

GRADES
3-5

**NAVIGATING™
NUCLEAR** 
Energizing Our World

Virtual Field Trip

EDUCATOR GUIDE

**NUCLEAR FRONTIERS:
POWERING POSSIBILITY**

Overview

In this Virtual Field Trip (VFT), elementary students ride along on a voyage to outer space and back again. Students will explore the different ways nuclear science is being used on Earth today. Additionally, they will learn about the potential of nuclear power for travel between Earth, the Moon, and beyond. They will also investigate some of the ways that nuclear technology can be used in space, and they'll learn about the potential these technologies have to positively impact life in lunar colonies. The companion activities included here are designed to engage students prior to and during the Virtual Field Trip, as well as extend learning from the Virtual Field Trip to the classroom.

Objectives

Students will:

- Investigate the multifaceted applications of nuclear science
- Compare and contrast the use and potential of nuclear energy on the Moon with other energy sources
- Design their own lunar base while considering where nuclear power and nuclear science are used

Materials

- Engage: Energy Sort Cards, one set for half the class (cut out in advance).
- During-the-Virtual Field Trip: Nuclear Science graphic organizer, one per student.
- After-the-Virtual Field Trip: Nuclear Science Potential graphic organizer, enough for half the class.
- After-the-Virtual Field Trip: Design A Lunar Base graphic organizer, one per student.

Instructional Delivery Method

The Virtual Field Trip is presented as an in-classroom experience, but it can also easily be completed at home. Feel free to make modifications based on your teaching environment. For example:

- All materials may be shared virtually.
- All partner activities may be completed independently or in virtual breakout rooms.
- Discussions can be conducted virtually, or students can respond to questions in writing independently.

Educator Prep

Looking for a fun way to prepare students for their extra-terrestrial Virtual Field Trip? Consider kicking off with a read-aloud! A story like *Max Goes to Mars* by Jeffrey Bennet will prompt students to begin thinking about some of the topics they will be exploring throughout this activity. This [digital version](#) is free to all and read by NASA Astronaut Michael Hopkins!

Engage

- Divide students into pairs and distribute one set of Energy Sort Cards to each pair. Challenge pairs to review the cards and devise a way to sort them into different categories.
- Once students have tried a few sorting techniques, invite them to share some of their categories.
- Then write the term energy on the board and describe energy as the ability to do work or make things happen. Explain that any kind of movement, change, or growth requires energy.
- Ask students to sort through their cards once more as they consider which images use or need energy. Then be sure the class understands that every card illustrates something that uses and/or requires energy. However, this energy comes in different forms! An *energy source*

is a place where energy can be found, taken from, and used. While all these images use energy, many of them get their energy from different sources.

- Instruct pairs to lay all their cards out in front of them and lead them through one final sort based on their background knowledge. Ask: Based on what you know about these images...
 - Which one(s) get energy from food?
 - Which one(s) get energy from sunlight?
 - Which one(s) may get their energy from batteries?
 - Which one(s) may use gasoline for energy?
- Wrap up by explaining that while humans get energy from food, plants get energy from sunlight, where most energy used on Earth comes from. Some electronics get energy from batteries, and there are also many other kinds of energy sources. Students will learn more about nuclear processes—and their emitted energy—as they participate in the ____ Virtual Field Trip!

During the Virtual Field Trip

Distribute one *During-the-Virtual Field Trip: Nuclear Science graphic organizer* to each student. Review the directions provided and explain that the Virtual Field Trip will explain how one type of energy—nuclear energy—can be used on Earth and in outer space! As students learn about how nuclear science can be used on Earth, on the Moon, and in transit between the two, instruct them to sketch images or write notes on their organizer.

After the Virtual Field Trip Activity 1

- Encourage students to refer to the sketches they created during the Virtual Field Trip and share the different ways that nuclear science can be used on the Moon. Create a list on the board as students share.
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- Once the list is complete, challenge students to recall

the benefits of using nuclear science for these purposes. Ensure students touch on ideas related to the following:

- Nuclear energy is reliable and more dependable in space than energy from other fuels or the Sun.
 - Nuclear science can provide benefits other than just power. For example, it can help prevent the spread of disease, sterilize food, etc.
 - In the future, nuclear fusion may be able to provide the universe with a huge and unprecedented amount of power.
 - Nuclear power can help us work toward a sustainable future. And one bonus fact! Our bodies are radioactive. There are many substances that are naturally in our environment that we safely eat, drink, and breathe that are absorbed in our bodies.
 - Then ask students to find their partner from the Engage Activity and distribute one *After-the-Virtual Field Trip: Nuclear Science Potential organizer* to each pair.
 - Read the directions aloud and challenge students to work with their partners to create three two-panel comics that communicate the potential (or importance) of nuclear science on the Moon. Remind students that the quality of their drawing skills is not important! Explain:
 - Each comic should include one panel that communicates how nuclear science would benefit a lunar base, as well as one corresponding panel that communicates what might happen if nuclear science wasn't discovered. You may also challenge older students to use the second panel to portray what might happen if the Moon base used a different energy source—solar, fuel, or wind, for example—but this is not a requirement.
 - Encourage students to be creative and even humorous but remind them to also base their comics on facts that they have learned during the Virtual Field Trip. They should use the list on the board and their *During-the-Virtual Field Trip* sketches to guide their brainstorming.
- For instance, in a comic centered on transportation, the first panel could illustrate how a nuclear-powered

charging station enables astronauts to use rovers to explore the planet, while the second panel could show an exhausted astronaut attempting to explore the planet on foot or a Moon-based tow truck bringing a broken-down rover back to the garage.

Tip: If you would like to give students the option of using a digital tool to create their comics, [Pixton EDU](#) and [StoryboardThat](#) are just a couple of the free resources available for digital content creation.

Extension/Enrichment

- Do you have a nuclear power plant in your state? If not, where is the closest one? Students can connect the concept of nuclear power to their own lives by [researching](#) the nuclear power plant(s) closest to them and considering how these power plants may benefit communities.
- Students can further explore the concept of fusion by exploring how the Sun makes energy using this [video](#) and [game](#) from NASA Space Place.

Activity 2

- Distribute one *After-the-Virtual Field Trip: Design A Lunar Base organizer* to each student. Explain that students will now use their creativity and what they have learned to design their own Moon Base.
- Review the directions provided and encourage students to have fun as they consider what they might want on a base if they lived there—in addition to the required elements. Also remind the class to label any part of the base that could rely on nuclear science (E.g., “Rover Charging Station”).

Note: You may wish to encourage students to brainstorm first with a partner, before completing the activity independently.

- When there are about 10 minutes left in the session, invite students to share their designs and compare and contrast the bases that each student envisioned.
- Wrap up by sharing this thought: thanks to aerospace

innovation, advances in nuclear technology, and space propulsion, students might someday have the opportunity to travel to the Moon and stay at a lunar base like the one they just designed!

Extension/Enrichment

- Students can build 3D models of their Moon bases using these moon habitat [ideas](#) from NASA Space Place as inspiration.
- Students can practice driving a rover in this [game](#) from NASA Space Place. They can then design and build their own rover—either by following this Make a Cardboard Rover [NASA activity](#) or by using everyday materials of their choice.

Standards

Next Generation Science Standards

- 4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses which affect the environment.
- 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

English Language Arts Standards

Speaking and Listening:

- CCSS.ELA-LITERACY.CCRA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

Engage: Energy Sort Cards

Cars



Lights



Rocket



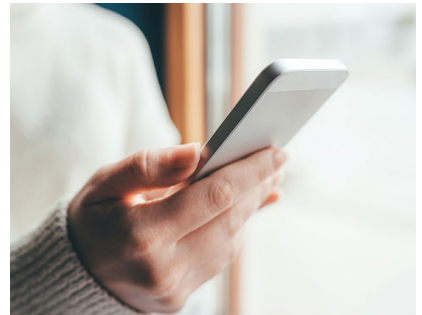
Child



Home heater



Cell phone



TV remote control



Shower



Plant



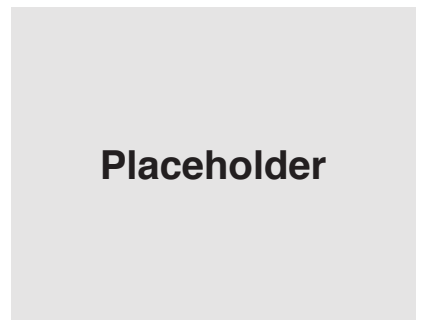
School



House

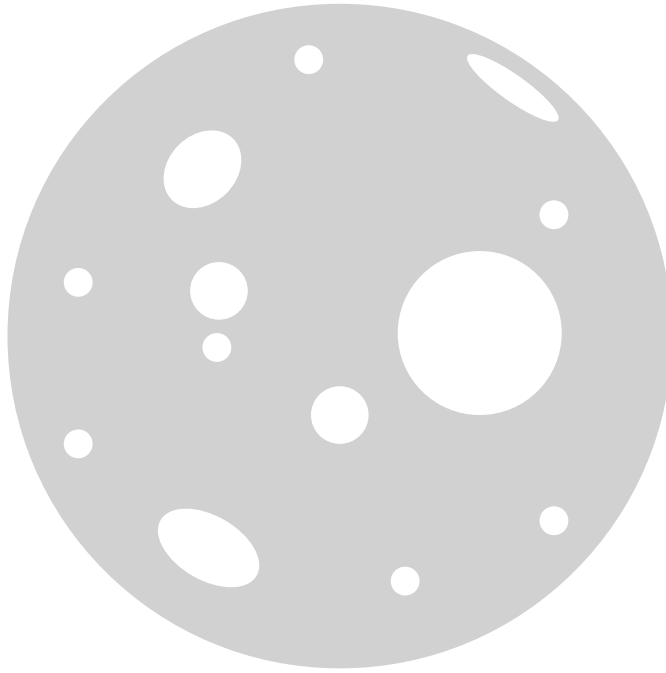


Moon base



During-the-Virtual Field Trip: Nuclear Science organizer

Directions: Jot notes or sketch pictures below as you learn how nuclear science can be used on Earth, on the Moon, and for travel between the two.



After-the-Virtual Field Trip: Nuclear Science Potential organizer

Directions: Help others identify the potential (or importance) of nuclear science on the Moon! Below, illustrate three important things that could happen at a Moon base thanks to nuclear science...*and* then imagine what a Moon base may look like if this science did not exist!

<i>With nuclear science on the Moon...</i>	<i>Without nuclear science on the Moon...</i>
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<i>With nuclear science on the Moon...</i>	<i>Without nuclear science on the Moon...</i>
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<i>With nuclear science on the Moon...</i>	<i>Without nuclear science on the Moon...</i>
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After the Virtual Field Trip: Design A Lunar Base organizer

STUDENT HANDOUT

1. In the space below, design your own Moon Base! Think about what you would want to have in your “home” if you were an astronaut living on the Moon. Also be sure to include where or how astronauts would:
sleep **grow food** **get water** **work** **travel** **refuel** **take off and land**
2. When your sketch is complete, label every part of your Moon Base that could be helped by nuclear science.

