Mars Habitation

Earth, Earth's moon, and Mars Balloons

Students construct scale models of Earth, Moon, & Mars to discover size and scale. Associated Mars Information Slideshow: Through a PowerPoint Presentation, students learn about the environmental constraints that would affect human habitation of Mars.

Supporting Video: https://mars.nasa.gov/msl/multimedia/videos/index.cfm?v=32

Overview

In this lesson plan, students will:

- Construct a balloon scale model of Earth, Earth's moon, and Mars
- Learn the relative distances of each part of the solar system at the balloon scale model
- Discuss how scientists use models to construct scientific explanations

Time

10 minute prep time

55-75 minute lesson time (not counting sections 6 & 7)

Materials

- Red, White, Blue balloons, one balloon per student. (for a class of 30 students, you would need 30 balloons total: 10 blue, 10 red, 10 white.)
- 10 cloth tape measures (or meter sticks, and pieces of string)
- 10 Calculators
- LCD Projector and computer with access to internet
- Student Handout #1: Earth, Earth's Moon, Mars Comparison – 1 per student
- Student Handout #2: Relative Size & Distance Sheet – 1 per student
- Student Handout #3: Student Reflection – 1 per student
- 3-2-1 Pyramid Template
- Writing journals
- Pens/Pencils

Objectives:

1. Students will better understand the relative sizes of the Earth, Earth's moon and Mars in relation to each other.
2. Students will apply math to understand how scientists utilize mathematics in their procedures
3. Students will communicate their understanding of the sizes of and distances between the Earth, Earth's moon, and Mars by creating a model to scale.

Activity (step by step):

STEP 1: ENGAGE (~10 minutes) Exploring Sizes of Planets

1. On Student Handout #1, ask students to draw and label 3 circles representing the Earth, Earth's Moon, and Mars to show what they think the sizes are in relationship to each other.
2. Discuss the size of the Earth, Earth's Moon, and Mars in relationship to each other.
    a. Have students to explain why they drew the circles the way they did.

STEP 2: EXPLORE (~25 minutes) Representing planetary objects with a simple model.

1. Discuss how people use models to represent ideas or objects. Point out that scientists and engineers create models to understand an idea or object. (Maybe show the Supporting Video here: https://mars.nasa.gov/msl/multimedia/videos/index.cfm?v=32
    - Today, we will be making models of the Earth, Earth's Moon, and Mars to represent their sizes and distances to scale.
2. Distribute blue balloons to 1/3 of the class, red balloons to 1/3, and white balloons to the final 1/3. Explain that the three balloons represent the Earth (blue), Earth's Moon (white), and Mars (red).
3. Group students in groups of 3, each with a different color balloon.
4. Have students Worksheet #2 and compare the actual circumference of Earth to the scale circumference of the blue balloon. (note the scale circumference is 80 cm because we are using a scale where 1 cm in the model = 50,000,000 cm in real world).
5. Ask the students with the blue balloon to blow their balloons up until it is 80 cm centimeters in circumference and tie it off. This balloon represents the Earth.

    a. if a measuring tape is provided, wrap measuring tape around balloon and measure 80 cm
    b. If measuring stick and string are provided, measure 80cm of string, mark where 80 cm ends, and wrap around balloon until 80 cm is measured
6. Let groups of students guess how big the White (moon) and Red (Mars) balloons should be compared to the Blue (Earth) balloon.
    a. Ask students to look at Handout #2 and compare the size of the Earth, Moon, and Mars. Is the moon bigger or smaller than the earth? What about Mars?
7. Students should record guesses for how big the White and Red balloons should be. Once students have guessed, share the correct answers (white = 22 cm, Red = 42 cm) and have students record them.
8. Students should now inflate Earth's Moon and Mars balloon to the appropriate sizes and tie them off.

STEP 3: EXPLAIN (~10 minutes) Explaining scale in a model.

1. Discuss the idea of scale with students.
2. Point out that it is obvious that the planets and moons are not as small as the balloons, but because we calculated them using a scale, the sizes represent the bodies in relationship to each other.
3. Point out that the scale size of the balloons 80 cm (blue), 22 cm (white), 42 cm (Red) is the proportional to the actual size of the Earth, Earth's Moon, and Mars.
    - Therefore, the Earth can be estimated as twice as big as Mars, and 4 times bigger than Earth's Moon.

STEP 4: ELABORATE (Optional, ~15 minutes) Using a model to make predictions.

1. Student will use their new understanding of scale to predict visualize the difference between the distance from the Earth to Earth's moon and the distance between Earth and Mars.

2. Have students look at the second table on Student Handout #2.
3. Measure 3.8 cm on a ruler or tape measure. This is the distance between the Earth and Earth's moon using a scale of 1 cm = 10,000,000,000 cm.
4. As ask students to use this scale to predict how far away Mars would be from Earth.
5. Once students have calculated the scaled differences, ask them to begin arranging themselves into the appropriate distances.
6. Once students are lined up reveal the correct scale distance of 780 cm or 7.8 meters.
7. Have students measure this distance with a meter stick or tape measure.
8. Discuss with the students the amount of time it would take us to travel to Earth's Moon and Mars. Typically, it takes 2 - 3 days to reach Earth's Moon using a rocket-powered vessel, while it would take approximately 6-11 months to reach Mars with robotic spacecraft, depending on where the Earth and Mars are in their orbits at the time of Launch.

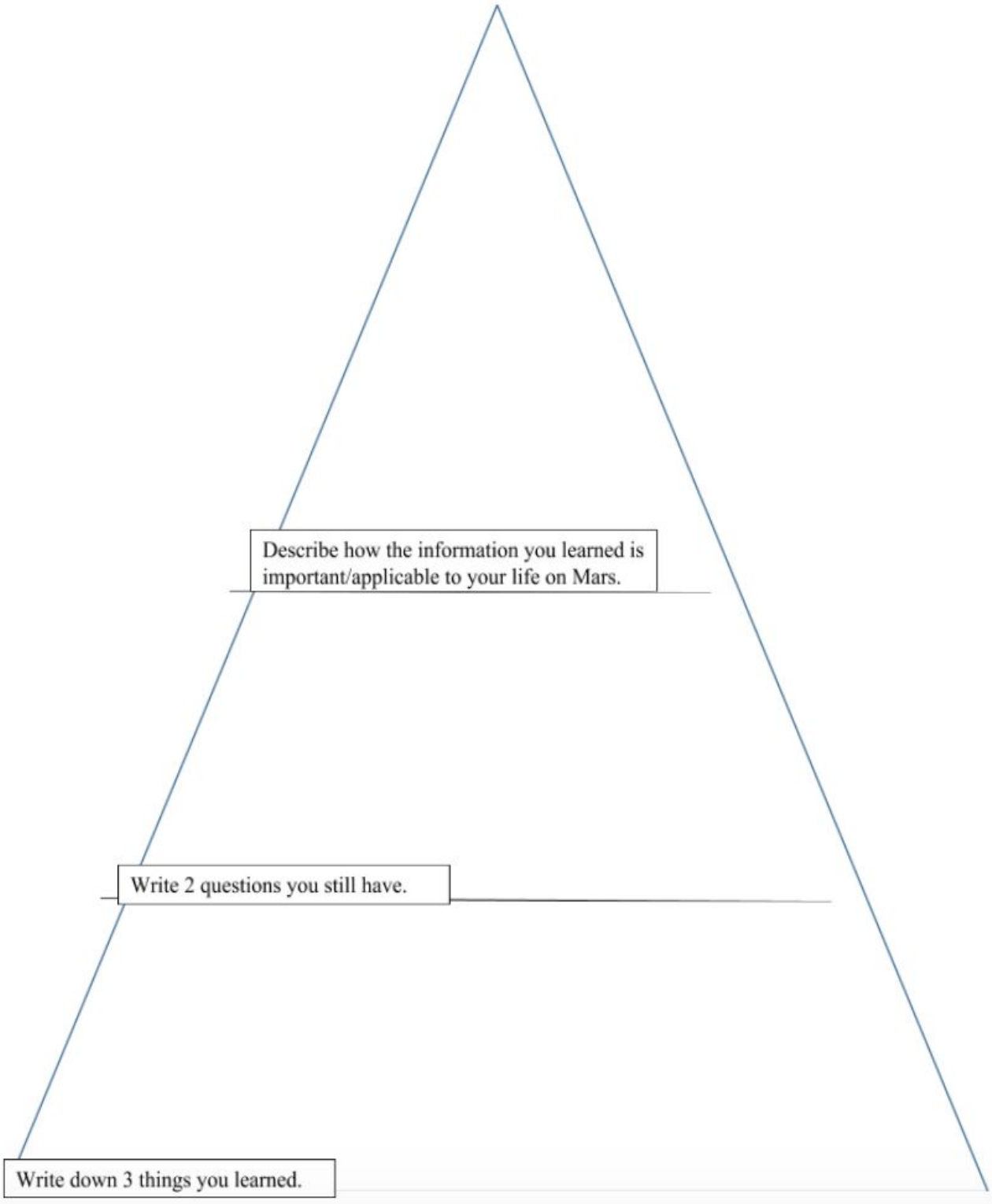
STEP 5: EVALUATE (~10 minutes) Reflect on the use of modeling in the scientific process

1. Ask students to complete Handout #1 #3 in their groups
2. Discuss with the class what they've learned and how scientists may use modeling and scaling as a way to present their work.
3. Collect student work.

STEP 6: Writing to Learn

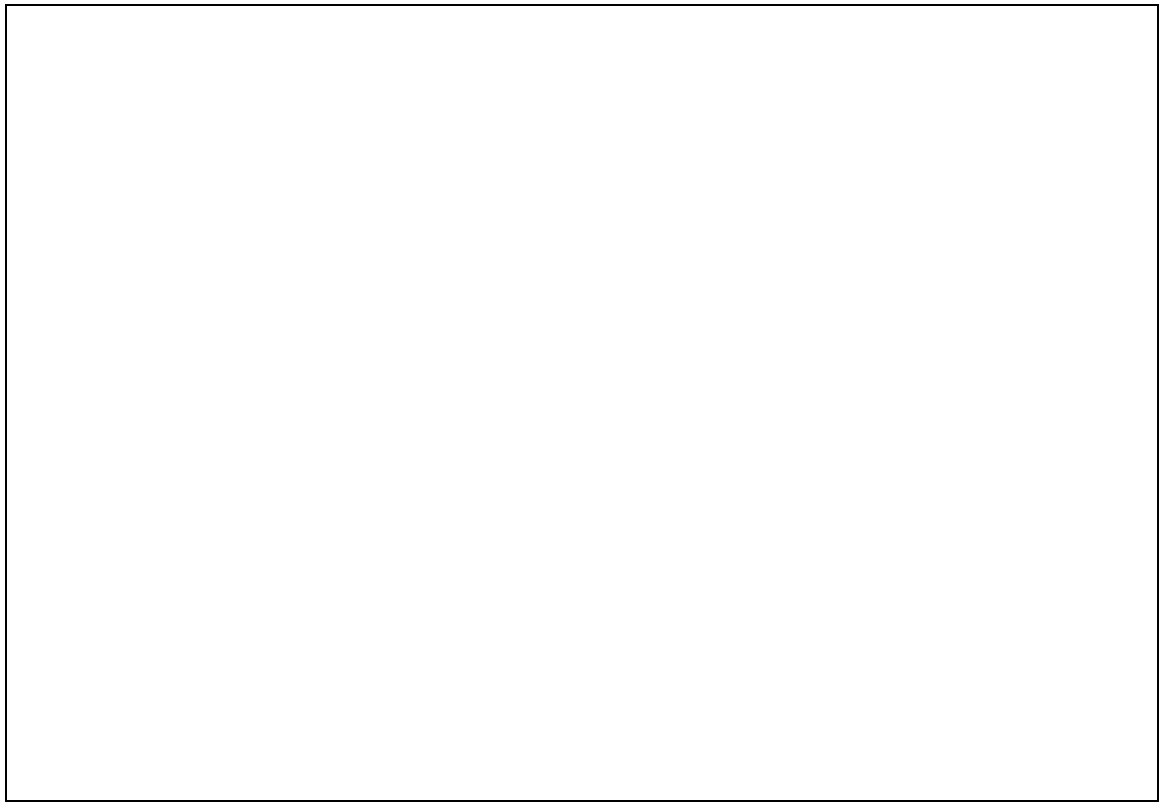
1. Use the 3-2-1 Pyramid Model (See Template) to reflect on today's activities

3-2-1 Pyramid Model for Learning



Student Worksheet #1- Earth, Earth's Moon, Mars Comparisons

1. In the box below, draw the your thoughts (predictions) of how large the Earth, Earth's Moon, and Mars are.



2. Explain why you think your prediction to be true.

Student Worksheet - Relative Size and Distance Sheet

Planet/Moon	Circumference (cm)	Balloon Circumference Prediction (cm)	Actual Balloon Circumference (cm)
Earth	4.00 Billion	80 cm	80 cm
Earth's Moon	1.09 Billion		
Mars	2.13 Billion		

Planet/Moon	Average Distance (cm)	Balloon Distance Prediction (cm)	Actual Balloon Distance (cm)
Earth to Earth's Moon	38,400,000,000	3.8 cm	3.8 cm
Earth to Mars	7,800,000,000,000		

Show your work:

Student Worksheet #3 - Student Reflection

1. What did you find most surprising during this investigation?

2. Why did we have to use a scale to create our model of Earth, Earth's Moon, and Mars?

3. This is called a scale model. How do you think scientists use scale models? (Hint: how did you use it?

4. Revisit your original prediction. Was it correct? What do you now understand about the relative sizes and distances of Earth, Earth's Moon, and Mars?