Mars Habitation

Strange New Planet

This hands-on lesson using play dough engages students in the way in which humans explore planets through a variety of missions from Earth-based telescopes to rovers.

Materials were edited for the purpose and benefit of the University of Houston's Mars Rover Celebration

Overview:

In this lesson plan students will:

- Understand the relationship among science, engineering, technology, and teamwork, necessary to discovery and innovation
- Find out how human curiosity in planetary exploration results in science questions, engineering solutions, and teamwork.
- Experience the different phases in planetary exploration, including telescope observations, fly by missions, orbiters, landers, rover and their own ideas about human exploration

Time:

45 minute prep time
1 hour lesson time

Materials:

- **For making "strange new planets"**
  - Modeling clay or play-dough
  - Choose among: plastic balls, foam balls, sequins, round fruit, perfume, essential oils, candy, small stickers, marbles, cotton balls, glue, toothpicks, marshmallows, beads

- **For viewing "strange new planets"**
  - Sheets of paper, paper towel rolls, toilet paper rolls, or paint roller tubes
  - Rubber bands
  - 5"X5" clear, blue cellophane squares

- **Other:**
  - cloth or towel
  - push pins
  - masking tape
  - colored pencils or crayons

Objectives:

1. Students will learn the values of teamwork and how to combine ideas while working in groups to create a "strange new planet."
2. Using their "planet viewers" students will work to find out all they can about each group's strange new planet.

Activity (step by step): (Please print handouts in the Student Guide**)**

Preparation (~45 minutes)

1. **Constructing the "Strange New Planets"**
    a. Take Play-Doh or modeling clay and form a ball (the planet). You can use multiple colors if you would like. Decorate the object with stickers, scents etc. to make the object interesting to observe. Some of these materials should be placed discreetly so that they are not obvious upon brief or distant observations. Making some suggested features include:
        i. creating clouds by adding cotton
        ii. carving channels in the Play-Doh or clay
        iii. attaching a grape or marshmallow using a toothpick
        iv. using small beads to make craters in the Play-Doh or clay e. affixing small stickers (perhaps with a picture of a bug to signify life)
        v. embedding beads or other small objects in the Play-Doh or clay
        vi. applying scent sparingly to a small area

    For older or more advanced students, form teams and allow each to create their own planets for other teams to view. This opportunity allows students to create their own set of planetary features and create a key. These features can then be compared with those found on other teams' planets.

    b. Place the object (planet) on a desk or table in the back of the room. Make sure the "back side" of the planet has something interesting that can't be seen from its front side. Cover the object with a towel before students arrive.
    c. Use masking tape on the floor to create a 2" distance and a 5" distance around the desk or table.

2. **Constructing the Planet Viewers**
    a. Construct viewers (or have students construct viewers) out of loose-leaf paper by rolling the shorter side into a tube (or supply an empty toilet paper or paper towel roll or paint roller tubes).

b. Place one clear, blue cellophane square over one end of the tube and attach with a rubber band.

Step 1 ENGAGE: How Science & Engineering Come Together in Planetary Exploration (~10 minutes)

1. Tell students they have a mission. They are scientists who have just discovered a strange new planet, and their job is to find out all about it. They will be exploring this new world in the same way that NASA explores the solar system.
2. If desired, provide a first-person account through storytelling.
    a. "Let me tell you a story about Dr. Christensen, a scientist who studies Mars today. He was interested in space since he was a kid. "Dr. C" remembers how people's ideas about Mars changed tremendously after the first spacecraft went to Mars. In the late 1950s, people thought Mars had plants, a thick atmosphere (air), and was a lot like Earth. Encyclopedias like The World Book Encyclopedia and publications like National Geographic had articles describing Mars like Earth. Our first spacecraft to Mars sent back the first photographs of another planet ever—in 1965. When we got those pictures, our ideas of Mars changed forever. Mars was not a lush green planet, but a barren, desert-like planet. That information helped NASA plan missions that followed, including orbiters, landers, and rovers. Each mission National Aeronautics and Space Administration On behalf of NASA's Mars Exploration Program, this lesson was prepared by Arizona State University's Mars Education Program, under contract to NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology. These materials may be distributed freely for noncommercial purposes. Copyright 2012; 2010; 2000. 8 brought new information that led to new questions. New questions lead to new discoveries. You're going to find that out in exploring your own "strange new planet."

Step 2: How Engineering & Technology Support Science Questions (~45 minutes)

1. Telescope Observations from the Earth's Surface
    a. Arrange Mission Teams (3-5 students) against the front of the room, or opposite the wall with the table and the cloth-covered "strange new planet." Tell students that they are standing in "Mission Control."
    b. Hand out Earth-based Observation Worksheet
    c. To simulate Earth's atmosphere, place a blue cellophane sheet on the end of the viewers, held in place by a rubber band. Tell the students that the tube represents a telescope located on the surface of the Earth and that the blue cellophane represents Earth's atmosphere.
    d. Tell students they will have the first look at the "strange new planet" with their telescopes/"planet viewers." Lift the towel. Allow the team to observe the planets with viewers for 30 seconds. Then replace the towel.
    e. Giving each group one Telescope Observation Worksheet, ask the students to write down everything they noticed about the planet.

2. Telescope Observations from above the Earth's Atmosphere
    a. Ask students to remove the blue cellophane and take one-step forward. Tell them that their viewer is now a space telescope (like the Hubble) and that the atmosphere no longer obscures their view.
    b. Tell students that a space telescope is expensive, and many scientists want time to use it to answer their questions. So, they have short scheduled times to use it. Lift the towel again and allow students to observe the planets with viewers for 30 seconds. Cover the planet again.
    c. Now the groups can go back and write everything they noticed this time, that they could not see last time.
    d. Ask students to come up with questions they have about the planets they observed.

3. Fly By of the Planets
    a. Ask students at their mission control stations to turn their backs to the planets until it is time to do their mission.
    b. Uncover the front part of the planet, but keep the backside covered by the cloth.
    c. Ask students in the first team to raise their viewer to their eyes. Tell them that they will have a chance to pretend to be a spacecraft that will quickly fly by the planet, but cannot cross the masking-tape line around the table. Have the first team turn around and make a pass by (fly by) the planet, and return to Mission Control, keeping their backs turned once there. Repeat with remaining teams.
    d. Once all teams have conducted their fly by mission, replace the towel.
    e. Hand out a (B) Fly-by Observation Worksheet to each student. Give students an opportunity to record their observations and discuss what questions they have for an orbital mission.

4. Orbiting the Planets
    a. Ask students at their mission control stations to turn their backs to the planets until it is time to do their mission.
    b. Uncover all sides of the planet.
    c. Tell each mission team they have one minute to orbit (circle) the planet at a distance of no more than 2 feet, looking through their viewer. Allow each team to conduct their mission and return to mission control.
    d. Hand out a Orbiter Observation Worksheet to each student. Give students an opportunity to record their observations and discuss what questions they have for an orbital mission.

5. Landing on the Planets
    a. Hand out a Lander/Rover Mission Plan to each student. Tell students they will develop a mission plan for their landing expedition onto the planet's surface. Mission plans should include the landing spot and feature to be examined based on their interests and science questions from prior observations. Teams will have to agree on one place to examine.
    b. Using a pushpin, have a mission team member approach the selected landing site and mark it. (Use masking tape or a sticker if the pin would damage the planet.)
    c. Tell each mission team that they have one minute to look at their landing site through their viewers. So that they all see the same things through their viewers, instruct students to line up the location of the pushpin in their "field of view" in the viewer in a common place (inside the viewer, at the top of their view, in the center. Teacher Tip: To illustrate, draw a simple circle on the board and mark the position of the pushpin at top center of the circle. D. When team members have observed the landing site to record their observations and discuss answers to their science questions.

Step 3: How Engineering & Technology Support Science Questions (~10 minutes)

1. Hand out student sheet - Comparisons of Mission Types.
2. Share information about the history of Mars Exploration or have them research online about Mars missions so far (see Teacher Guide at the end of this lesson.) Ask students to compare mission types based on their own observations of the strange new planet and the history of mission types in Mars Exploration.

Step 4: Planning a New Mission (~10 minutes)

1. Tell students they are going to plan the first human mission to Mars, which will involve the ideas of teams from many nations and people from many cultures. Explain that this mission may be the first step in many before we can establish a community there.
2. Allow each team to choose a country or culture to represent. The culture can be real or imagined, based on a common heritage, a common aspiration for their mission or science question of interest, or simply team names (e.g., Blue Team, Red Team etc.).
3. Hand out student worksheet - Mission Concept for the First Human Mission to Mars and allow each team to complete the first section, with each team member contributing at least one idea for inclusion. Tell each team that all team members should pick at least one science question they would want astronauts to answer and their ideas about what kind of engineering and technological solutions would be needed.

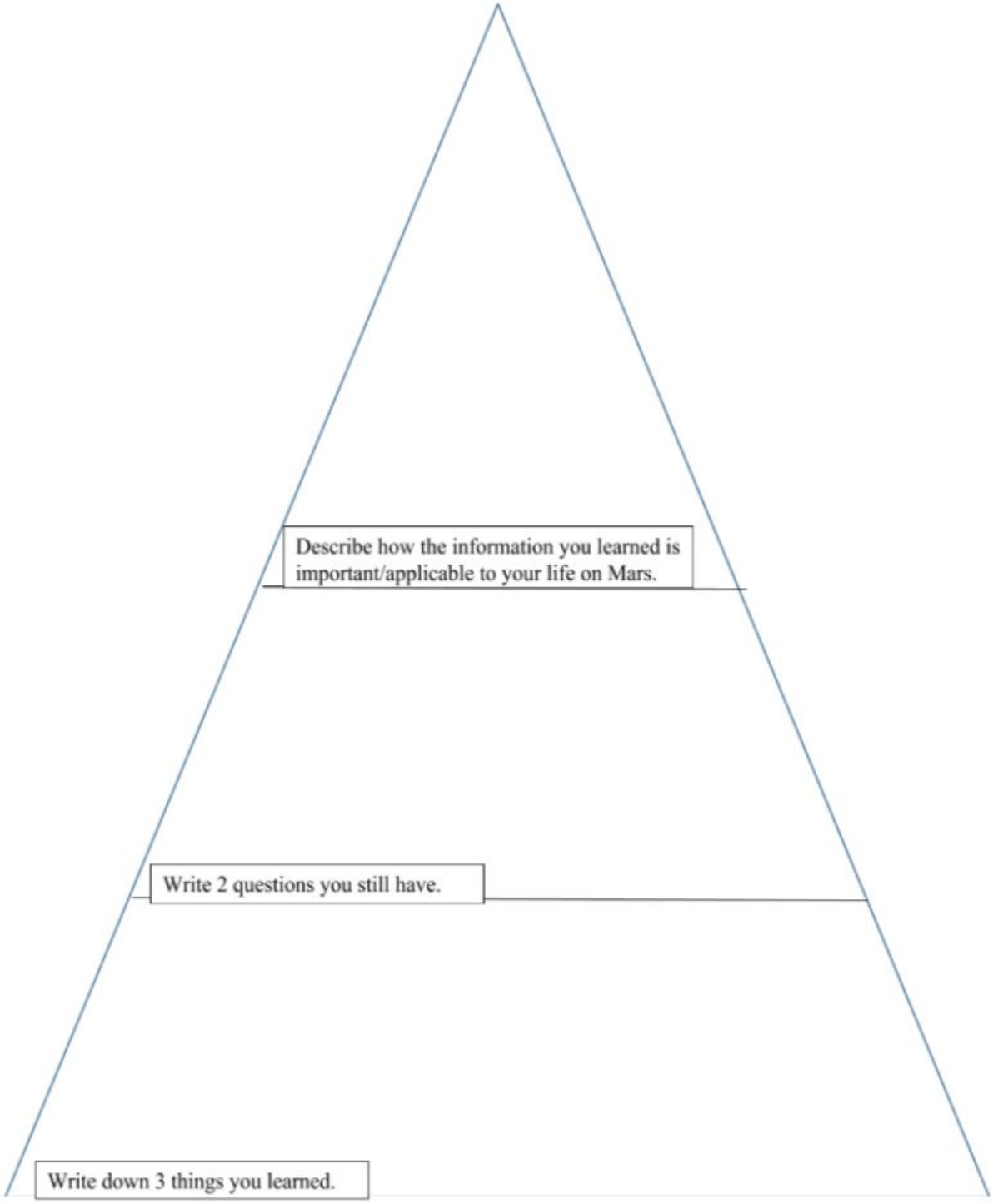
Step 5: Assessing Proposed Strengths and Weaknesses of Missions (~60 minutes)

1. Ask each team to present the ideas for their mission to other teams, with each team member explaining at least one science question related engineering and technological solutions that would be needed.
2. As each team presents, have other teams complete the second section of the student worksheet - Mission Concept for the First Human Mission to Mars.

STEP 6: Writing

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

3-2-1 Pyramid Model for Learning



Student Handout - Telescope Observations

1. Explain how you think we know about the planets and moons in our solar system.

2. Record your Observations

Draw	Describe

3. Based on your observations, record your questions for future exploration.

Student Worksheet - Fly By Mission Observations

1. Record Your Observations

Draw	Describe

2. Which of your questions (based on your “telescope” observations) did the fly-by mission answer? What are the answers?

3. What new or remaining questions do you have for a future spacecraft that can orbit the planet?

Student Worksheet - Orbiter Mission Observations

1. Record Your Observations

Draw	Describe

2. Which of your questions (based on your “telescope” and fly-by observations) did the orbiter answer? What are the answers?

3. What new or remaining questions do you have for a future spacecraft that can land on the planet?

Student Worksheet - Lander/Rover Mission Plan (1 of 2)

1. Plan Your Observations

Draw the Landing Site	Describe Features to Observe

2. How did your team decide on a landing site?

Student Worksheet - Lander/Rover Mission Plan (2 of 2)

3. Record Your Observations

Draw	Describe

4. Which of your questions did this mission answer? What are the answers?

Student Worksheet - Mission Type Comparisons (1 of 3)

1. In the tables below, list the kinds of information you can collect from each type of mission, as well as the advantages and disadvantages of using each type.

Mission Type	Type of Information	Advantages	Disadvantages
Telescope Observations			
Fly By Missions			

Student Worksheet - Mission Type Comparisons (2 of 3)

1. In the tables below, list the kinds of information you can collect from each type of mission, as well as the advantages and disadvantages of using each type.

Mission Type	Type of Information	Advantages	Disadvantages
Orbiter Missions			
Lander/Rover Missions			

Student Worksheet - Mission Type Comparisons (3 of 3)

1. In addition to engineering and technology, teamwork among people with different perspectives is important in answering science questions. Reflect on the following:

Question	**My Thoughts**
What were the advantages of working on a team to study the "strange new planet"?	
What were the disadvantages of working on a team to study the "strange new planet"?	
What could you do to encourage good teamwork in the future?	
Why is it important for many people with different perspectives and backgrounds to work together?	
How do you think scientists and engineers benefit from working together?	

Student Worksheet - Humans to Mars Mission Concept

1. Congratulations! You've just been selected to be part of a team that designs the first human mission to Mars! This mission is daring, and will require the skills and talents of many people.

Human Aspiration: Our human mission to Mars will seek answers to the following science questions:	Human Innovations: Engineering and Technology Tools we imagine will be needed to answer these questions:
1.	
2.	
3.	
4.	
5.	

2. Compare your team's ideas to those of other teams. What ideas were similar? Which ideas did you appreciate from other teams that your team didn't think of?