EARTH SCIENCE AND TECHNOLOGY

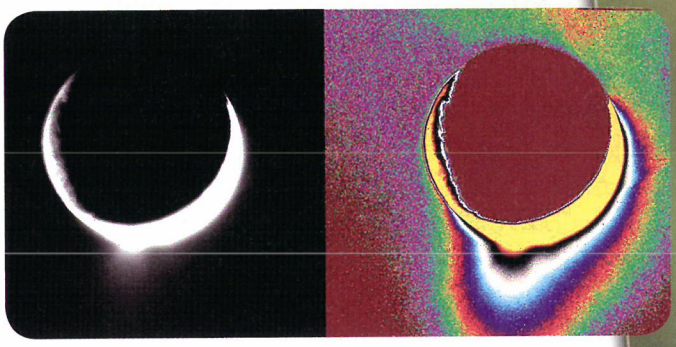
WATER IN THE SOLAR SYSTEM

In recent years, data collected by spacecraft have shown evidence of water in places in our solar system other than Earth. Scientists think there might be water, either in a liquid or solid state, on Earth's Moon, under the poles of Mercury and Mars, on several of Jupiter's moons, and on at least one of Saturn's moons. Further investigation and data collection is planned by NASA to confirm these findings.

Earth's Moon Several spacecraft have collected evidence that leads scientists to believe there is subsurface ice at the Moon's poles. In 1994 and 1998, spacecraft possibly detected ice and water. Scientists hope to find definitive evidence of water under the surface of the Moon with the *Lunar Reconnaissance Orbiter (LRO),* set to launch in 2008. A probe will take samples to test for water.

Mercury's poles Because Mercury's axis is not tilted, the interior temperatures of large craters at the poles do not ever rise above −212°C. Radar images lead scientists to think that ice exists in these craters. In August 2004, NASA launched the *Messenger* spacecraft that will reach Mercury in 2011. *Messenger* is equipped with a spectrometer that will be used to detect hydrogen, which is part of water, at Mercury's poles.

Mars's north pole Using a spectrometer, the *Odyssey* spacecraft recorded high levels of hydrogen just beneath the surface at Mars's north pole in 2002. Scientists think that water exists there in the form of ice, and that the soil might be comparable to the permafrost found at high latitudes on Earth. The *Phoenix Lander,* scheduled to launch in 2007 and reach Mars in 2008, is equipped with a robotic arm that will drill into the surface of Mars at the pole. A specialized sensor will be able to detect if there is any water in the soil.



This colorized image shows the plume of liquid water ejected from Enceladus's surface in geyserlike eruptions.

Jupiter's moons Ganymede, Europa, and Callisto all have icy surfaces. However, based on readings of the magnetic fields and high-resolution photos taken by the spacecraft *Galileo* of all three moons, scientists hypothesize that they each have a subsurface ocean. NASA has proposed a new mission to Jupiter called *Jupiter Icy Moons Orbiter* (JIMO) that would launch in 2015 and orbit the three moons. The main goals of the mission would be to learn more about the history of the moons, map their surfaces, and confirm the existence of subsurface oceans.

Saturn's moon—Enceladus The spacecraft *Cassini* has recorded geyserlike eruptions of liquid water coming from the surface of Enceladus, even though the moon's average temperature is −201°C. The figure above shows a colorized image of such an eruption.

WRITING in Earth Science

Poster Research more information about where in the solar system water might exist. Make a poster that shows the bodies of the solar system and if water might be found on them. Include captions that explain what type of exploration is planned. To learn more about the water in the solar system, visit glencoe.com.

GEOLAB

DESIGN YOUR OWN: MODEL THE SOLAR SYSTEM

Background: **Models are useful for understanding the scale of the solar system.**

Question: *How can you choose a scale that will easily demonstrate relative sizes of objects and distances between them in the solar system?*

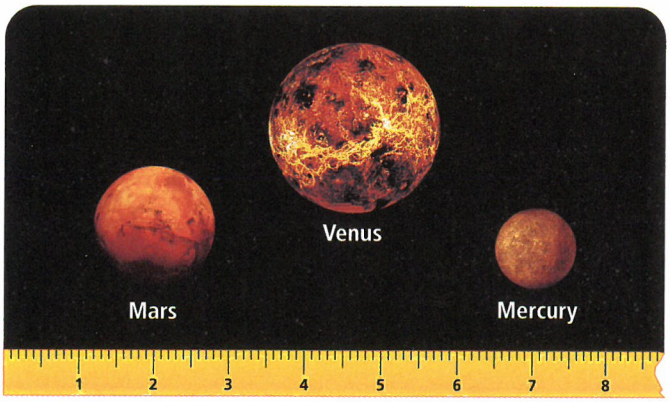
Materials

calculator
tape measure
meterstick
marker
masking tape
common round objects in a variety of sizes

Safety Precautions

Procedure

1. Read and complete the lab safety form.
2. Develop a plan to make a model showing the relative sizes of objects in the solar system and the distances between them.
3. Make sure your teacher approves your plan before you begin.
4. Design a data table for the information needed to complete your model. Include the original data and the scale data.
5. Select a scale for your model using SI units. Remember your model should have the same scale throughout.
6. Calculate the relative sizes and distances of the objects you plan to model.
7. Select the materials and quantities of each, and build your model according to the scale you selected.



1 cm = 4000 km

Remember that the scale used has to include the largest and smallest objects and should be easy to produce.

Analyze and Conclude

1. **Think Critically** Why did the scale you chose work for your model?
2. **Explain** why you chose this scale.
3. **Observe and Infer** What possible problems could result from using a larger or smaller scale?
4. **Compare and Contrast** Compare your model with those of your classmates. Describe the advantages or disadvantages of your scale.

APPLY YOUR SKILL

Project Proxima Centauri, the closest star to the Sun, is about 4.01×10^{13} km from the Sun. Based on your scale, how far would Proxima Centauri be from the Sun in your model? If you modified your scale to better fit Proxima Centauri, how would this change the distance between Pluto and the Sun?