

LESSON 1: INTRODUCING EXTREME LIFE



Module 3: Exploring Extreme Life

OVERVIEW	<p>Students are introduced to organisms that survive in extreme Earth environments. The teacher will read Bartholomew and the Oobleck, and then invite students to investigate “oobleck” – a mixture of cornstarch and water that has interesting physical properties. They will then learn about one particular form of extreme life: snottites. Lesson 1 is optional and not needed for Lesson 2 or 3. Duration: 60 minutes</p>
K-2 AZ STATE STANDARDS	<p>Kindergarten:</p> <ul style="list-style-type: none"> Science (K.L2U1.8): Observe, ask questions, and explain the differences between the characteristics of living and non-living things. There is a wide variety of living things, including plants and animals. They are distinguished from non-living things by their ability to move, reproduce, and react to certain stimuli Career Development (CD.K.2): Identify different types of jobs and explain why people work. <p>First Grade</p> <ul style="list-style-type: none"> Science (1.L4.U3.11): There are many different kinds of plants and animals in the world today and many kinds that once lived but are now extinct. Social Studies (1.E1.1): Identify different occupations and the skills and education needed for jobs in our community. <p>Second Grade</p> <ul style="list-style-type: none"> Science (2.L2U1.10): All living things need food as their source of energy as well as air, water, and certain temperature conditions. Career Development (CD.2.3): Describe how different jobs require different skills and education.
MATERIALS	<ul style="list-style-type: none"> Bartholomew and the Oobleck book or YouTube read aloud (https://www.youtube.com/watch?v=0OJIBIDA-qw) Video on how to make Oobleck (https://www.youtube.com/watch?v=nw8KaHglokQ) Slime Mold Video (https://youtu.be/Nx3Uu1hf16Q) Snottite Video 1 Measuring cup Bowls Spoons Corn starch (1.5 cups per pair or group) Water (1 cup per pair or group) Ziploc bags (optional) Food coloring (optional)

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VOCABULARY	<ul style="list-style-type: none"> • Astrobiologist: All different kinds of scientists who study how life works on Earth and beyond Earth. • Extreme Life: A living thing that survives and thrives in conditions that most living things could not survive in. • Snottite: A gooey and dripping thing that looks like snot and hangs from cave ceilings. It is made up of tiny bacteria that can survive the cave environment.
SET UP	<ul style="list-style-type: none"> • Set up your computer for watching the YouTube videos mentioned in the Materials section. • Watch the YouTube video on how to make Oobleck. If you are making the Oobleck as a class, we recommend having the corn starch and water pre-measured and placed into ziploc bags and cups to streamline the process. Depending on time, you might also decide to make all of the Oobleck beforehand, or while the read aloud book is playing.
LESSON PROCEDURE	<p>Warm up (5 minutes)</p> <ul style="list-style-type: none"> • Tell the students, "Today we're going to learn about some interesting and strange life. What's the weirdest or strangest living thing you've ever heard of, and what makes it weird or strange?" • Allow students to share their answers. • Tell the students that you have another weird creature to share: slime mold. Watch the YouTube video about slime mold. (https://youtu.be/Nx3Uu1hfl6Q) • Tell the students that there are lots of scientists that love to study weird and interesting life. One of those types of scientists is called an astrobiologist. Astrobiologists study what life might be like on other planets or moons beyond Earth. • Ask the students, "Why would studying weird and interesting life on Earth be helpful to an astrobiologist, who is looking for life beyond Earth?" • Explain to students that scientists have not found life beyond Earth. We have not discovered definitive evidence of life anywhere else except planet Earth. Astrobiologists need to learn about all of the different kinds of life that can exist on Earth, because it will help us understand what life might look like on other worlds.

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LESSON PROCEDURE

Reading: Bartholomew and the Oobleck (15 minutes)

- Tell the students that you are going to read a book about a village being covered in a slime called Oobleck.
- Tell the students, "While I'm reading the story, I want you to imagine that the Oobleck isn't just another type of weather, like rain or snow, and it wasn't created by magicians like in the story. Instead, I want you to imagine that it's a living creature from outer space. If you were a scientist in this story, how would you study this creature? What tools would you use to study it?"
- Read the book aloud or use a Youtube video read along.
- As you are reading, you might consider stopping at these points in the story to connect the story to the astrobiology theme:
 - When the Oobleck first appears:
 - Text: "Something green and gooey was dripping out of the sky."
 - Discussion Point: Ask students to describe the appearance and behavior of the oobleck. How would they collect samples of this substance? What initial observations would they make about its properties? How would scientists make sure they are being safe when encountering a potentially dangerous new substance?
 - When the Oobleck starts causing problems:
 - Text: "The Oobleck was everywhere! It was sticking to everything and everyone."
 - Discussion Point: Discuss how scientists might study the impact of the oobleck on the environment and living organisms. What tools would they use to analyze its effects on different materials and creatures?
 - Bartholomew's observations:
 - Text: "Bartholomew watched the Oobleck closely. He noticed it was getting thicker and stickier."
 - Discussion Point: Encourage students to think like scientists. What changes in the oobleck's properties might indicate it's a living creature? How would they test their hypotheses?
 - Bartholomew's solution:
 - Text: "Bartholomew thought hard. He had to find a way to stop the oobleck."
 - Discussion Point: Encourage students to think about problem-solving in science. What strategies would they use to find a solution to the oobleck problem? How would they test their ideas?

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LESSON PROCEDURE

Activity: Oobleck Observation (20 minutes)

- Explain to the students that you will be making some Oobleck and pretending to be astrobiologists studying the Oobleck. Remind them not to eat the Oobleck.
- Watch this video as a class about how to make Oobleck, and some of Oobleck's interesting properties. (<https://www.youtube.com/watch?v=nw8KaHglokQ>)
- If you have not made the Oobleck beforehand, have the students work in pairs or groups to mix their cornstarch and water together. (Note: while less interactive, if you're worried about a mess, you can have them mix the oobleck inside a bag. Pour the water in, then seal the bag shut. Have students use their fingers to knead the bag until it's all mixed together. They can even explore its properties while in the bag.)
- Remind the students that now they are going to pretend that the Oobleck is a newly discovered form of life. They are going to pretend to be astrobiologists and "study" this new life with their groups.
- Give the students 10–15 minutes to study their Oobleck in pairs or groups. If the students are older, have them write down their observations.
- Have students clean up their stations and prepare for class discussion.

Reflection (10 minutes)

- Ask the students to share their scientific observations during their time pretending to be an astrobiologist.
- Reiterate that the Oobleck they made is not *actually* alive, we were just pretending. Ask the students, "How do we know that it's not actually alive?" Explore this question as appropriate for the grade level (Such as Oobleck doesn't need food/sunlight/energy, doesn't die or grow, doesn't reproduce, can survive any temperature, etc.).
- Ask the students to imagine that they are a scientist exploring a new cave. Suddenly you see a weird slime that looks like snot, jiggling and hanging from the ceiling of the cave. Would you think it was alive? What tests would you do to see if it's alive?
- Watch the video on Snottites and talk about what they learned.
- Ask the students, "Did you hear the word 'extreme life' in that video? What do you think that word means?"
- Tell the students that astrobiologists are especially interested in studying extreme life on Earth, because it helps them to know what extreme conditions life might be able to survive on other planets.
 - For instance, snottites can survive acid environments, so studying snottites can help astrobiologists understand how life might survive on an acidic planet.
 - Also, unlike most living things that get their energy from the Sun (or their food gets energy from the Sun), snottites get their energy from chemicals. So, studying snottites can help astrobiologists understand how life might survive on a planet or moon that doesn't get much sunlight.
- (If doing the next lesson) Tell students that they'll be learning about more types of extreme life in their next science lesson.

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EXTENSION AND TAKE-HOME ACTIVITIES

- Have students describe snottites to their family. Encourage them to ask their family about some other weird living things they have seen or know about.
- Some living things have adapted to thrive in extreme conditions. Have students reflect on this question: "What superpowers have you, your family, or your culture developed to thrive in your environment?"
- You might consider allowing students to take the Oobleck home in a bag to show off to their families.

This lesson was created by Marguerite Samples, an elementary school educator at Pueblo Elementary in Tucson, AZ, in collaboration with the Arizona Astrobiology Center. It is supported and distributed by the University of Arizona's Astrobiology Center with funding from the Marshall Foundation, Tucson, AZ. For more information, contact Lauren James at laurenjames@arizona.edu. Lesson kits are available for checkout from the Arizona Astrobiology Center - <https://astrobiology.arizona.edu/>