

Summary: For this lesson, I will be using radiation data that has been collected over the course of six separate space missions. These missions include: Apollo 11, 12, 14, 15, 16, and 17. In this data, NASA has determined the level of radiation on astronauts compared to the total duration of the mission. In this lesson, students will determine the average amount of radiation impacted on astronauts of the different missions. From this, students will research the different types of spacesuits used for each mission and discover how electromagnetic radiation travels through materials differently. Students will use this analysis of data to create an argument of which space suit material keeps the astronauts the safest and poses a design for future missions.

NGSS: HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

CCSS.MATH.CONTENT.HSS.IC.B.4

Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS.MATH.CONTENT.HSS.IC.B.6

Evaluate reports based on data

Lesson Duration: 3 hours

Grade Levels: 8-12

Data is found on page 6 of

[https://www.nasa.gov/sites/default/files/atoms/files/space\\_radiation\\_ebook.pdf](https://www.nasa.gov/sites/default/files/atoms/files/space_radiation_ebook.pdf)

**Engage: (15-20 minutes)** To get students expressing their thoughts. Students will be asked to draw out a concept map with the word radiation in the middle.

Steaming from the center of the concept map, students will be asked to practice a KWL writing. Students will write what they know about radiation (this can be anything related to radiation) and students will write questions of what they want to know about radiation. After this point, a class discussion will be formed to have students express their ideas and questions.

Next, students will be shown two short videos about radiation. After the video, students will then complete the L portion of the KWL writing. They will write statements of what they learned during the video.

<https://ed.ted.com/lessons/is-radiation-dangerous-matt-anticole>

<https://www.nasa.gov/feature/space-radiation-is-risky-business-for-the-human-body>

Engage Materials:

Students (pencil, paper)

Teacher (computer/internet, projector, video)

**Explore: (15-20 minutes)** The engagement will lead into the next discussion about space radiation. The teacher will pose the question "What causes the radiation present in space?", from this question a class discussion should be formed. Students should have a basic understanding that the sun's ray energy in space is much stronger than here on Earth. From this, the teacher will pose a second question "What do you think happens when we are exposed to large amounts of radiation?". From background knowledge and scaffolding, students should start thinking about mutations of cells, cancer, death...etc. This will move into the introduction of the NASA twins and their discoveries with the effects of radiation. Students will be shown a short video explaining the effects found on the twin that spent a year in space. After the video, the teacher should discuss with students if they were shocked by the video or not.

<https://www.nasa.gov/press-release/nasa-s-landmark-twins-study-reveals-resilience-of-human-body-in-space>

Explore Material: Teacher (computer/internet, video)

**Explain: (15-20 minutes)** The teacher will pose the question "what could be updated and engineered in a different way to reduce the levels of radiation for astronauts?" Students will likely bring up the rocket itself, however the teacher should encourage students to think about "What protects the astronauts individually?". With scaffolding the students should come to the conclusion that the spacesuits help protect the astronauts from radiation. However, these spacesuits could be improved upon. Once this conclusion has been made, the teacher will introduce the missions radiation data to the students. Students will work in pairs to determine the average radiation per hour for each mission. From this data, students will determine which mission had the lowest amount of radiation exposure.

Data is found on page 6 of

[https://www.nasa.gov/sites/default/files/atoms/files/space\\_radiation\\_ebook.pdf](https://www.nasa.gov/sites/default/files/atoms/files/space_radiation_ebook.pdf)

Explain Material:

Students (paper, pencil, calculator) Teacher (computer/internet, projector, video)

**Elaborate: (40-60 minutes)** Students will use the NASA data to lead their research project. Students will research the materials commonly used on the NASA mission that the data was collected from. From their research students will come to a conclusion of which "main" material is most beneficial to refract the radiation from the astronauts, thus, should be the main material used for future astronaut suits. Students will support their scientific argument by developing a C.E.R (Claim, Evidence, Reasoning) scientific writing, that uses the research that they have found.

\*The C.E.R rubric can be found at the end of the lesson (page 5)

Elaborate Material:

Students (chromebook, C.E.R rubric, paper, pencil)

**Evaluate: (40-60 minutes)** As a final assessment, students will express their creative side and engineer their own barbie astronaut suit (using recycled materials that represent the researched material). They will present their design to the class, justifying their material selection and design using the evidence from their research project.

\*The Astronaut Suit Presentation rubric can be found at the end of the lesson (page 6).

Evaluate Materials:

Students (barbie, recycled material, Astronaut Suit Presentation rubric, research from elaborate stage)

References

The data for this lesson was retrieved from NASA. Below are the citations for each resource.

NASA's Landmark Twins Study Reveals Resilience of Human Body in Space. (2019). NASA.

<https://www.nasa.gov/press-release/nasa-s-landmark-twins-study-reveals-resilience-of-human-body-in-space>

Space Radiation. (n.d.).

[https://www.nasa.gov/sites/default/files/atoms/files/space\\_radiation\\_ebook.pdf](https://www.nasa.gov/sites/default/files/atoms/files/space_radiation_ebook.pdf)

Space Radiation is Risky Business for the Human Body. (2017). NASA.

<https://www.nasa.gov/feature/space-radiation-is-risky-business-for-the-human-body>

C.E.R Scientific Writing Rubric

Rubric Categories	Distinguished	Proficient	Apprentice	Novice	zero
<b>Claim</b> (out of 10 points)	-Claim is <u>correct</u> .  -Claim is in a <u>complete detailed sentence</u> . <b>10 points</b>	-Claim is <u>correct</u>  -Claim is in a <u>complete sentence</u> (not detailed). <b>8 points</b>	-Claim is <u>not correct</u> , but in a complete sentence.  Or  -Claim is <u>correct</u> , but not in a complete sentence. <b>6 points</b>	-Claim is not correct and is not in a complete sentence. <b>4 points</b>	-Claim was not stated. <b>0 points</b>
<b>Evidence</b> (out of 15 points)	-All three pieces of evidence are supporting claim.  -All three pieces of evidence come from the provided text.  -All three pieces of evidence begin with a sentence starter and cite where information is from. <b>15 points</b>	-Two pieces of evidence are supporting claim.  Or  -Two pieces of evidence come from the provided text.  Or  -Two pieces of evidence begin with a sentence starter and cite where information is from. <b>12 points</b>	-One piece of evidence are supporting claim.  Or  -One piece of evidence comes from the provided text.  Or  -One piece of evidence begins with a sentence starter and cite where information is from. <b>9 points</b>	-One piece of evidence supports claim  Or  - One piece of evidence comes from the provided text.  And  -Missing all sentence starters and evidence cites. <b>6 points</b>	-Missing all three evidence pieces. <b>0 points</b>
<b>Reasoning</b> (out of 15 points)	-All three reasonings explain the connected evidence and support claim.  -All three reasonings are detailed and in the student's own words. <b>15 points</b>	-All three reasonings explain the connected evidence and support claim.  -All three reasonings are in the student's own words, but not detailed. <b>12 points</b>	-Two reasonings explain the connected evidence and support claim.  -Two reasonings are detailed and in students own words. <b>9 points</b>	-One reasoning explains the connected evidence and supports claim.  Or  -Two reasonings are not detailed, or not in students own words. <b>6 points</b>	-Missing all three reasonings. <b>0 points</b>
<b>Grammar</b> (out of 10 points)	-Only 1-3 small grammar mistakes (spelling, capital letter, punctuation) <b>10 points</b>	-Writing has 4 -6 small grammar mistakes. <b>8 points</b>	- Writing has 7-10 small grammar mistakes  and/or  -1-2 incomplete sentences. <b>6 points</b>	-Writing has 10-13 small grammar mistakes.  and/or  -3-5 incomplete sentences. <b>4 points</b>	-Writing has more than 13 small grammar mistakes.  and/or  -More than 5 incomplete sentences. <b>0 points</b>

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**Astronaut Suit Presentation Rubric**

<b>Rubric Categories</b>	<b>Expectations</b>
<p><b>Model Astronaut Suit (10 pts)</b></p>	<p>The suit is well thought out and is obvious that the student spent a lot of time and effort on the design.</p>
<p><b>Scientific Argument (20 pts)</b></p>	<p>The student presents which material he/she has chosen for his/her astronaut suit. He/she supports his/her claim with evidence from their corresponding research.</p>
<p><b>Presentation (10 pts)</b></p>	<p>The student will present their astronaut suit in a way to try to sell his/her design idea. The student will present the information professionally:</p> <ul style="list-style-type: none"> <li>- Presentation 3 - 7 minutes duration</li> <li>- Speak clearly</li> <li>- Talk to your audience (eyecontact)</li> <li>- Be prepared to answer basic questions about the design or material.</li> </ul>