AIM 6 | How does the sun heat the atmosphere?

Without the sun, there would be no life on earth. Plants need the sun to help them grow. Without plants we would have no food to eat and no oxygen to breathe.

The sun also gives us warmth. The sun heats the atmosphere and all the lands and waters.

Heat moves in three ways—*conduction*, *convection*, and *radiation*.

CONDUCTION Heat moves through solids by *conduction*. In conduction, vibrating molecules pass on heat from molecule to molecule.

CONVECTION Heat moves through gases and liquids by *convection*. In convection, heated molecules move *away* from the heat. Cooler molecules take their place. Then *they* become heated, too.

RADIATION Conduction and convection need molecules to work. Radiation does not. *Radiation* is the way heat moves where there are no atoms or molecules.

Now let's trace the sun's energy.

- The sun is about 150 million kilometers (93 million miles) from earth. Most of this distance is empty space where there are almost no atoms or molecules. The sun's energy moves through this empty space by *radiation*.
- The sun's energy then hits the atmosphere. The air molecules become heated by *convection*.
- The sun's energy finally reaches the land and water on earth. The water becomes heated by *convection*. The land becomes heated by *conduction*.

Some of the heat from the land and water reflects (bounces) back into the atmosphere. This warms the atmosphere even more.

CONDUCTION, CONVECTION, AND RADIATION

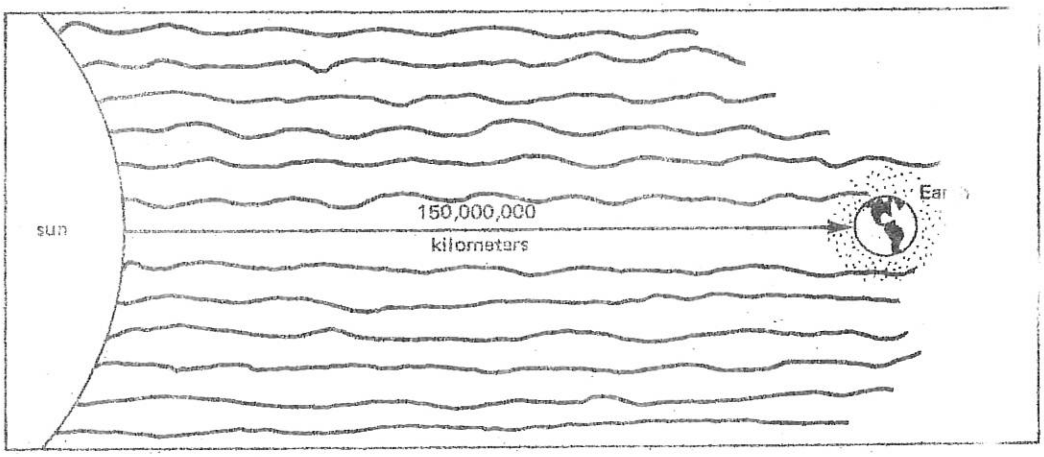

Figure A

1. Most of the distance between the sun and the earth is _____ .
   air, empty space
2. In outer space, there are _____ atoms and molecules.
   few, many
3. The sun's energy moves through outer space by _____
   conduction, convection, radiation
4. Radiation _____ need atoms and molecules to work.
   does, does not

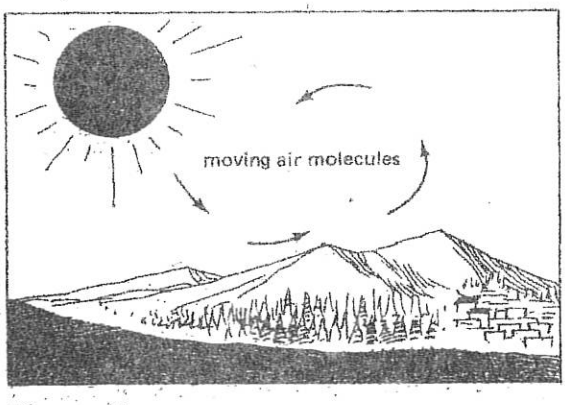

Figure B

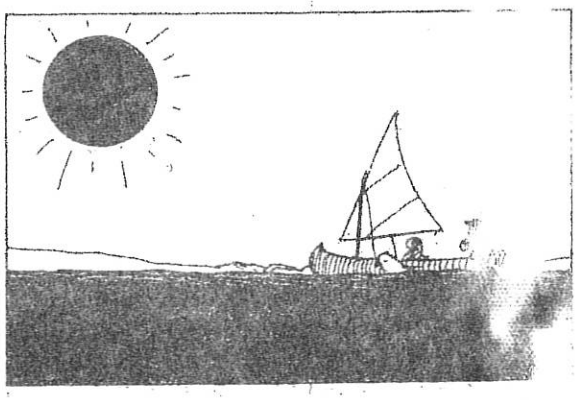

Figure C

5. Heat moves through gases and liquids by _____ .
   conduction, convection, radiation
6. Convection _____ need atoms and molecules to work.
   does, does not
7. What are liquids and gases made of? _____
8. Can the atoms and molecules of gases and liquids move from place to [illegible]?

   _____

COMPLETING SENTENCES

Complete the sentences with the choices below. Two terms may be used twice. One term may be used three times. One term may be used four times.

convection
atmosphere
radiation
atoms and molecules
conduction

1. The three ways that heat moves from place to place are _____, _____, _____.
2. Heat moves through solids by _____.
3. Heat moves through liquids and gases by _____.
4. Heat moves through empty space by _____.
5. In conduction and convection, heat is carried by _____.
6. In empty space, there are hardly any _____.
7. Our atmosphere is heated by _____.
8. Our rocks and soil are heated by _____.
9. Our oceans, rivers, and streams are heated by _____.
10. Some of the heat from the land and water bounce back into the _____.

MATCHING

Match the two lists. Write the correct letter on the line next to each number.

1. _____ sun
2. _____ conduction
3. _____ convection
4. _____ radiation
5. _____ atmosphere

a) the way heat moves through empty space
b) mixture of gases
c) warms our entire planet
d) the way heat moves through gases and liquids
e) the way heat moves through solids

9. After atoms and molecules of gases and liquids are heated, they move *away* from the heat. What takes their place? _____

10. What happens to some of the heat from the oceans, lakes, and streams?

_____

_____

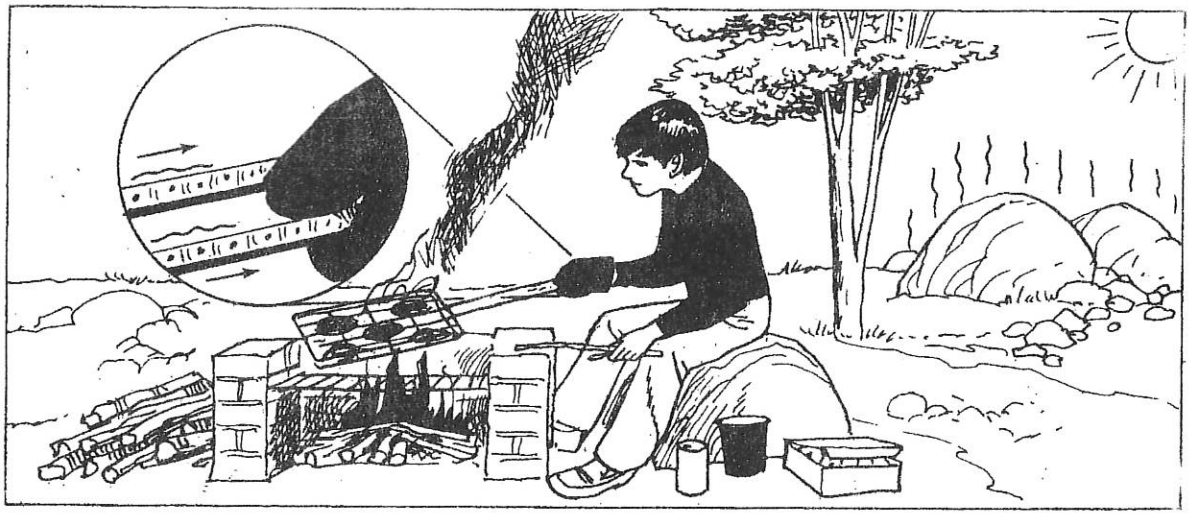

Figure D

11. Heat moves through solids by _____.
(conduction, convection, radiation)

12. Conduction _____ need atoms and molecules to work.
(does, does not)

13. What are solids made of? _____

14. Can the atoms and molecules of solids move from place to place? _____

15. Explain how heat moves through solids. _____

_____

16. What happens to some of the heat from the land? _____

_____

_____

TRUE OR FALSE Write T on the line next to the number if the sentence is true. Write F if the sentence is false.

1. _____ Heat stays in one place.
2. _____ Heat moves only where there are atoms and molecules.
3. _____ Heat moves in three different ways.
4. _____ In solids, heat moves by convection.
5. _____ In gases and liquids, heat moves by convection.
6. _____ Conduction and convection need atoms and molecules.
7. _____ In empty space heat moves by radiation.
8. _____ There are many atoms and molecules in outer space.
9. _____ The earth gets its heat from the sun.
10. _____ Heat can be reflected.

REACHING OUT In what simple way can you show that the earth bounces some heat back into the atmosphere? (You need no instruments to do this—only your hand.)

AIM 7 | What is a wind?

You cannot see wind. But you know it's there. You can feel it pressing against your body. You see tree branches bend when it blows. A gentle wind makes you feel fresh. A strong wind can blow you down.

What is this invisible force we call wind?

A *wind* is air that is moving parallel to the ground. (Air that moves up or down is *not* called wind.)

There are two main groups of winds. They are planetary winds and local winds.

PLANETARY WINDS move across our *entire* planet. They cover *very* large areas.

Most of the time a planetary wind blows at the same speed and in the same direction. Some planetary winds blow high in the atmosphere. You cannot feel them on the ground.

LOCAL WINDS move across small areas. They change direction and speed very often. Local winds blow low in the atmosphere. You can always feel them on the ground.

Every wind has *speed* and *direction*.

- An *anemometer* [an uh MOM uh tur] measures how fast a wind blows.
- A *wind vane* tells us from which direction a wind blows.

Do you want to know what *causes* winds? You will find out in the next Aim.