Activity: What Can You See?

Introduction

Weather satellites have sensors aboard that detect both visible light and infrared or heat radiation. The sensors providing views of reflected sunlight are engineered to be more detailed than infrared, so that smaller objects can be seen. However, visible images are only available during the day, limiting their continuous monitoring of weather conditions. Although less detailed, infrared views are temperature maps of surfaces viewed from the satellite's vantage point, whether land, water or clouds. The temperature variations of the surfaces may be enhanced to highlight certain features of interest to meteorologists.

After completing this activity, you should be able to:

- Explain how satellite pictures can be made with reflected sunlight (visible radiation) and with the heat (infrared radiation) given off by Earth.

- Describe the advantages and disadvantages of visible-light weather satellite pictures.

- Describe the advantages and disadvantages of infrared-radiation weather satellite pictures.

Method

The accompanying drawing shows an Earth surface and atmospheric cross-section. A temperature scale at the left shows the decrease in temperature with an increase in height in the atmosphere.

The numbers in the drawing indicate temperatures of various surfaces. For example, the lake surface is at +23 degrees C, the upper surface of the fog bank is +18 degrees, and the thunderstorm top is at a very cold –64 degrees.

The rates of infrared (heat) radiation from objects are related to their surface temperatures. The higher the surface temperature, the greater the radiation. The lower the temperature, the less the radiation. Because of this, the cold tops of high clouds appear white while the tops of warmer low clouds appear gray in infrared pictures (unless the images have been enhanced). Land and water surfaces being the warmest often appear darkest.

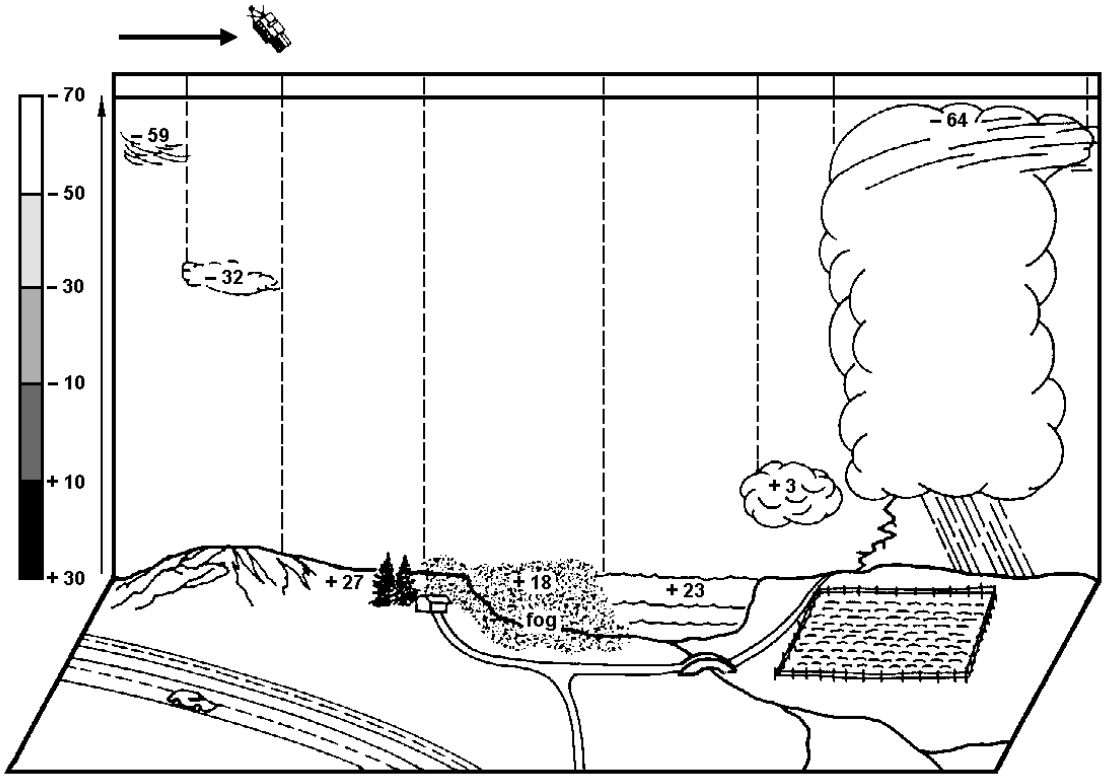
Questions

1. What does a satellite “see” when it senses the Earth in reflected sunlight (visible radiation)? Imagine yourself looking straight down from a satellite moving across the top of the drawing. Your direction of travel is shown by the arrow. List the sequence of things you would see as you make the trip across the field of view.

   _____

   _____

   Could you see this same scene at night?



2. What does a satellite “see” when it senses the Earth by infrared radiation? Imagine yourself making the same scan but now you sense the heat or infrared radiation given off by the upper surfaces of objects. Using the shading scale for temperature at the left as a guide, shade in the strip along the top of the picture based on the temperatures of surfaces directly below. List the sequence of “things” (shadings) you would see as you scan across the field of view.

   _____

   _____

Could you see as many different things as you saw with visible light?

Can you distinguish between land, fog, and water?

Were there some things you could "see" better in the infrared scan than in the visible light view?

Which are whiter in shading, low or high cloud surfaces?

Can you see this temperature scene day or night?

3. In the list below, place a (✓) in the appropriate column to indicate which kind of satellite view (visible or infrared) is better suited to provide the information requested:

	Visible	Infrared
a. 24-hour coverage of atmosphere	_____	_____
b. finer details of cloud surfaces	_____	_____
c. temperatures of cloud tops (and indirectly, their heights)	_____	_____
d. distinguishing fog from surrounding Earth surfaces	_____	_____
e. determining extent of snow cover on ground	_____	_____
f. detecting small fair-weather clouds	_____	_____
g. the color-coding of cloud tops	_____	_____