Volcanoes on Other Planets

Overview:

Active and dormant volcanoes occur on many planets and moons other than Earth. In this activity, students learn about differences in planet size and orbit, and relate surface temperature to distance from the sun. They also learn that distance from the sun does not always predict the presence or absence of volcanoes on bodies in our solar system.

Objectives:

The student will:

- observe that planet size and orbit size vary between planets;
- model how the length of a year differs on planets due to orbit size;
- graph the relationship between planet surface temperature and distance from the sun;
- describe where volcanoes exist in the solar system; and
- explain that distance from the sun doesn't necessarily predict the presence/absence of volcanoes.

Materials:

- *Ola Ka Honua: Volcanoes Alive* multimedia and video playlist
- Scissors (one pair per student)
- Rulers (one per student)
- Student Information Sheet: "Features of Planets"
- Student Worksheet: "Volcanoes on Other Planets"

Answers to Student Worksheet:

1. Jupiter
2. Answers for this estimate will vary: Uranus in actuality is about 15 times larger than Earth.
3. Venus and Earth are about the same size.
4. Mercury
5. Pluto
6. Jupiter's orbit measures about 1.2-1.3 cm; Neptune's orbit measures about 5.5 cm
7. Based on these measurements, Jupiter's orbit is ~4.5 times smaller than Neptune's.
8. The orbit of Pluto is more elliptical than other orbits and it crosses Neptune's orbit.
9. shorter
10. longer
11. Students should include a graph of temperature vs. distance from the sun.
12. Answers will vary, but should indicate that, in general, temperature decreases with distance from the sun.

13, 14. See the tables at right.

15. Yes, there is a relationship. Planets further away from the sun do not have volcanoes, while planets closer to the sun do have volcanoes.
16. Many volcanic moons occur near planets far away from the sun.
17. Answers will vary, but should indicate that distance from the sun cannot be the only factor that predicts presence or absence of volcanoes.

Planet	Does it have volcanoes?	If so, are they active?
Mercury	Yes	No
Venus	Yes	Maybe
Earth	Yes	Yes
Mars	Yes	Maybe, but have not erupted for a long time
Jupiter	No	
Saturn	No	
Neptune	No	
Uranus	No	
Pluto	No	

Name of moon	To which planet does the moon belong?
The Moon	Earth
Io	Jupiter
Europa	Jupiter
Triton	Neptune

Volcanoes on Other Planets

Activity Procedure

1. Ask students why the planets revolve around the sun (because of the gravitational force of the sun). Draw the relative size of the sun vs. Earth on the board. Explain that the large size of the sun means it has a huge gravitational force, 273.95 meters per second squared compared to 9.8 meters per second squared on Earth.
2. Explain that, although all planets revolve around the sun, making a roughly circular path, the distance from the sun is different for each planet, and thus, the orbits are different. Point out that each orbit is slightly elliptical, so the distance from the sun is not precisely the same at all times of the year. Illustrate the difference between an ellipse and a circle by drawing each on the board.
3. Ask students to use the data on the Student Information Sheet: "Features of Planets" and the *Ola Ka Honua: Volcanoes Alive* multimedia and video playlist to complete the Student Worksheet: "Volcanoes on Other Planets."

Cultural Tie

Several geological features on Io are named after Hawaiian deities. Pele volcano and Maui Volcano are named after the goddess and the demigod, respectively, while Hi'iaka Mountain is named after Hi'iaka, Pele's younger sister.

Features of Planets

Figure 1

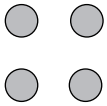


Figure 2: Planet size to scale.

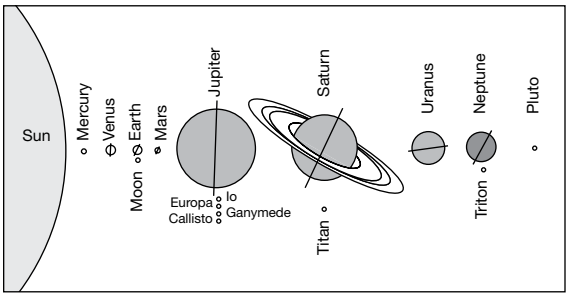
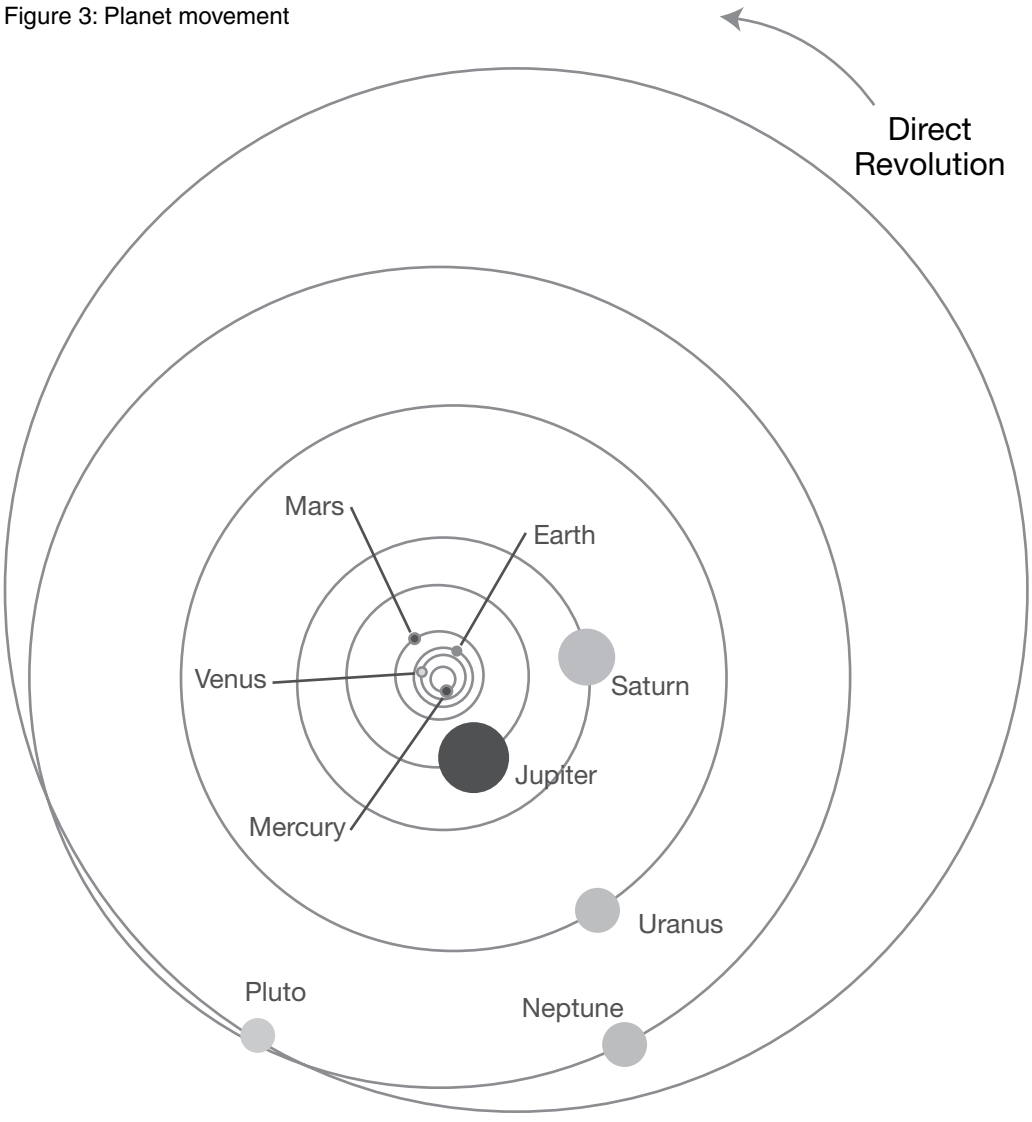
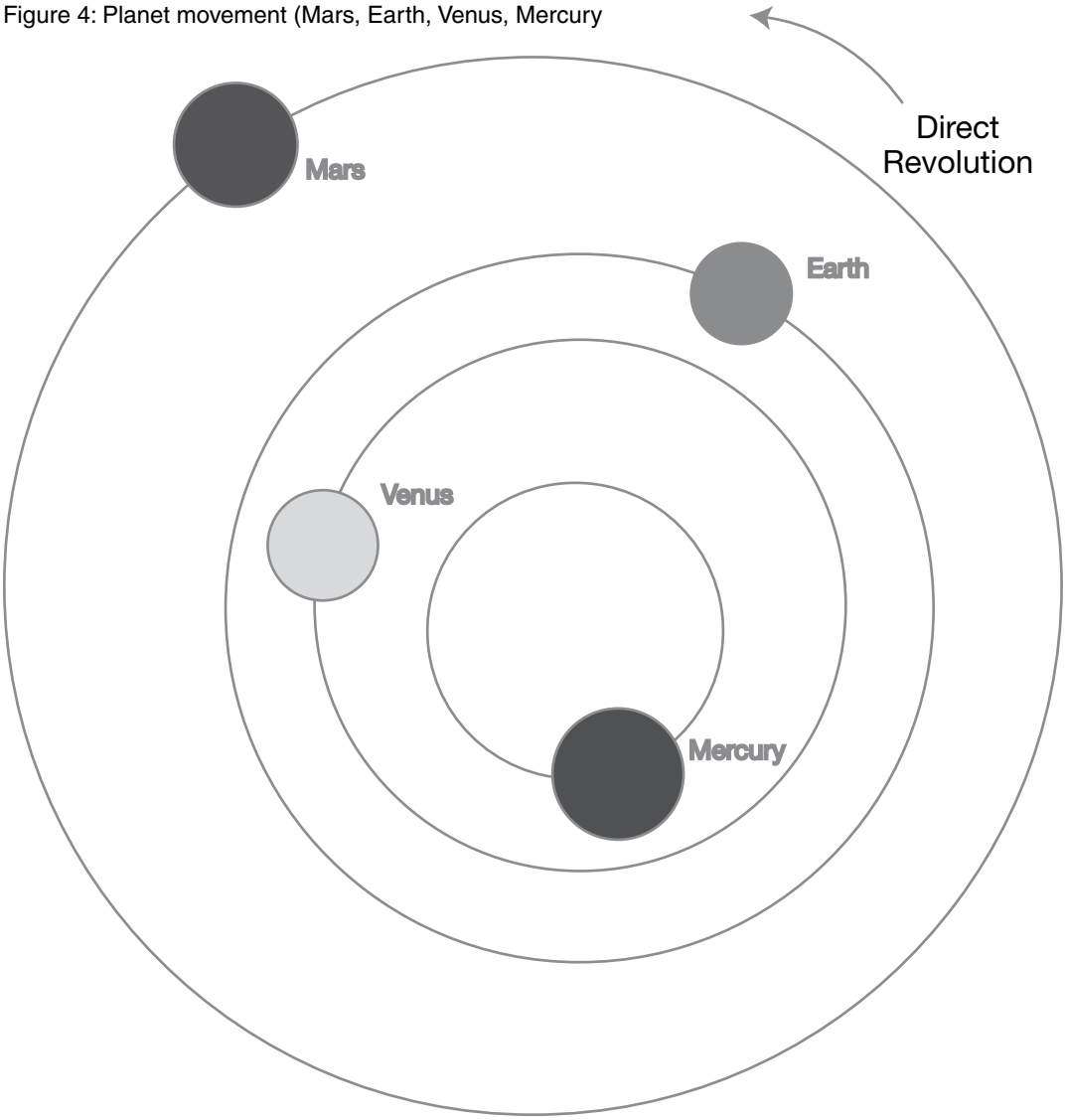


Figure 3: Planet movement



Features of Planets

Figure 4: Planet movement (Mars, Earth, Venus, Mercury



Features of Planets

Figure 5: The temperatures of the planets

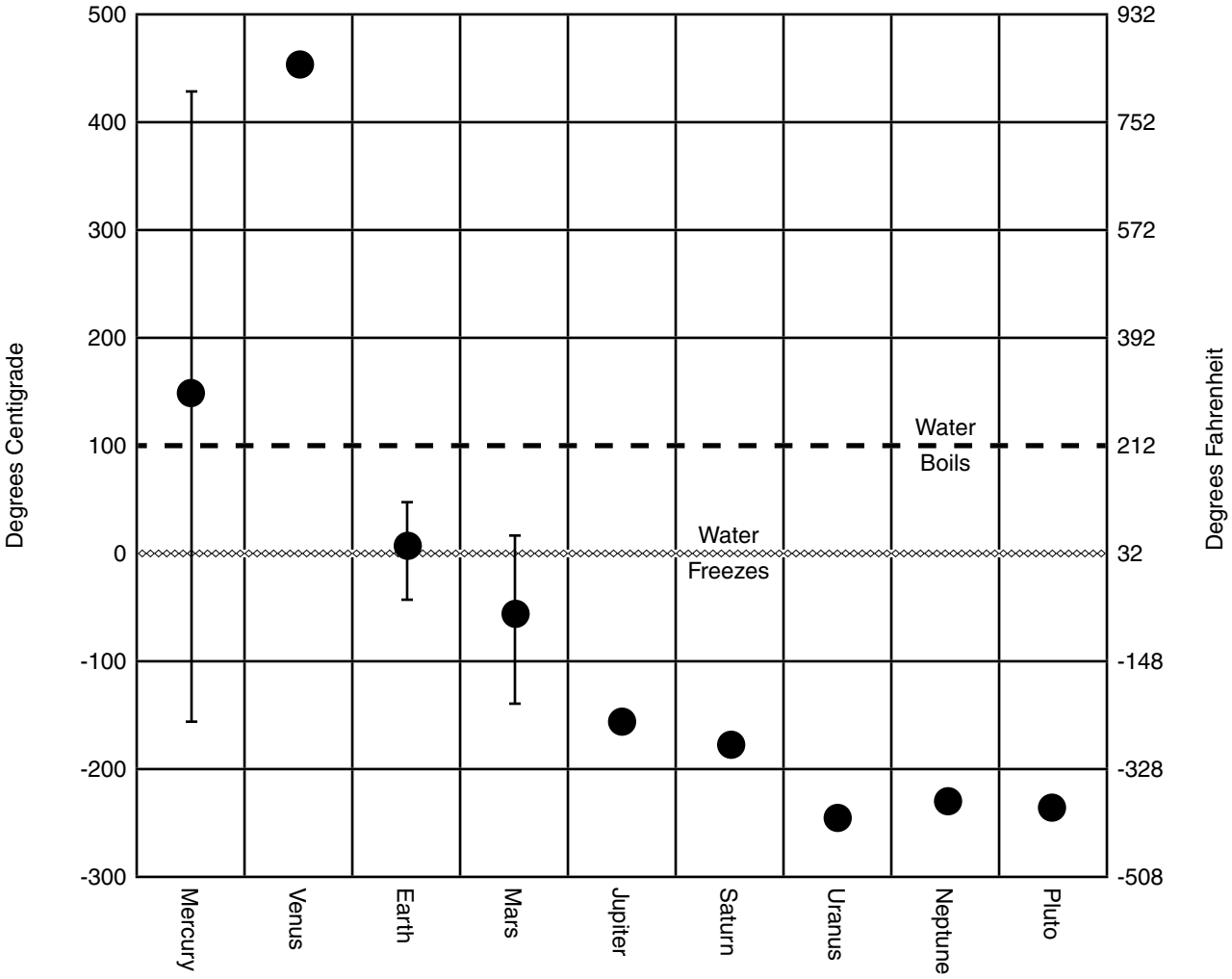


Figure 6: Positions of the planets

Planet	Distance from sun (in A.U.)
Mercury	0.39
Venus	0.72
Earth	1
Mars	1.52
Jupiter	5.2
Saturn	9.54
Uranus	19.18
Neptune	30.06
Pluto	39.44

Name:_____ **Student Worksheet**

Volcanoes on Other Planets

Directions: Use the Student Information Sheets: "Features of Planets" to help you complete the following activities. Begin by cutting out the unlabelled circles in Figure 1. These circles represent the four inner planets, Mercury, Venus, Earth, and Mars. Note: In reality, these planets differ greatly in size. Label each planet with its name.

Background Information: The nine planets of our solar system are different in many ways, including size, distance from the sun, temperature, and year length. This activity will explore whether or not some of these features are related to the presence of volcanoes.

Look at the diagram in Figure 2 of the Student Information Sheet. This drawing shows the actual size differences between the planets.

1. What is the largest planet? _____

2. How big is Uranus compared to Earth *(hint: how many Earth-sized circles will fit inside Uranus)*?

   _____

3. How big is Venus compared to Earth? _____

Now, look at Figure 3 of the Student Information Sheet. This drawing shows the size and shape of all nine planets' orbits compared to one another. Most of the planets orbit the sun in a pattern that is almost circular. The orbits of the four inner planets are so small compared to the others that they are compressed into the center of the drawing.

4. Which planet is closest to the sun? _____

5. Which planet is furthest from the sun?_____

6. Using a ruler, measure the diameter of Jupiter's orbit in centimeters (center of the sun to center of the planet). Now do the same for the orbit of Neptune. Record answers below.

   Jupiter's orbit is _____ centimeters. Neptune's orbit is _____ centimeters.

7. About how much smaller is the orbit of Jupiter than the orbit of Neptune?

8. What is different about the orbit of Pluto?

Next, look at Figure 4 of the Student Information Sheet. These four lines around the sun show the size of the orbits of the four inner planets compare to one another. Place the four cut out planets on their orbits in order.

Place Mercury on its "start" dot, and Earth on its "start" dot. Move the circles at the same speed all the way around the orbit until they reach the start dot again.

Name:_____ **Student Worksheet**

Volcanoes on Other Planets

9. A complete revolution around the sun takes one year. Is the year on Mercury shorter or longer than the year on Earth? _____

10. Repeat the procedure in #13 with Mars and Earth. Is the year on Mars shorter or longer than an Earth year? _____

11. Use the information in Figures 5 and 6 to create a graph in the space below showing average surface temperature vs. distance from the sun. Plot temperature on the y-axis and distance on the x- axis for each planet. Label the axes.

12. Using a complete sentence, describe the relationship between surface temperature of a planet and distance from the sun.

_____

_____

13. Use Unit 10 of the *Ola Ka Honua: Volcanoes Alive* multimedia and video playlist to find out which planets and moons have volcanoes. Use this information to complete the tables below.

Planet	Does it have volcanoes?	If so, are they active?
Mercury		
Venus		
Earth		
Mars		
Jupiter		
Saturn		
Neptune		
Uranus		
Pluto		

Volcanoes on Other Planets

14. In the following table, indicate which moons have volcanoes, and to which planet the moon belongs:

Name of moon	To which planet does the moon belong?

15. Considering only volcanoes on planets, is there a relationship between distance from the sun and presence of volcanoes? Describe the relationship in a complete sentence.

_____

_____

_____

_____

16. Consider the presence of volcanoes on moons. How does this change the relationship described in the previous question?

_____

_____

_____

_____

_____

_____

17. Is distance from the sun the only factor that predicts whether a volcano will occur in the solar system? Explain why or why not.

_____

_____

_____

_____

_____

_____

