

Exercises

(A). Fill in the blanks:

1. Heat
2. Conduction
3. Insulator
4. Convection
5. Radiation

(B). Match the following: (Ans.)

1. Solid
2. good conductor
3. liquids
4. good absorber of heat
5. air blowing from land to sea

(C). Multiple choice questions:

1. conduction
2. radiation
3. land to sea
4. solids
5. iron

(D). Give scientific reason: (Ans.)

1. Because the molecules in solids are rigid and only vibrate on heating rather than moving from one place to other. The vibrating molecules of the hotter region hit those molecules in the colder region causing the transfer of heat.
2. Because black colour is very good absorber of heat. This property is used in solar cooker where sunlight beats on the device and due to its black colour more heat is absorbed.
3. Because mercury is the only metal which is available in the liquid state. To heat the Mercury, the conduction method is used and not convection like most of the liquid.
4. Because radiation is transfer of heat through electromagnetic waves through space. Unlike convection or conduction where energy from gases liquids and solids is transferred by the molecules, radiation does not need any medium.

(E) Answer the following questions:

1. Plastic and wood are the two examples of insulators.
2. Heat transfer by conduction and conduct convection works by particles colliding and transferring energy as there are no particles in a vacuum heat transfer can only occur by radiation.
3. Good conductors : Those materials which allow the heat to pass through them easily are called as good conductors of heat. E.g.: silver, aluminium, copper, and mercury are good conductors of heat energy.
Poor conductors : The substances which pass very little heat or do not allow the heat to pass through them. E.g.: wood, air, plastic, wool, stone and glass are the poor conductors of heat energy.
4. The land and sea breezes occur constantly at places near the coast due to convection currents. This makes the coastal climate pleasant and moderate.
5. Application of convection :
 - (a) Smoke and hot gases produced in factories and workshop escape through the tall chimneys due to convection currents.
 - (b) Room heaters are placed on the floor of the room are at lower level. This is because when the air molecules close to the floor gets heated and rises upwards.

6. Factors affecting radiation :

- (a). Temperature : The hotter the object, the more it radiates.
- (b). Surface area : More the surface area of the object radiating heat more is the heat radiated from it.
- (c). Nature of the body : It is found that a black surface absorbs more heat than a bright surface.

7. An increase in temperature causes the water molecules to gain energy and move more rapidly. When water is heated it expands, or increases in volume. When water increases in volume it becomes less dense.

8. Because the end of the spoon dipped in the tea absorbs heat and passes it on to the other end of the spoon. The entire spoon becomes hot due to conduction.

9. This will keep the cool air inside the room and keep the temperature moderate. In addition to cooling efficiency, leaving the windows open will also put stress on the air conditioner.

10. Because black colour is both a good absorber and a good radiator of heat. The heat generated by the engine is efficiently radiated due to the dull black paint.

(F). Answer in brief :

1. Differentiate between conduction and convection are :

Conduction :

- a. The mode of transfer of heat from a hotter end of an object to a colder end is called conduction.
- b. This mode is also used to transfer heat from one object to another.
- c. All solids transfer heat through conduction.

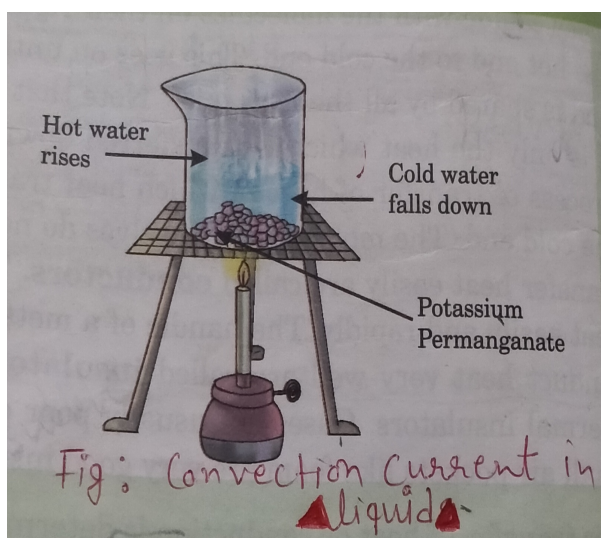
Convection :

- a. When heat is transferred from one place to another by actual movements of particles or molecules, it is called convection.
- b. The moving air always carries heat from a place of higher temperature to a place of lower temperature.
- c. Liquids and gases transfer heat through convection.

2. An experiment to show convection current in liquids :

We need a beaker with some water. Put a few crystals of potassium permanganate in it. The crystals settle at the bottom of the beaker. Now heat the water over a burner. After some time, we will very clearly see a motion of coloured water forming a loop in the beaker. This happens because the water at the bottom gets heated and expands. The warm water being lighter rises up, carrying the heat energy with it. Very soon the rising water becomes cold. The cold water being heavier moves down from the sides. The cold water again gets heated and rises, thus forming a loop. This constant movement of water is called convection current of water and this method of heat transfer is called convection.

This process continues and gradually the whole water in the beaker gets heated up.



3. In solids, molecules are closely packed and there is no intermolecular space between them. So, when the solids are heated the closely packed molecules cannot move but they can only vibrate as they gain the

thermal energy. When they vibrate they collide with each other and in the process they transfer the thermal energy to the next molecule. This process continues till the heat is passed from one end to the other. Thus, the heat speeds throughout the solids.

4. Sea breeze : In the day, when the sun is up the land surface is heated by radiation from the sun. The air above the land becomes hot and expands and then it begins to rise. The air above the sea water is relatively colder and heavier. So, it rushes on to the land to occupy the space created over the land. This current of cool air from sea to the land is called sea breeze.

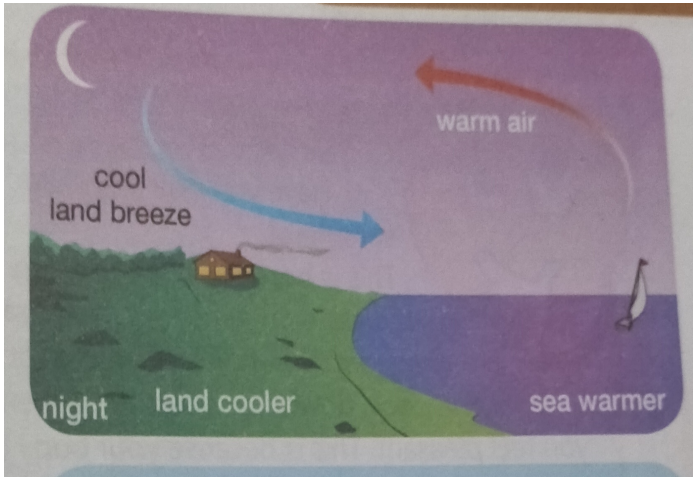


Fig. - Sea breeze

Land breeze : In the night, the reverse happens. In absence of the heat of sun, the land quickly loses its heat and cool down. But the sea water does not lose heat as quickly and it remains warm. Hence, the real over the water is warmer, less dense and begins to rise. Now the relatively cooler and heavier air from the land rushes on to the sea to occupy the space created over sea and to replace the warmer rising air. The cool bridge from the land to the sea is called a land breeze.

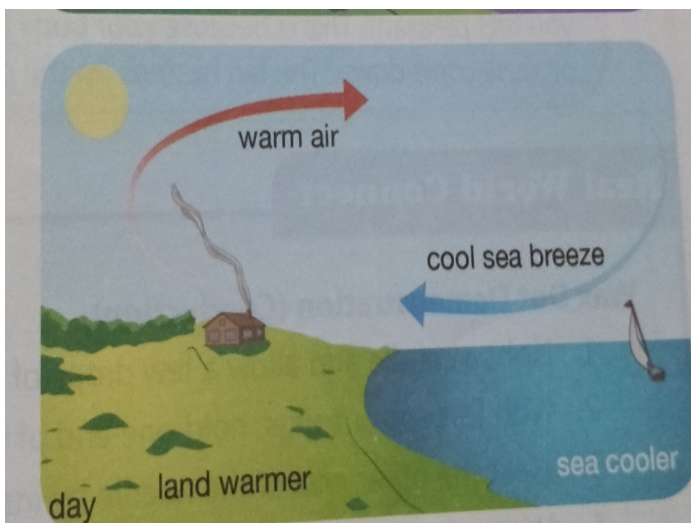


Fig. - Land breeze

5. The transfer of heat energy from a hot body to the cold body without any medium in between the two bodies. This mode of transfer of heat is called as thermal radiation.

Application of thermal radiation are :

1. The amount of heat absorbed by a body depends on its colour. Black bodies absorb more radiant energy than white bodies because black colour is a good absorber of heat.
2. The outer side of a cooking utensil is coated with black colour so that it absorbs more heat and cooking can be done in very less time.
3. Cars, machines and air conditioners have radiators painted with black colour so that they maintain the cooling effect and radiate maximum heat.

6. An experiment to show convection in gases.

Take a rectangular wooden box, whose one side is fitted with two glass chimney's. Light a candle and place it under the chimney B. Now hold a soldering agarbatti near the mouth of chimney. It is seen that the smoke is sucked in by the chimney A. It then travels towards the lighted candle and finally rises up from the chimney B.

This happens because :

The air in the region of lighted candle becomes hot the air directly above the flame becomes less dense and rises up as compared to the air around the flame. Thus, lighted air rises up through chimney B, thereby causing a region of low pressure. To make up for this fall in pressure, the air from outside rushes into the box, through chimney A. In doing so, it sweeps the smoke of the agarbatti along with it.

Thus, we can see that the molecules of the air actually moved to the source of heat, and on absorbing heat energy, move away from it.

Hence, gases are heated by convection.
