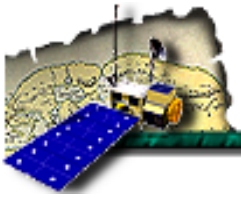

Visit to an Ocean Planet

Solar Energy and Distance

Overview

The effect of distance from the Sun on planetary temperatures is explored using energy from a light bulb to simulate solar energy.

Concepts

- Planets and moons that are further from the Sun receive less solar energy (sunlight) than planets and moons closer to the Sun.

Materials

- 2 Thermometers
- 1 Desk lamp or flood lamp
- Meter stick

Preparation

Gather one set of materials together if done as classroom demonstration. Create multiple sets of materials if done by students in groups. Note that the light bulb can be several inches above the table, but the light bulb should be over the 0 cm mark (discussed below).

Procedure

Engagement

Ponder the question, "Which planets will receive the most solar energy (sunlight) and why?"

Activity

1. Lay the meter stick on a table and place the lamp at the 0 centimeter end. Leave the lamp off.
2. Place one thermometer 10 cm (4 in) from the lamp. Place the second thermometer 100 cm (40 in) from the lamp.
3. Record the temperature of the two thermometers to the nearest tenth of a degree.
4. Turn the lamp on for ten minutes. Record the temperatures of both thermometers after ten minutes.

Table 1

Thermometer Placement	Starting Temperature	After 10 Minutes
10 cm		
100 cm		

Explanation

The light bulb converts electrical energy into light energy (including both visible light and infrared "light.") The thermometers, or any other object, absorb some of that light energy, which is in the process of being converted to heat energy. The thermometers measured increased temperatures due to that heat energy.

The thermometer that was 10 cm away got hotter. The thermometer that was 10 times further away (100 cm) from the light bulb did not change temperature as much and therefore did not receive nearly as much energy from the light bulb. In the same way, planets that are further from the Sun receive less energy and therefore are generally colder. Additional factors, including atmospheric *greenhouse effects*, the presence of clouds, and surface structure and brightness, will also affect the actual temperature of a planet, but the amount of *solar energy* reaching the planet is the most significant factor. Earth has just the right combination of factors--including distance from the Sun--to allow the presence of liquid water, which is key to life as we know it.

Extension

Saturn is approximately 10 times further from the Sun than Earth is from the Sun. The temperature of the cloud tops of Saturn is approximately -180°C (-292°F), so cold that ammonia will crystallize. Compare this to the coldest temperature recorded on Earth: -89.2°C (-128.6°F). Based on this information, do you think there is life on Saturn similar to that found on Earth? Can you imagine what kind of life-forms, if any, might be found on the surface of Saturn? What about Saturn's moons?

Links to Related CD Activities, Images, Movies

Activity *Absorbing Light: Dark versus Bright*

Vocabulary

greenhouse effect *solar energy*

Source

Adapted from Janice VanCleave, 1991, *Astronomy for Every Kid, 101 Easy Experiments that Really Work.* John Wiley and Sons Publisher, p.12-13.