

Chasing Meteorites

Learning Activity – Celebrating Diversity from Space Association of Space Explorers

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Description

Meteorites enter the atmosphere very frequently, leaving a visible trail. Sometimes astronauts capture such trails in their photographs. Students will explore the nature of meteorites

Grade Level

Middle School

Duration

1-3 class periods

Learning Goals

- Understand the science of meteorites. Describe what meteorites are, their origin and how they are identified.
- Use STEM tools to create a tool to retrieve the meteorite from water, land, or ice.
- Simulate a retrieval operation on water, land or ice for retrieving the meteorite.
- Analyze data for meteorite location.
- Collaborate in teams designating land, water or ice to apply problem solving skills and collaborate on the retrieval process, simulating a real-world mission.

NGSS Standards:

Science and Engineering Practices

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

Disciplinary Core Ideas

ESS1.B: Earth and the Solar System

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)

Materials

- Link to video www.earthmusictheater.org/Your-Playlist
- STEM building supplies such as: wooden sticks, straws, pipe cleaners, cardboard, tape/glue, scissors, string, balloons (you may add whatever other supplies you have access to such as 3D printers, 3D pens, etc)
- A minimum of 3 plastic or metal trays to simulate land, ocean or ice.

Lesson Activities

Introduction (5-10 minutes)

- Engage: Play part or all of video www.earthmusictheater.org/Your-Playlist
- Objective Overview: As you watch the video, look to see what “shooting stars” you may see. Do they land more on land, the water or ice? Why?

Direct Instruction (10-15 minutes)

- Explain where and why meteorites enter our atmosphere.
- A meteoroid is a small, natural particle made of ice or rock that orbits the sun. They range in size from grains up to a meter wide. Many are often small fragments from comets or asteroids.
- A meteor is the visible passage of a meteoroid entering the Earth’s atmosphere. They can enter the atmosphere at a speed in excess of 20 km/2 or 45,000mph. It produces a streak of light from both the glowing object and the trail of glowing particles it leaves in its wake. Meteoroids typically come from the asteroid belt be Mara and Jupiter.
- It is estimated that 25 million meteoroids enter Earth’s atmosphere each day.
- Meteors are often composed of rock (silicate minerals) depending on its origin. It can also be rocks, metallic or a combination of both. Some may contain iron and nickel or stony-iron

Guided Practice (10-15 minutes)

- Show tools such a shovel, rake, scooper, etc...
- Give students a scenario:
- As you stare out the window, you notice the sky filling up with the yearly meteor show. But you notice a rather large, bright streak across the sky so you decide to go on a meteorite hunt to find it. Where did it go? Where is it from? How big is it? Many questions run through your head, as you gather your gear and head out in search of the bright light. Did it land on land or water?

- Students, your job is to create a tool to retrieve a meteoroid on land, water or ice. You can use your hands to work the tool but you must have a way to retrieve the meteoroid on either land, water or ice depending which your teacher assigns you to. You cannot touch the meteoroid until the proper tests have been done on it to ensure it contains no alien life form. How are you going to test to see if it is a meteoroid? You may want to add a magnet to your tool---this is often the first test meteorite hunters use to establish what it is.

Independent Practice -

- Have students sketch their ideas for 3-5 minutes before putting them in groups (decide on land, ocean or ice). Students then work together to look at each other's sketches and create one sketch of the tool they agree to build. Sketch should include details such as what materials they are going to use.
- Students will work together to create their tool. Allow them access to the tray (land, ocean or ice) to test their tool. If time allows, allow students to re-engineer it.
- Teacher: you may want to have simulated meteoroids available in different pans around the room. For example: for the earth pan, you can use flour & cocoa powder layered in a plastic tray or metal pan from dollar store. If you have students with gluten allergies, you can sub out flour for gluten free flour, rice, corn meal, etc.
- For the ocean tray, fill a tray or bowl with water. To make it more challenging you can add blue food coloring to color the water. If you have access to a fish tank, consider using gravel, plastic plants, etc plus tinted water for more of a challenge
- For ice: a metal pan filled with water with ice cubes, or you may decide to freeze the tray. Take it out ahead of time, so it may be slightly squishy for tools to go through and so they do not break.
- If you have large classes, then you may want to consider having multiple trays around the room.

Reflection and Discussion:

- At the end of each class period, call on groups to share what they completed that day and what they need to do in the next class period.
- Have students create posters, power point, etc. of their tool. Have them present to class (or just submit to you) showing their before and after designs, what worked well, what had to be changed, did they find the meteoroid, where did the meteoroid come from, did it pass the magnetic test, etc

Differentiation Strategies

- Visual: www.earthmusictheater.org/Your-Playlist
- Auditory: Provide verbal explanations and discussions.
- Kinesthetic: Incorporate hands-on experiments or model-building.
- Allow students to work together or if needed, for a student to be the materials manager, if they are opposed to the building process. This lesson is designed for small groups of students 2-3 to work together but adjust it to best fit your needs.

Assessment Rubric

Criteria	Excellent (4)	Proficient (3)	Basic (2)	Needs Improvement (1)
Scientific Understanding	Demonstrates deep understanding of meteorites and the methods to detect them, including relevant scientific principles (e.g., magnetism, density, impact craters).	Demonstrates solid understanding of meteorites and basic methods to detect them.	Demonstrates basic understanding of meteorites and detection methods with some errors or misconceptions.	Demonstrates limited or incorrect understanding of meteorites or detection methods.
Engineering Design	The tool is well-designed, creative, and highly functional with clear consideration of real-world constraints and challenges.	The tool is well-designed and functional, with consideration of some real-world constraints.	The tool is functional but lacks attention to real-world constraints or has design flaws.	The tool is incomplete, impractical, or lacks clear functionality.
Problem-Solving & Innovation	The tool shows high levels of innovation and problem-solving, using creative solutions and adapting to unforeseen challenges.	The tool includes some innovative ideas and demonstrates effective problem-solving.	The tool shows limited innovation or problem-solving, relying on basic solutions.	The tool lacks creativity and does not demonstrate effective problem-solving.
Collaboration & Teamwork	Worked exceptionally well as a team, with clear roles, effective communication, and cooperation throughout the project.	Worked well as a team with minimal conflicts and shared responsibilities.	Teamwork was limited, with unequal participation or occasional conflicts.	Poor teamwork, with little to no collaboration or communication among team members.
Use of Materials/ Resources	Resources were used creatively and effectively, with a clear understanding of the materials' properties and limitations.	Resources were used effectively, with minimal waste and appropriate use of materials.	Resources were used adequately, but there was some waste or inefficient use of materials.	Resources were used poorly, with significant waste or mismanagement of materials.

Criteria	Excellent (4)	Proficient (3)	Basic (2)	Needs Improvement (1)
Accuracy & Precision	Tool is highly accurate and precise in detecting meteorites, with clear testing and validation of results.	Tool is accurate and precise, with some testing to validate its function.	Tool is somewhat accurate, with limited testing or validation.	Tool is inaccurate or untested.
Presentation	Presentation is clear, well-organized, and professional; thoroughly explains the design process, challenges, and results.	Presentation is clear and organized; provides a good overview of the design process and results.	Presentation is somewhat unclear or disorganized, with limited explanation of the design process.	Presentation lacks clarity, organization, and does not adequately explain the design process or results.
Reflection & Improvement	Thoughtfully reflects on the design process, identifying areas for improvement and suggesting solutions for future work.	Reflects on the design process, identifying some areas for improvement.	Minimal reflection on the design process with few suggestions for improvement.	No meaningful reflection or suggestions for improvement.

Teacher Notes

There are many versions of the Engineering Design Process. This image is just an example. Feel free to use one that you are required to use or love.

The engineering design process is a series of steps that engineers use to create functional products and processes. The process can vary, but it often includes the following steps:

- **Define the problem:** State the problem you are trying to solve
- **Research:** Research the problem
- **Brainstorm:** Generate ideas for solutions
- **Plan and select:** Choose a solution and plan how to create it
- **Build:** Construct a prototype or model of the design
- **Test and evaluate:** Test the prototype to see if it meets the design criteria, and collect data to help improve the design
- **Present:** Share the solution if it was successful

