IMAGINING LIFE BEYOND EARTH

Lesson 5: **Design Your Mission**

OVERVIEW	This final lesson challenges students to apply everything they have learned about astrobiology, extremophiles, planetary environments, and careers in space science to design a fictional space mission. Students will work in groups to plan their mission, justify their choices, and present their ideas. The lesson reinforces prior concepts and helps students see how astrobiology is an interdisciplinary field requiring collaboration across multiple scientific careers. Duration: 45-60 minutes
LEARNING OBJECTIVES	• Collaborate in groups to plan a fictional space mission. • Synthesize knowledge from previous lessons to design a mission strategy. • Understand the ethical and practical considerations of space exploration. • Reflect on personal interests and how they connect to space science careers.
ARIZONA STANDARDS	**Core Ideas - U2:** The knowledge produced by science is used in engineering and technologies to solve problems and/or create products. **6th Grade** - 6.E2U1.7 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. This lesson also fulfills some of the Arizona Department of Education **Career Exploration Standards** for grade 6-8, including healthcare careers, education careers, science and technical careers, and the benefits of technology to careers and work.
NEXT GENERATION SCIENCE STANDARDS	• **MS-ETS1-1:** 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. • **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. • **MS-ESS1-3:** Analyze and interpret data to determine properties of objects in the solar system. • **Science and Engineering Practices - Asking Questions and Defining Problems** (Students explore scientific questions related to space missions and the search for extraterrestrial life) • **Science and Engineering Practices - Obtaining, Evaluating, and Communicating Information** (Students analyze how different scientific careers contribute to astrobiology and space exploration and reflect on how their own skills align with different scientific fields) • **Nature of Science (NOS) Connections - Science is a Human Endeavor** (Scientific discoveries result from collaboration between people of different backgrounds, disciplines, and expertise)

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MATERIALS	• "Imagining Life Beyond Earth" student booklets • Whiteboard or paper for group brainstorming • Art supplies (optional, for designing presentation posters, spacecraft or mission patches) • Career cards (may be needed as a reference)
VOCABULARY	• **Astrobiology:** The study of life in the universe. • **Unmanned Mission:** A robotic space mission without human crew members. • **Interdisciplinary Science:** A field combining multiple scientific disciplines.
SET UP	• Arrange students into medium sized groups (4-6 students per group). • White board (or similar) for brainstorming warm up • Ensure students have access to their booklets and past notes for reference. • Distribute a set of career cards to each group for reference. • Distribute art supplies (optional)
LESSON PROCEDURE	**Warm Up** 1. Ask the class what things they think are essential for a successful space mission. Discuss as an entire group and write their ideas on a white board that everyone will be able to see for the rest of the class period. **Space Mission Design** 2. Announce that each student group is now a team of scientists planning a space mission. The "Extreme Worlds" they created in Lesson 3 are the possible destinations for this mission. ◦ (You may need to remind them that this is a fictional mission, and we won't be taking into account the time or distance factors for space travel to their world.) ◦ In their groups, each student shares the planet/moon they designed on pages 20-21 and the extremophile they created on page 22-23 of their booklets. ◦ The group must then decide (out of all of the options) which world will be the focus of their mission, and come up with an official name for that planet/moon. 3. After each group has determined which world they are going to study, have them open to the two careers they wrote down in their booklets in the previous lesson. ◦ Each person in the group should pick one of those two careers to focus on during the next part of the assignment. ◦ Ideally, every person in the group will have a different career.

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LESSON PROCEDURE

4. Next, the group should open their booklets to page 28 and 29, titled "Mission to _____" and "Career Notes."
    - Explain that the students will discuss all of the questions in the book with their group.
    - During the discussion, they do not need to write down the answers to every question. Instead, they should take notes on how that question is related to their job, and what mission responsibilities they will have related to that question. Encourage students to help each other recognize when a question is a part of their career responsibilities.
5. The last two pages of the book titled "Mission Design" are for open-ended use. For groups that finish their discussion early, you might have them draw a picture of their spacecraft or design a mission patch in this space.

Student Presentations

6. Have students present their mission plan to the class.
    - If time allows, you might choose to have them create posters or a slide show.
    - If you are short on time, you can have the students describe their planet and their career duties as part of the mission team.

Reflection

7. Explore the following questions with the students as time and interest levels allow. You might also choose one of these questions as an "exit ticket" type of activity.
    - How did your extreme environment influence your mission plan?
    - How important are teamwork and collaboration in mission design?
    - How does your mission connect to real-world space exploration?
    - What careers in astrobiology and space exploration seem most exciting to you now?
    - What was the most interesting part of this astrobiology unit?

EXTENSIONS AND TAKE HOME ACTIVITIES

Here are some additional activities you might consider to extend the lesson or expand learning beyond the classroom.

- For a longer project: tell each group that they are competing for NASA funding to fund their mission, and they need to put together a presentation to convince NASA to fund their project.
- Design a Mission Patch: Have students create a mission logo that represents their team's goal.
- Ethics in Space Exploration: Research real-life planetary protection policies and write a short reflection.
- Creative Writing: Write a science fiction story based on their mission.