SCIENCE FAIR CENTRAL

Maker Corner Activity

DESTINATION: SPACE!

Grades 6–8

MAKE. CREATE. EXPLORE.

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Can you imagine what it would be like if you lived on the moon?

Overview

Can you imagine what it would be like if you lived on the moon? In an age when the possibility of living in space is becoming more and more of a reality, students will learn about the moon's unique conditions in order to design a prototype of a lunar base. Students will perform research to help them understand how to overcome the obstacles that the moon's surface provides. They will then use their research to build a prototype of a lunar outpost that uses resources wisely.

Have you ever wondered . . .

What makes the Earth so unique?

Every day, we wake up and go to sleep on Earth, often taking our planet for granted. From miniscule organisms to plant life and animals, Earth is able to sustain life by providing living things with the drinking water, food, and air needed to survive. In addition, Earth maintains a temperature that is temperate, its atmosphere protects us from radiation, it provides a surface that is safe to walk on, and it has ways to get rid of waste products in a safe manner.[1] Does this make you appreciate our planet a little more?

This activity focuses on the **Defining the Problem**, **Designing Solutions**, **Creating or Prototyping**, **Refining and Improving**, and **Communicating Results** stages of the Engineering Design Cycle.

Engineering Design Cycle

- **Defining the Problem**
- **Designing Solutions**
- **Creating or Prototyping**
- **Refining or Improving**
- **Communicating Results**

Objectives

Students will be able to:

Understand the conditions on the Moon's surface and the impact these conditions could have on humans.
Evaluate the best way to overcome the Moon's obstacles in order to build a life-sustaining lunar base.
Create a prototype of a lunar base that tackles these challenges.

If you lived on the moon, one failed system could ruin everything!

Materials

- Earth and Moon image, to project
- Moon Mission Brainstorming Sheet, one per group
- Popular Science Article, one per student
- Devices with internet access, at least one per group

The following materials can be shared among all student groups:

- Duct Tape
- (2) Metal Washers
- Trash Bags
- Paper
- Paper Cups
- Bubble Wrap
- Paper Plates
- All Purpose Glue
- Super Glue
- Scissors
- (3) Sticky Notes

The teacher can determine if the following items should be cut into even pieces ahead of time or if groups can have a design plan approved and have the material cut to size as needed:

- Aluminum foil
- (2) Multi-purpose Foam
- (6) Cardboard
- String

Could we live on the moon?

Everything mentioned above changes when you consider moving to another celestial object. All of a sudden, the very basic elements of life that we take for granted are no longer present! Everything that humans need to survive must be brought to that other celestial object, and the celestial object's conditions must be considered long before humans get there. It's also important to have some kind of backup for materials that are necessary to sustain life. You wouldn't want one system fail to ruin everything! And to complicate things even further, it is expensive to transport goods to outer space, so every material must be carefully thought out before it is transported.[2]

In space, the very basic elements of life that we take for granted are no longer present!

Make connections!

How does this connect to students?

In 1969, Neil Armstrong and Buzz Aldrin became the first two people to land on the moon. As science has advanced since that time, private companies have shown a growing interest in beginning tourism on the moon, which is an industry that could debut during your lifetime! [3]

How does this connect to careers?

Aerospace Engineer—Aerospace Engineers not only design space stations and spacecrafts, but they also design satellites that help build our understanding of outer space.

Mechanical Engineer—Mechanical Engineers create products like engines, sensors and other machines that play an important role in supporting space missions.

Astronomer—Astronomers use Earth-based and space-based equipment to analyze data and make observations about space.

Electronics Engineer—Electronics Engineers are critical for space exploration because they design equipment and monitor existing equipment to make sure it is safe.[4]

How does this connect to our world?

As technology continues to advance and a greater number of careers and companies are focusing on space, travel to the moon is becoming more and more of a real possibility for the average person. It's important, however, to understand the challenges that come with this exploration! In this activity, you will uncover some of the obstacles to lunar living, as well as ways that we may be able to overcome them.

Blueprint for Discovery

Prior to the Class Arriving:

- Prepare Earth and Moon image to project or print out several copies of the image for students to examine in groups.
- Photocopy the article (one per student) and brainstorming sheet (one per group of 3-4 students).
- Display the prototype materials in an area of the room that is easily accessible to students.

During Class:

1. Project the Earth and Moon image

2. Have students work with a partner to create a t-chart examining what they think they need to survive and be healthy living on Earth versus the Moon.

3. Probe: How are the two sides of your chart similar and different? Why? Engage the class in a quick group discussion around this topic.

4. Pass out the Popular Science article, "We Could Be Living on the Moon in Ten Years or Less," to each student. Instruct students to read and annotate the article for the challenges of living on the moon. They should add information to their t-chart as needed.

5. Give students the following task: Fast-forward ten years. You are all now working for a top company called the Aerospace Design Firm. No one has lived on the moon yet, and your company has been tasked with changing this! In teams, you will work to create a lunar base model that could serve as a temporary residence for humans. At least four humans will need to be able to live on your base for one year. After researching ways to overcome some of the challenges to living on the moon, your team will design a prototype of your lunar base. It is this prototype that will be shared with your firm's client, who will ultimately choose one design for the world's very first lunar base!

6. Break students into groups of three or four and give each group a Moon Mission Brainstorming sheet. Provide students with a general overview of the brainstorming sheet and the materials they have available to produce their prototype. Be sure to share the amount of time students will have to complete Steps 1 through 3 on their Moon Mission Brainstorming sheet.

7. Provide students with updates indicating how much time they have left throughout the research, design and building process.

8. Close to the end of the timet allotted for building their prototype, **pass out sticky notes** to each group and direct the students to label the different components of their design.

9. Before class wraps up, **encourage students to take part in a Gallery Walk** so they have a chance to see what the other groups have produced.

Take Action

Possible Extension Activities:

1. Encourage each group to share their prototype with the class and explain their design decisions. Student groups may then revise their own prototypes as they incorporate ideas from their classmates. As the head of the Aerospace Design Firm, you may select one "winning" design proposal once all designs have been finalized—or, the class may decide through a vote.

2. Students can create a written proposal for their lunar base, which will be sent to NASA for their consideration. The proposal should describe the challenges that the moon presents as well as rationale for their design.

The class proposals can be mailed to:

NASA Headquarters
300 E. Street SW, Suite 5R30
Washington, DC 20546

National Standards

Science

Next Generation Science Standards

MS-ETS1-1 Engineering Design
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design
Evaluate competing design solutions based on jointly developed and agreed-upon design criteria using a systematic process to determine how well they meet the criteria and constraints of the problem.

Technology Education

Next Generation Science Standards and **International Technology and Engineering Educators Association**

Students will develop an understanding of Design. This includes knowing about:

- Attributes of design.
- Engineering design.
- The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

English Language Arts

Common Core

CCSS.ELA-LITERACY.CCRA.R.1
Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCSS.ELA-LITERACY.CCRA.R.10:
Read and comprehend complex literary and informational texts independently and proficiently.

English Language Arts

CCSS.ELA-LITERACY.CCRA.W.7
Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

CCSS.ELA-LITERACY.CCRA.W.4:
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-LITERACY.CCRA.SL.3:
Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

CCSS.ELA-LITERACY.CCRA.SL.4:
Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

Works Cited

1. Tranfield, Erin. "Building a Space Habitat in the Classroom." *Science in School: The European Journal for Science Teachers.* http://www.scienceinschool.org/2011/issue19/habitat.

2. Lunar Nautics: Designing a Mission to Live and Work on the Moon Educator Guide. NASA. https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Lunar_Nautics_Designing_a_Mission.html.

3. Powell, Corey S. "NASA Has Big Plans for the Moon – and Big Competition. NBC News. https://www.nbcnews.com/mach/science/nasa-has-big-plans-moon-it-s-not-only-one-ncna806646.

4. Angeles, Domingo and Vilorio, Dennis. "Space Careers: A Universe of Options. Bureau of Labor Statistics. https://www.bls.gov/careeroutlook/2016/article/careers-in-space.htm

Moon Mission Brainstorming Sheet

Your Mission: As an employee of ADF (Aerospace Design Firm), you have been tasked with the job of creating a lunar base that will serve as a temporary residence for humans. At least four humans will need to be able to live on this base for one year. Your team will first need to research how to overcome some of the challenges to living on the moon. Your team will then design a prototype of your lunar base, being careful to use resources efficiently.

Step 1: Use the internet to research potential challenges on your lunar base and how to overcome them:

Challenge	How can you overcome this?
Shelter from radiation, meteorites, and the moon's extreme temperatures	
Protection from the moon's dusty soil, which can clog crucial mechanisms as well as cause vision impairment and incorrect instrument readings	
Access to nutritious food and water	
Access to breathable air	
Additional Challenge:	

Step 2: Considering the problems and solutions that you just assessed, create a rough sketch of your ideal lunar base below. Include notes to indicate how the design addresses each challenge, and the materials you would use to build the lunar base. Remember, money is not unlimited, so try to be as cost effective as possible.

Step 3: Using the materials available in your classroom, create a prototype of your design. Think carefully about which materials will best portray your vision! Near the end of class, you will be asked to label the different parts of your prototype so observers can easily understand your design!