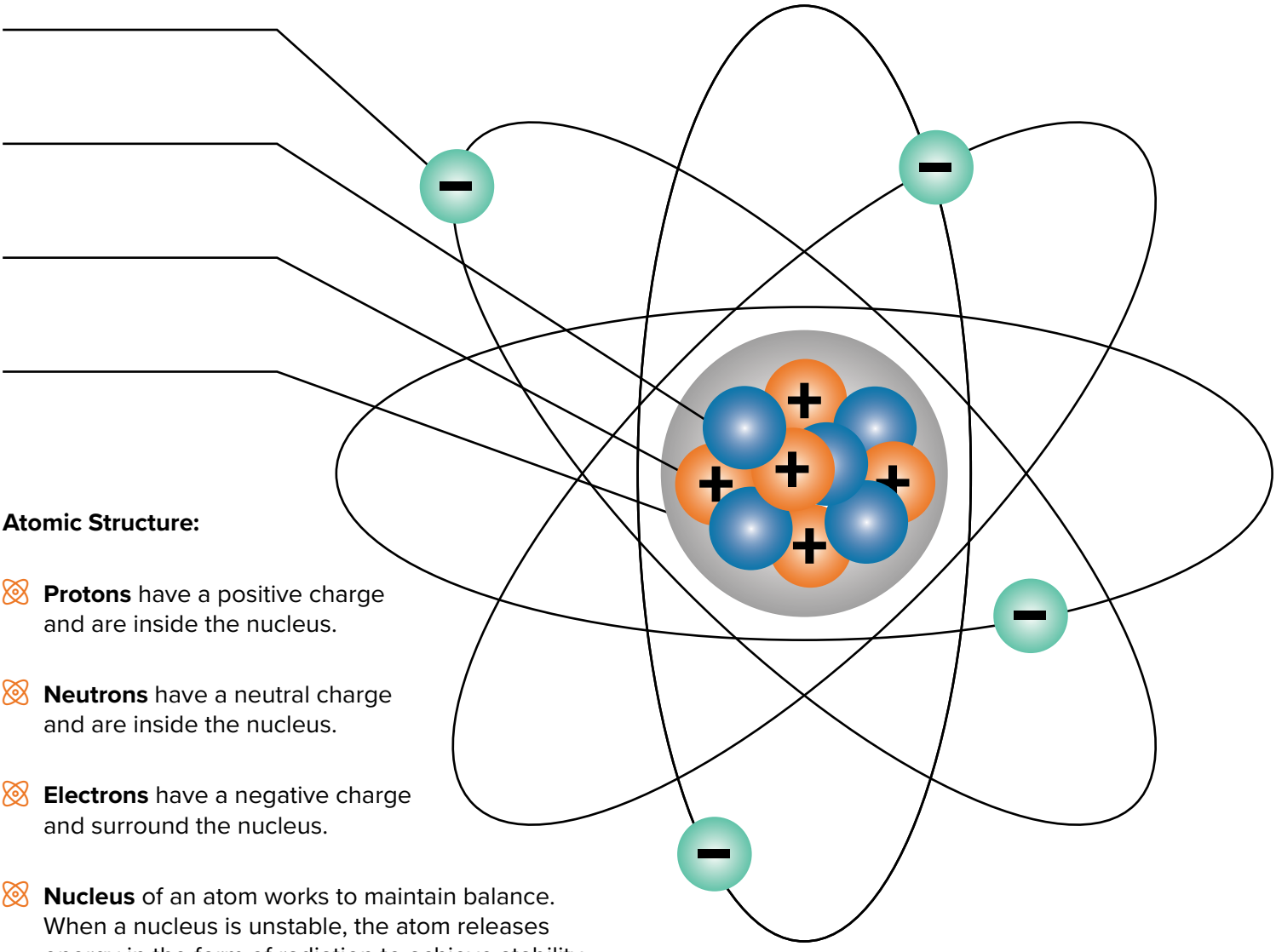
Age Level: 11-14 (middle school).

Key Definitions: atom, protons, neutrons, electrons, radiation, alpha, beta, gamma, radiation frisker.

Objective: to understand the basics of radioactive science and radiation control.

In order to understand radiation, you must first know the basics of atoms. Atoms are the building blocks of all matter. Just like blocks, atoms fit together to make up everything we see — even us! However, atoms are extremely tiny, so much so that we can't see them, even with a microscope.

There are three basic parts to an atom: protons, neutrons, and electrons. Identify the parts of an atom on the illustration below.



Atomic Structure:

- **Protons** have a positive charge and are inside the nucleus.
- **Neutrons** have a neutral charge and are inside the nucleus.
- **Electrons** have a negative charge and surround the nucleus.
- **Nucleus** of an atom works to maintain balance. When a nucleus is unstable, the atom releases energy in the form of radiation to achieve stability.

Nuclear Science & Radiation Activity Sheet

What is Radiation?

Radiation is the emission of energy from a substance. There are two main categories used to classify the source of radiation: naturally occurring (also known as background radiation) and human-made. Naturally occurring radiation comes from natural sources, which can range from the soil, water, and vegetation that we find on Earth to a wide variety of events taking place throughout the universe, like a supernova. Human-made radiation, as its name plainly states, comes from human activity, such as mining and milling of uranium.

Determine whether the following items produce naturally occurring or human-made radiation.
For naturally occurring, circle and for human-made, circle .

SUN

X-RAYS

URANIUM GLASS

URANIUM ORE

BANANAS

BUILDING MATERIALS

Nuclear Science & Radiation Activity Sheet

Three Main Types of Radiation

It might surprise you that we are surrounded by naturally occurring radiation. For instance, bananas, the sun, and even you are radioactive.

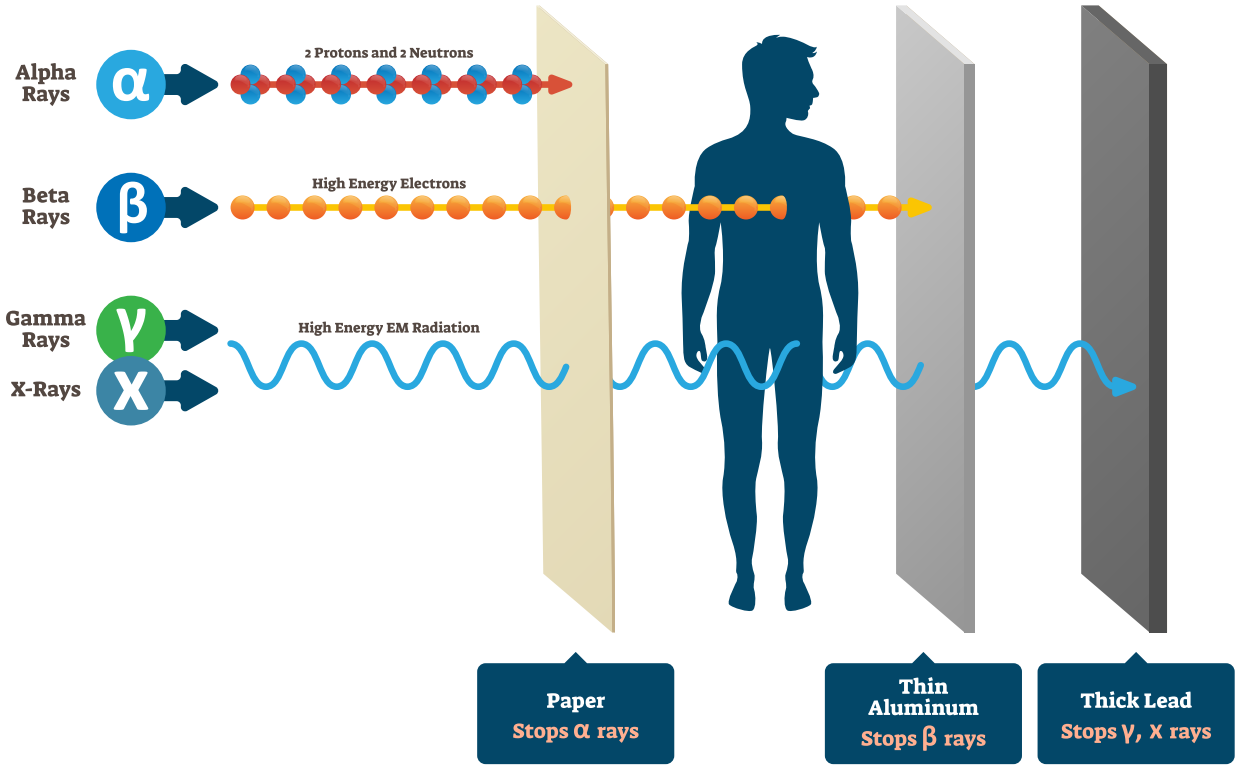
On average, we receive very low levels of radiation that are not harmful to us. However, too much radiation — like too much of anything — can be harmful. Therefore, it is important to know the basics of radiation safety like time, distance, and shielding. Time simply means limiting the exposure time to a source of radiation. Distance means making sure you keep a safe distance from a source of radiation. Shielding refers to the proper materials that can stop the emission of the three types of radiation.

1. **Alpha radiation** occurs when an atomic nucleus releases two protons and two neutrons. These particles are heavy and slow moving, making them easy to stop with a piece of paper.

2. **Beta radiation** occurs when an atomic nucleus releases an electron. These light, fast-moving particles can be stopped by thin plates of material like aluminum.

3. **Gamma radiation** involves a high energy photon escaping the nucleus and damaging surrounding material. These particles are fast moving with no electrical charge. Though harder to stop, they can be captured with thick, dense material, like lead.

***X-rays emit a form of gamma radiation, which is why we wear lead aprons when receiving a x-ray.**



Nuclear Science & Radiation Activity Sheet

Key Terms Crossword Puzzle

ACROSS

2. A type of radiation that can be stopped by aluminum.
4. The part of an atom that has a neutral charge.
5. The emission of energy from a substance.
8. A tool used to measure radiation contamination.
9. A type of radiation that can damage surrounding material.

DOWN

1. A type of radiation that releases two protons and two neutrons.
3. The part of an atom that has a negative charge.
6. The building blocks of all matter.
7. The part of an atom that has a positive charge.

Radiation cannot be detected using our five senses, which is why we use tools like the Radiation Frisker to locate and measure radiation contamination.

STEM WITH LM

energy.gov/lm/programs/stem-lm

nuclearscienceweek.org

U.S. DEPARTMENT OF ENERGY

ATOMIC LEGACY CABIN

To learn more about nuclear science and discover STEM education across the nation, explore these other resources.

U.S. DEPARTMENT OF ENERGY

Argonne NATIONAL LABORATORY · BROOKHAVEN NATIONAL LABORATORY · INL Idaho National Laboratory · Los Alamos NATIONAL LABORATORY · Lawrence Livermore National Laboratory · Lawrence Berkeley National Laboratory · NETL · NREL · OAK RIDGE National Laboratory · Pacific Northwest National Laboratory · SLAC · Sandia National Laboratories · SRNL

nationallabs.org/our-labs/stem-resources

STEM RISING

U.S. DEPARTMENT OF ENERGY

energy.gov/science-innovation/stem-rising