



Activity 7: Benefits of Radiation

Objectives

Students will examine how radiation is often used in devices and processes that help protect us and ensure our safety.

Next Generation Science Standards

The concepts in this activity can be used to support the following science standards:

- PS4. Waves and Electromagnetic Radiation.
- ESS3. Human Impact.

Common Core State Standards (CCSS)

The concepts in this activity align with the following CCSS English Language Arts Standards for Literacy in History/Social Studies, Science, & Technical Subjects:

- Comprehension and Collaboration: CCSS.ELA-LITERACY.SL.6-12.1
- Research to Build and Present Knowledge: CCSS.ELA-LITERACY.WHST.6-12.7
- Research to Build and Present Knowledge: CCSS.ELA-LITERACY.WHST.6-12.8
- Research to Build and Present Knowledge: CCSS.ELA-LITERACY.WHST.6-12.9
- Key Ideas and Details: CCSS.ELA-LITERACY.RST.6-12.2
- Integration of Knowledge and Ideas: CCSS.ELA-LITERACY.RST.6-12.7

Materials and Resources

- Radiation Protection: Teacher Background Information.
- Vocabulary Materials.
- Benefits and Unintended Impacts Worksheet (one per student, pair or group).
- Paper and/or poster board and colored pencils, pens or markers (optional).
- Student computers with Internet access to the following and a printer: (optional)
 - RadTown USA: <https://www3.epa.gov/radtown/>

Time

You may choose to have students complete the entire activity within one or two (45-60 minutes) class periods. If time or computer access is limited, the activity can be introduced, completed outside of the class and concluded in another class period.

Vocabulary

- Alpha particles
- Beta particles
- Gamma rays
- Ionizing radiation
- Radiation
- Radioactive atom
- Radioactive material

Directions

1. Start with a vocabulary activity if students are not familiar with radiation and the terms used in this activity, or provide students with the terms and definitions.

2. Explain that we use radioactive elements in many devices, processes and treatments that are beneficial and life-saving. These elements may emit ionizing radiation in the form of alpha or beta particles, x-rays and/or gamma rays.
3. Have students brainstorm sources of ionizing radiation and their useful purpose. You may want to list student responses on the board. Examples include irradiation (used to kill bacteria in food and on medical tools and devices), diagnostic nuclear medicine, nuclear energy, moisture and density nuclear gauges (used to construct stable and safe road and highways), navigation beacons and buoys, security screening devices, radiation testing and protection devices, ionizing smoke detectors and devices used to test for leaks or cracks in pipeline and aircraft parts.
4. Distribute the Benefits and Impacts Worksheet. Answers on this worksheet will vary. Supporting material for educators can be found in "Radiation Protection: Teacher Background Information."
5. Direct students to:
 - Select a device, a process or a treatment that uses radiation. Students may refer to RadTown USA (<https://www3.epa.gov/radtown>) or the links provided (Materials and Resources).
 - Identify the type of radiation used (alpha or beta particles, x-rays and/or gamma rays).
 - Research and list the benefits of the selected device, process or treatment including supporting data.
 - Research and list the impacts that may result from developing or using this radiation source, include supporting data, and consider social, economic and environmental impacts. For example, a potential social impact of nuclear medicine is that people may live longer by surviving illnesses like cancer; economically there are costs associated with the proper storage and disposal of radiation sources; and environmentally, radiation sources that are not disposed of properly may lead to radiation contamination.
 - Determine whether they think benefits outweigh the impacts.
 - Optional: Find or create a visual diagram that describes the technology and use of the radiation source.
6. Have students share their findings and thoughts on whether the benefits outweigh the impacts. Some uses of radiation may be more controversial than others. Allow students to comment on or debate the issues.
7. Explain that agencies like the U.S. Environmental Protection Agency (EPA) help monitor and manage potential impacts and protect us and our environment from radiation exposure or contamination.
8. Students should determine that:
 - Radiation is a part of our daily lives.
 - There are many benefits and uses of radiation.
 - Ionizing radiation may present health and environmental risks if not handled or disposed of properly.

Benefits and Unintended Impacts Worksheet

Name: _____

Date: _____

Identify a device, a process or a treatment that uses radiation:

What types of radiation (alpha particles, beta particles, x-rays or gamma rays) are used or given off by the device, process or treatment?

List the benefits and impacts of the source in the appropriate columns. Consider the social, economic and environmental impacts. List any supporting data.

Benefits	Impacts

If possible, create or provide a visual diagram that shows the technology or way the device, process or treatment is used.

Do the benefits outweigh the impacts? Explain your answer.
