MARS...OR ARIZONA?

ARIZONA ASTRO BIOLOGY CENTER
aabc.arizona.edu

OVERVIEW

How can scientists learn about Mars by studying Arizona? Students explore how scientists study Mars by using Arizona as an analog. They will watch short video clips of Mars research being done at analogs on Earth, play a game of "Mars...or Arizona?", and compare and contrast Arizona with Mars.

LEARNING OBJECTIVES

Students will be able to:

- Compare at least four similarities and differences between Mars and Arizona.
- Explain what an analog environment is.
- Describe why scientists test equipment in Earth analog environments before sending it to Mars.

ARIZONA STANDARDS

Grade 3

- **Science 3.E1U1.4**: Construct explanations about Earth systems using evidence. (Students compare weather, atmosphere, and surface conditions.)
- **Social Studies: 3.G1.1** Use maps and geographic representations to understand Arizona. (Students identify where Mars analog sites exist in Arizona.)

Grade 4

- **Science 4.E1U1.6**: Investigate interactions among Earth's major systems. (Students compare how atmosphere, weather, rocks, and surface processes shape Arizona and Mars.)
- **Science 4.E1U1.7**: Use models and evidence to explain changes to Earth's surface. (Students analyze landforms that resemble Martian terrain.)
- **Social Studies 4.G2.1**: Explain how people interact with and adapt to environments. (Students examine why scientists conduct research in Arizona deserts.)

Grade 5

- **Science 5.E2U1.7**: Develop and revise models explaining Earth and other planetary bodies. (Students compare characteristics of Earth and Mars while using evidence from observations.)
- **Social Studies 5.G4.1**: Describe how geographic characteristics influence human activities. (Students explain why scientific research is concentrated in particular landscapes.)

NEXT GENERATION SCIENCE STANDARDS

- **3-ESS2-2:** Obtain and combine information to describe climates in different regions.
- **3-LS4-3:** Construct an argument with evidence about how habitats affect survival.
- **3-5-ETS1-1:** Define a design problem with criteria and constraints.
- **3-5-ETS1-2:** Generate and compare possible solutions.
- **3-5-ETS1-3:** Plan and carry out fair tests to improve a design.

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MATERIALS

- Mars or Arizona slideshow
- Projector/screen
- Video clips (links in lesson procedure below)
- Paper/pencils for each student (optional)
- Venn Diagram or T-Chart for each student (optional)

BACKGROUND KNOWLEDGE

Students should know:

- Mars is a planet in our solar system.
- Mars is one of the closest planets to Earth, but it is still very far away from Earth. (It would take at least 6 months to get there on a spaceship.)
- Mars has never been visited by humans.
- Scientists explore Mars using robots and satellites.
- Scientists cannot easily test new equipment on Mars.

VOCABULARY

- Earth - the planet where we live.
- Mars - The fourth planet in our solar system, after Earth.
- Arizona - A state in the southwestern United States with deserts similar to some parts of Mars.
- Analog - A place on Earth similar to another place, like Mars.
- Rover - A robot that explores planets
- Atmosphere - The layer of gases surrounding a planet.
- Gravity - The force that pulls objects toward the ground.
- Desert - A very dry place that gets little rain.
- Iron Oxide - A mineral that gives many rocks and soils a reddish color.
- Environment - Everything around a living thing, including air, water, land, and other organisms.
- Astrobiologist - A scientist who studies where life might exist in the universe.

SET UP

- Load slideshows
- Cue up video clips

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LESSON PROCEDURE

Activity 1: What is a Mars Analog? (10 minutes)
Show 3 video clips of Mars analog research, then discuss each with the accompanying questions.

- Life On Mars Sim: Rover Deployed In High And Dry Utah
  https://youtu.be/Fg7yH6LmkJQ?si=5jeUo-X9lp3pnejX
  - Where is this rover being tested?
  - Why are they testing the rover in Utah before going to Mars?
  - Did you catch the scientist say the word "analog"? What do you think that means?

- A Mars Analog Mission to the Flashline Research Station
  https://youtu.be/gqRaXbgaYnw?si=Cgl14AezNMhApMrf
  - Notice that this video also uses the word "analog" again! In this video, they are using a polar desert (Devon island) as a Mars analog. Why was this environment chosen as an analog?
  - How did they make their arctic mission seem even more like Mars?
  - How is this environment different from Mars?

- Biosphere 2 Interview with Kai and Luna at SAM. You can watch the whole video if you have time, but the most important part is from 0:00 until 1:38.
  https://youtu.be/b8u7Fjsk-0w?si=SemrjwWlwYgf1Aiy
  - What did Kai say about analogs?
  - How is the SAM at Biosphere 2 used as a Mars analog?

Activity 2: Mars or Arizona Game (10-15 minutes)
- Pull up the slide show titled "Mars...or Arizona?"
- For each slide, have students observe the images and decide which is Mars, and which is Arizona. (The second slide in each pair reveals the answer.)
- You might choose to make this into a team or individual game.
- You might utilize these questions to encourage critical thinking skills:
  - What do you notice?
  - What evidence supports your guess?
  - What features helped you decide?
  - What surprised you?

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LESSON PROCEDURE

Activity 3: Arizona as a Mars Analog (10-45 minutes)

- Pull up the "Arizona as a Mars Analog" slide show.
- These slides compare Mars and Arizona in regards to the following categories: Air and Weather, Temperature, Gravity, Desert Environment, Dirt, and Terrain.
- Here are some ways you might utilize this slide show:
  - The slides come in pairs, with Mars first, and then Arizona. You might read the Mars slide as a class, then discuss how Arizona is different. Then, reveal the Arizona slide to check your answer.
  - Utilize the slides to create a Venn Diagram or T-Chart comparing Mars and Arizona.
  - During the slide show, discuss or debate whether Arizona is a "good enough" analog for Mars. Where does it fall short? Have students "rate" each category on a 5-star scale depending on how close they think Arizona comes to the Mars environment.
- After going over the slides, discuss:
  - Could we live on Mars? What would we need to bring for humans to survive on Mars?
  - Do you think other things could live on Mars without spacesuits or habitats?
  - Scientists who study the possibility of life on Mars are called **astrobiologists**.
  - What do you think astrobiologists study, besides Mars?
  - If time, show the short video entitled, "What is Astrobiology?" (https://youtu.be/SDdGhiYAfX4)

Conclusion and Reflection (10 min)

You might discuss as a class, or use one or more questions as an exit ticket or writing exercise.

- What images surprised you the most?
- Why do scientists study places on Earth to learn about Mars?
- Would you volunteer for a mission to Mars? Why or why not?
- List two similariries and two differences between Arizona and Mars.

EXTENSIONS AND TAKE HOME ACTIVITIES

- Compare another Mars analog to Mars. Some examples include Utah, Iceland, and Antarctica.
- Take some pictures of places in your neighborhood or near your school that resemble Mars, and explain the similarities and differences.
- Research an Arizona scientist who studies Mars.