



TeachEngineering

STEM Curriculum for K-12

Shielding from Cosmic Radiation



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Ice Breaker

Start thinking about a few things:

- What's your favorite movie/book about space?
- What's something about space that fascinates you?
- What do you want to do after high school?

Why do we go to space?

- Explore and learn about the unknown
- Discover new worlds
- Push the boundaries of scientific and technical limits
- Develop new technologies and industries
- Create economic growth
- Foster peaceful connections with other nations
- Provide and maintain national security
- Address fundamental questions about our place in the universe and the history of our solar system.

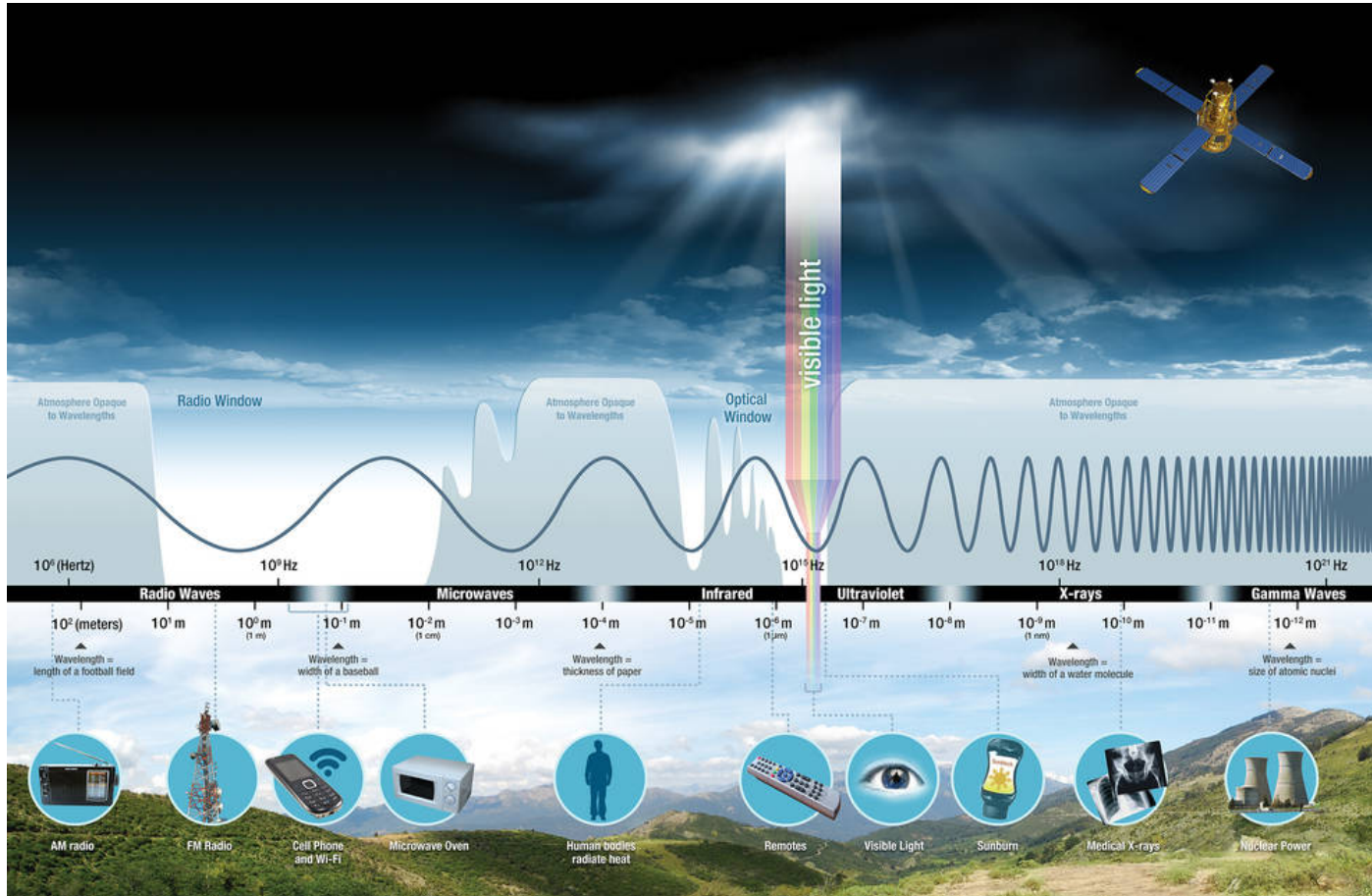
From NASA's "Why we explore?" https://www.nasa.gov/exploration/whyweexplore/why_we_explore_main.html#.YEu8JGhKhaQ

What's the obstacle?

Although we have the technology to get rockets into space, we don't have the technology to keep astronauts alive.

→ **We need to develop radiation protection.**

Electromagnetic Spectrum



The Electromagnetic Spectrum (<https://science.nasa.gov/ems>) Credits: NASA

What are different types of radiation?

Particle Radiation

- Alpha
- **Beta**
- HZE Ions
- Cosmic Radiation

Electromagnetic Radiation

- **Gamma rays**

WHAT IT TAKES TO STOP RADIATION

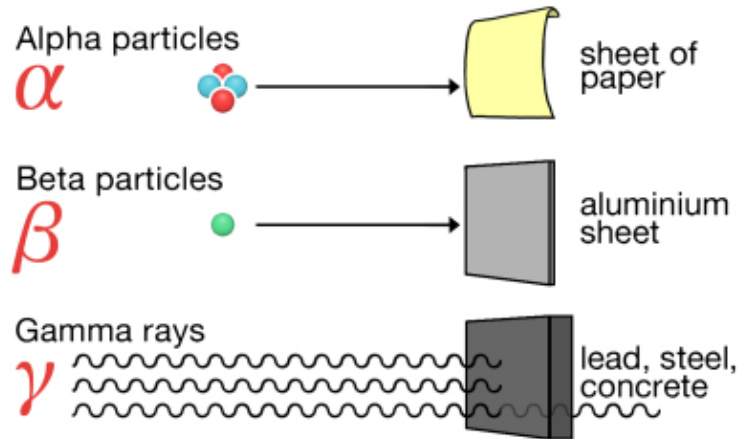


Image: en.Wikipedia.org

Radiation Video One



<https://youtu.be/GoEk7Uu8a2M>

Radiation Video Two

Cosmic
Rays history



<https://youtu.be/Asc-tArn0nk>

What are we doing?

We are going to be sending up a payload to near space!

You will be designing and constructing these payloads and measuring the radiation up in the atmosphere.

But we're also going to be shielding the Geiger counters from radiation, using various materials as the shielding.

Your job is to determine which materials work the best at shielding radiation.

The Space Agency Scenario

The Hoswar States and Dufrol Empire have initiated a space race!

The goal is to create a space-faring vessel that will protect your “astronaut” (Geiger Counter) from deadly cosmic radiation.

You must design, create, and construct your payload better than the other nation in order to win this space race.

Each agency has people in different roles working together to win the space race.

Payload Materials

Essentials:

- Arduino
- Geiger Counter
- Wires
- Batteries
- Adhesives
- Radiation Shield

Available Shielding Materials

- Balsa Wood
- Steel
- Galvanized Steel
- Space Blanket
- Aluminum
- Secret Material

Director of the Space Agency

- The Director oversees the entire Agency.
- Provides strategic direction for the Agency.
- Make decisions for the Agency.
- Make sure everyone sticks to the schedule to unlock a special achievement.
- Do a mini presentation on your agency's progress.

Economic Advisor

- Buy and trade materials.
- Keep track of the budget.
- Maintain good budgeting skills and receive funds from your government for your space agency.
- Work with the Director on the Director's presentation concerning economics.

Computer Scientist

- Assemble, wire, and operate the Arduino, which will be recording data during the launch.
- Research basic operations of the Arduino.
- Improve code, monitor radiation.
- Test the Arduino prior to launch.

Engineers

- Assist in the designing process.
- Advice on the buying of materials.
- Build the payload and protective shielding for your astronaut.
- Test the payload to ensure it functions properly (drop test, shake test, etc.).
- Ensure the payload is secure.
- See worksheet for engineer descriptions and salaries

Research & Development

- Use available resources to research which materials would be best in protecting your astronaut from radiation.
- Design how the payload is to be constructed, taking into consideration how to secure the elements.
- You will have the opportunity to discover a NEW MATERIAL for your agency and unlock a special achievement!

Public Relations

- Design a logo for your space agency.
- Create an Instagram and/or Twitter page for your space agency and project.
- Take pictures of your agency's groups at work.
- Obtain likes on your social media page to unlock special achievements.
- Create a poster board for your space agency.

Get in your groups

Role	Hoswar States	Dufral Empire
<u>Director</u>		
<u>Engineers</u>		
<u>Computer Scientists</u>		
<u>Research and Development</u>		
<u>Economic Advisor</u>		
<u>Public Relations</u>		