LESSON 2: ASTROBIOLOGISTS AND EXTREME LIFE

Module 3: **Exploring Extreme Life**

OVERVIEW	Students explore different types of extreme life - organisms that can survive heat, cold, high pressure, or low water. Students then play either a "Red Light Green Light" inspired game or a "Tag" inspired game as they pretend to be one specific living thing that survives in an extreme environment. (You can choose to play one game, or both games.) **Duration: 40-60 minutes**
K-2 AZ STATE STANDARDS	Kindergarten: • 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. • Physical Education (S1:E1): Performs locomotor skills (hopping, galloping, running, sliding, skipping, jumping) while maintaining balance. First Grade • 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. • Physical Education (S1:E1): Hops, gallops, jogs and slides using a mature pattern. Second Grade • 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. • Physical Education (S1:E2): Runs with a mature pattern.
MATERIALS	• Extreme Life slide show • 32 Extreme Life cards (half page) • 4 Extreme Environment cards (full page) if playing "Red Light Green Light" • 4 Tardigrade cards (half page) if playing "Tag" • Tardigrade YouTube video (https://www.youtube.com/watch?v=IxndOd3kmSs) • Large space (such as gym or outdoor area) for playing the games. • (Optional) badge clips for attaching cards to students

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VOCABULARY

- **Astrobiologists**: 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.
- **Tardigrade**: A tiny creature that looks like an eight-legged gummy bear. It's so tough, it can live almost anywhere - even in space!

SET UP

- Prepare the Extreme Life PowerPoint.
- Have the 32 Extreme Life cards in a stack, with the picture side up.
- If playing the tag game, find a way to divide the play area into four roughly equal sections, such as with cones or chalk.

LESSON PROCEDURE

Warm up (20 minutes)

- Tell the students, "Today we are going to be astrobiologists and look at living organisms that survive in extreme conditions. Astrobiologists like to study living things that survive extreme conditions, so we can learn what types of environments we might find life beyond Earth."
- Tell students "We are going to start by visiting a living thing that you cannot see without a microscope. It is called a Tardigrade, or a Water Bear." Watch this video (Meet the Tardigrade): https://www.youtube.com/watch?v=IxndOd3kmSs
- Discuss all of the different "extreme conditions" the tardigrade survives in.
- Next, explore more extreme life with the slide show, reading about each organism and how it is adapted to its extreme environment. As you go, check for understanding using questions such as,
  - "What type of extreme environment is this creature living in?"
  - "How has this creature adapted to survive such an extreme condition?"
- Explain that they will soon be playing a game where each student is going to pretend to be a specific type of extreme life, and we are going to focus on one specific environment that they survive and thrive in.
- Get out the Extreme Life cards. Show the students the picture side and read the sentence on the back. Have the students guess whether this organism is adapted to heat, cold, pressure, or low water. (Note that some of the heat/low water organisms do have both abilities, but we are focusing on one ability for the purposes of this activity.)
- As you go through the cards, hand each one to an individual student. If desired, use badge clips to attach the organism to the student so they don't get lost during the game.

Note to Teachers: There are two games to choose from. You can choose to do one or both games. They do not need to go in order. Each can last from 10-30 minutes, depending on your class dynamics and your needs.

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LESSON PROCEDURE

Game 1: Extreme Life Red Light, Green Light (10-20 minutes)

- To play Red Light, Green Light, first designate a starting and finishing line.
- Choose an extreme environment caller. Hand the caller the four Extreme Environment cards (heat, cold, pressure, and low water), and have the caller face away from the group at the finish line.
- All other students go to the starting line and review their type of extreme life (heat, cold, pressure, or low water).
- The caller chooses one environment, holds up the card, and yells out the environment. "Heat!"
- The creatures that thrive in that environment move towards the finish line until the caller yells out a different environment, such as "Pressure!"
- As soon as a different environment is called, the previous extreme life (students) must stop in their tracks until their environment is called again. Players caught moving at the wrong time are sent back to the starting line.
- You can also have students do different motions for each round, such as hopping, crawling, or side-stepping.
- The player who reaches the finish line first gets to be the next caller.
- Play as many times as you like. After a few rounds, you might have students trade cards so that they can be a different type of life.

Game 2: Extreme Life Tag (10-20 minutes)

- Before the game begins, make sure that the area is divided into four distinct areas or "environments": Heat, Cold, Pressure, and Low Water.
- Have all students find the correct environment to stand in according to their card. Tell the students that during the game, they MUST stay in that designated area or they are out.
- Spend a few minutes letting students pretend to be their creature in their environment, and interacting with other organisms in that same environment.
- When you are ready to play the game, choose 2-4 students to give up their cards and be the "tardigrades." Give them a tardigrade card instead.
- Review with students that tardigrades can survive in many different environments. Because they can survive in heat, cold, high pressure, and low water, they get to move around the entire space and don't have to stay in one area.
- Initiate the game of tag, with the tardigrades being "it," and when they tag someone else, that person is "out." All students except the tardigrades should stay in their assigned environment.

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LESSON PROCEDURE	• Variation: When a student is tagged out, have them find the teacher. Show them a card that is currently not being used. If they can guess the extreme environment that organism survives in, they get the new card and can re-enter the game.
	• You can play multiple rounds, giving other students an opportunity to be a tardigrade. In between rounds, you can also have students pair up and swap cards, so they can experience pretending to be a new living thing and environment.
	
	Cool Down (5 minutes)
	• Discuss after the game: After playing, gather the children and discuss what they learned. Ask questions like:
	  ◦ "What kind of places are extreme?"
	  ◦ "What did the extreme life do in the game?"
	  ◦ "Why do you think some living things can live in those places?"

EXTENSIONS AND TAKE HOME ACTIVITIES	• If you need a video to watch while the students calm down after their exciting game: Dumbo Octopus video (https://www.youtube.com/watch?v=tMMyXQd4oB8) • For older students: Before or after the activities, have students sit down with one card and see if they can use their reading comprehension skills to identify the creature's name, location, and one or more details. You can have them swap cards and do this as many times as you like. • Book Recommendation: *Tardigrades: Nature's Toughest Survivors* by Anne Therese Morgan • Book Recommendation: *Microbe Adaptations: Glowing Lights, Hot Vents, and Large Numbers* by Andi Diehn • Give the students an opportunity to draw and describe their favorite extreme life from the lesson, either in class or at home.

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/