

## What did you learn about...?

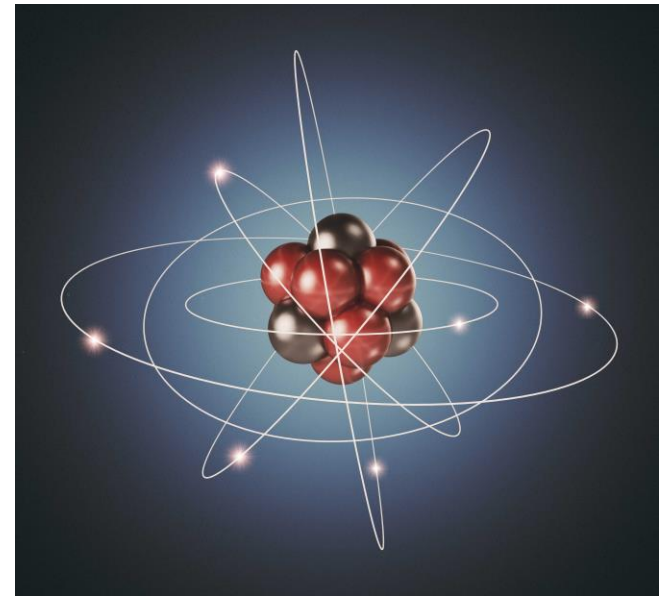
- Sources of radiation
- The amount of radiation in your home
- The relative risks of radiation
- Radiation exposure from medical sources
- Radiation exposure from natural sources
- How radiation varies based on where you live

## You will:

- Describe the radiation we receive and identify relative risks.
- Use a Geiger-Müller counter to detect radiation.
- Analyze and communicate the science behind uses of radiation.



- Atoms make up all matter, and they are made up of smaller particles.
- The atom has a nucleus.
- The atomic nucleus consists of protons and neutrons. The number of protons determines the element.
- An atomic nucleus can emit particles.
- Electrons circulate around the nucleus.
- Electromagnetic radiation is a form of energy traveling in waves, waves we can see – light – and waves we can't see – X-rays and gamma rays. The wave is determined by the energy.




## Think-Pair-Share:

- What is radiation?
- What are some risks associated with radiation?
- What are some benefits of radiation?
- How can we detect radiation?

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Pd.: \_\_\_\_\_ STUDENT HANDOUT

**THINK-PAIR-SHARE Capture Sheet**

Questions	What I Thought	What My Partner Thought	What We Will Share
What Is Radiation?			
What Are Some Risks Associated with Radiation?			
What Are Some Benefits of Radiation?			
How Can We Detect Radiation?			



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# Electromagnetic Radiation and Nuclear Radiation



Name: \_\_\_\_\_ Partner's Name: \_\_\_\_\_ Date: \_\_\_\_\_ Pd.: \_\_\_\_\_

**STUDENT HANDOUT**

## Comparing Electromagnetic and Nuclear Radiation

\_\_\_\_\_ and \_\_\_\_\_ are similar because they both:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ and \_\_\_\_\_

are different because: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

# Electromagnetic Radiation and Nuclear Radiation

Radiation is energy that can travel as a wave or stream of particles.

Electromagnetic radiation is a form of energy that travels in waves.



Nuclear radiation originates in the atomic nucleus. It is energy or particles that come out of a nucleus.

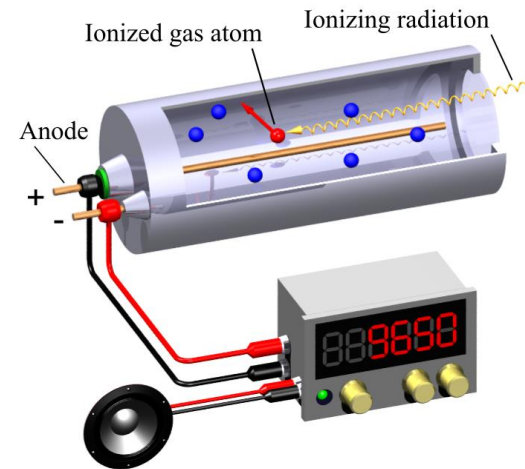




# Detecting Radiation

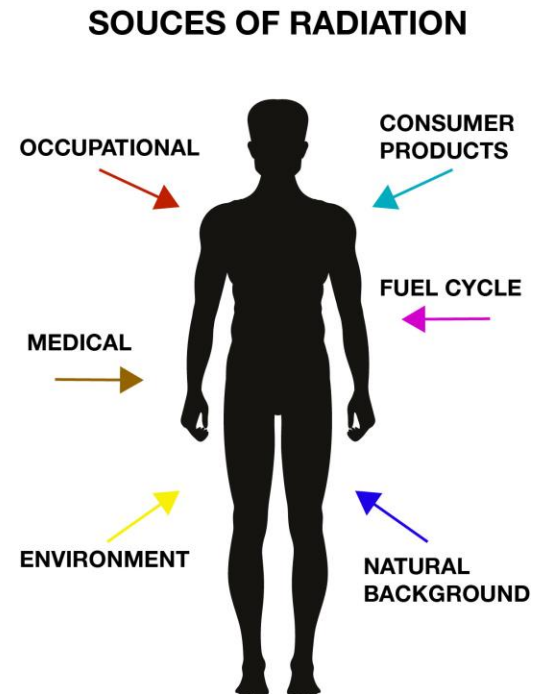
Geiger-Müller counters detect and measure ionizing radiation.

- The ionizing radiation enters a chamber that is filled with gas.
- When the radiation strikes one of the gas particles, it strips off electrons.
- The electrons move onto a wire and down the wire to the detector, which registers the surge of electrons.
- The detector registers this as a radiation event.



- Natural background
  - Radon
  - Ground
  - Cosmic Rays
- Environment
  - Stone homes
  - Granite countertops
- Medical
  - X-rays and gamma rays
  - Radiation therapy
  - Radionuclide imaging
- Occupational

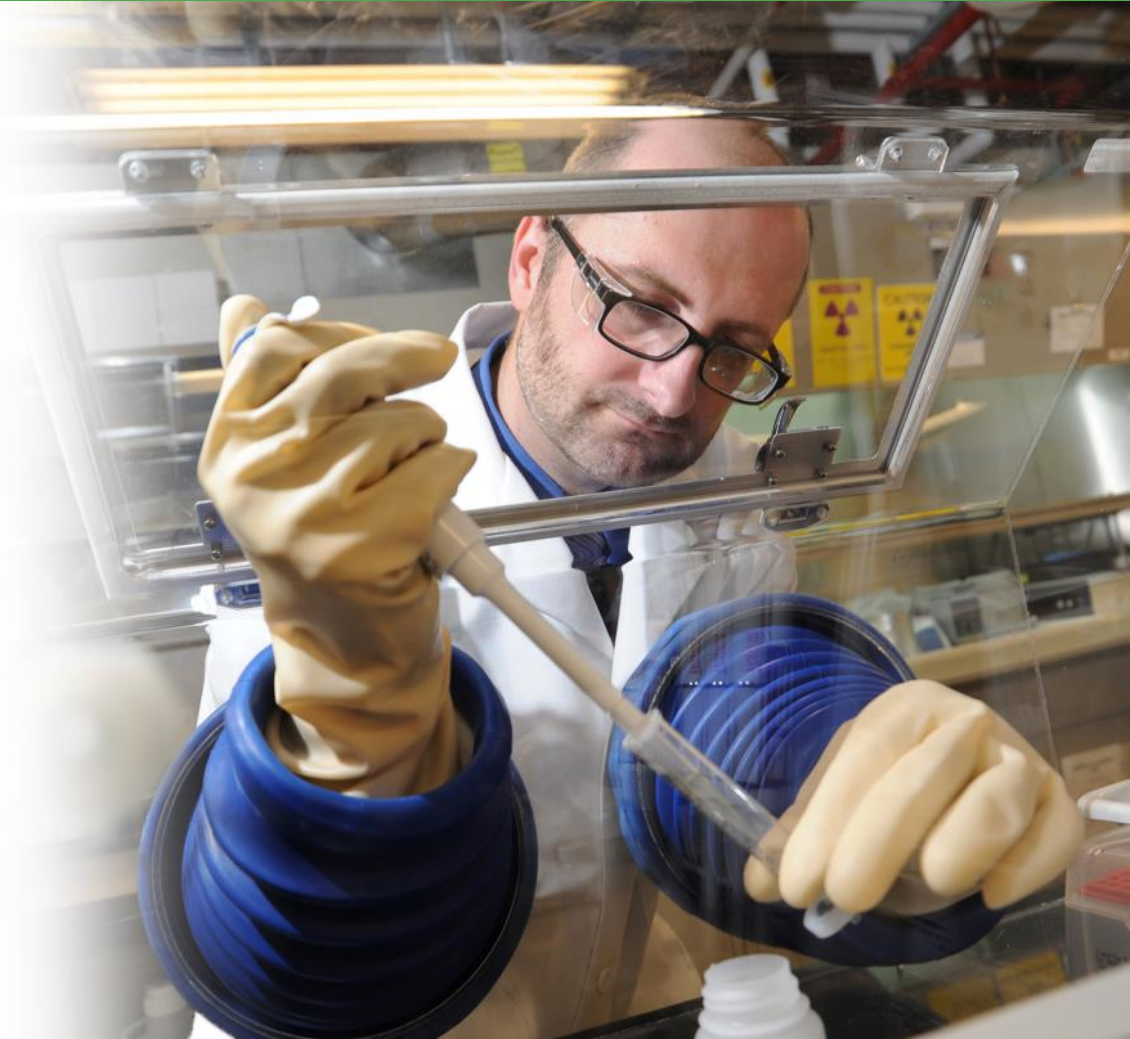
- Consumer products
  - Food
  - Smoke detectors
- Energy





# Safely Handling Radiation

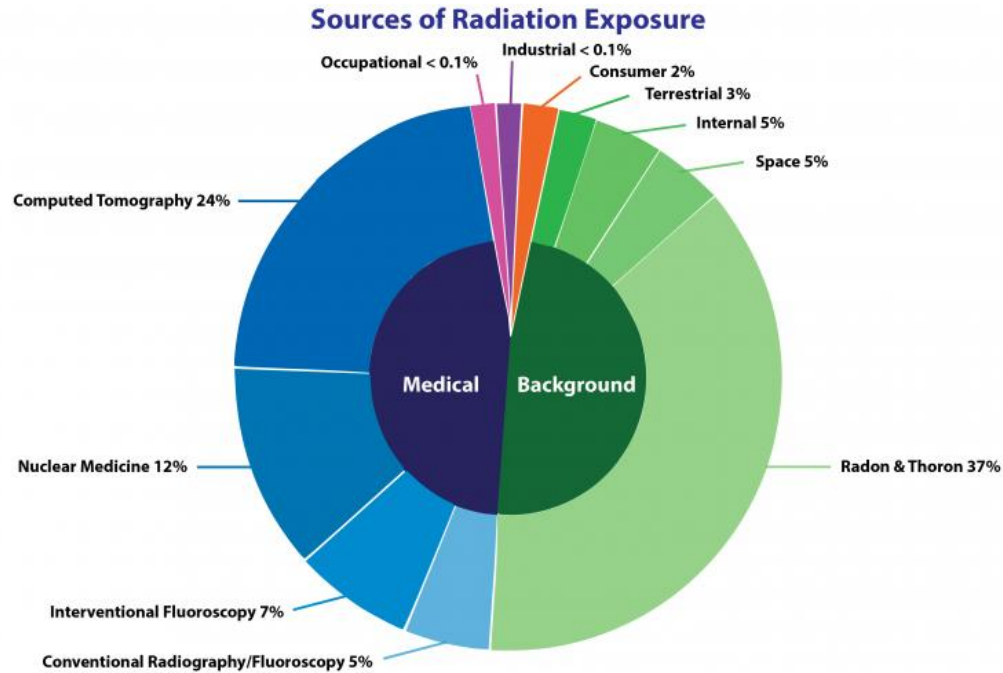
- All radiation can be dangerous if exposed to it for a long time at close range with no protection. Even non-ionizing radiation like the radiation from the sun can be harmful.
- Alpha and beta radiation generally do not get into our bodies because it cannot penetrate the skin. However, they can be harmful when the sources of alpha and beta radiation are breathed in or ingested. Hence, breathing masks are essential.
- Gamma radiation and other high-energy photons are best avoided by using thick, dense walls.



- Nuclear medicine can be used as a direct form of treatment as in radiation therapy. Radiation is directed to cancer cells to destroy them.
- Radiation is often used in imaging, such as X-rays.
- Radiation can also be used indirectly to image cancer cells.
  - Because cancer cells use a larger amount of sugar than normal cells, if you could detect where sugar is being most frequently used, you could detect the cancer. A radioactive form of sugar can be made. When it is absorbed by the cancerous tumors, the radiation emitted can be detected and the tumors can be located.



# Data on Sources of Radiation



Average Annual Radiation Dose											
Sources	Radon & Thoron	Computed Tomography	Nuclear Medicine	Interventional Fluoroscopy	Space	Conventional Radiography/Fluoroscopy	Internal	Terrestrial	Consumer	Occupational	Industrial
<b>Units</b>											
mrem (United States)	228 mrem	147 mrem	77 mrem	43 mrem	33 mrem	33 mrem	29 mrem	21 mrem	13 mrem	0.5 mrem	0.3 mrem
mSv (International)	2.28 mSv	1.47 mSv	0.77 mSv	0.43 mSv	0.33 mSv	0.33mSv	0.29 mSv	0.21 mSv	0.13 mSv	0.005 mSv	0.003 mSv

(Source: National Council on Radiation Protection & Measurements, Report No. 160)



# Using Different Types of Radiation



- Scanning technologies used at ports and airports
- Smoke detectors

- Radium dial painters
- The thyroid and nuclear medicine
- Radioactive consumer goods and dishes

