

09 Heat and Its Effects

Go to a place where sunlight falls abundantly. Stay there for about 5 minutes. What do you feel? You will feel a warmth. During the day time the surrounding gets warm because of the sunlight. Does everything in the environment get warm equally? Let's do the following activity to find about that.



Activity 9.1

You will need:- A thermometer

Go to some different places in your school garden with your teacher and measure the temperature.

Note down the temperature shown in the thermometer.

- A place where there is plenty of sunlight
- Under the large tree
- A sample of soil taken from a dry place
- A sample of soil taken from a wet place.
- Water gathered in a certain place.

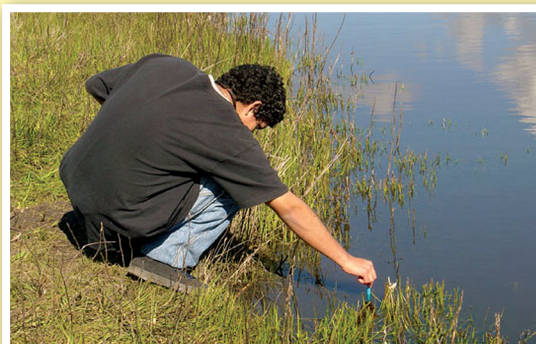


Fig 9.1 ▲ Measuring the temperature of water

Think about the reasons for the variation of the temperature recorded in the thermometer.

The environment gets heated during the daytime due to sunlight and it gets cool during the night. This process is one of the major factors which affects the existence of life on earth.

In some countries people die of extreme cold and in some other countries people die of extreme heat. This tells us that there is a limit in the temperature that affects our existence.



Fig 9.2 ▲ Extremely cold areas



Fig 9.3 ▲ Extremely hot areas

The normal body temperature of a human being is 37°C . Though the temperature in the environment is changed our body temperature doesn't change. When the environment gets cold our body produces more heat. But some animals such as reptiles, frogs, lizards and insects can't do so. The body temperature of those types of animals is changed according to the temperature of the environment.

The body of some animals is covered with fur. In some animals, there is a thick fat layer too. These types of adaptations help those animals to maintain the body temperature.

The type of energy that is used to increase the temperature of some objects, is heat. Our main source of heat is the sun.



Fig 9.4

9.1 Heat Generation

Activity 9.2

We can generate heat even by rubbing two surfaces of some substances. Now rub your palms.

In the past man used to rub two stones together to light fire. From this, we can understand that the friction between two surfaces can generate heat.



Fig 9.5

Heat is not used only for the existence of living organisms. We have to use heat in many instances. Now let's learn about it.

Solar power can be used to heat water. Have you seen solar panels fixed on top of roof of some houses?

Activity 9.3

Let's make a model of a solar water heater.

You will need :- A cardboard box without a lid (the length of a side must be at least 30 cm), a flexible plastic tube (about 3 m), a paper cutter/ a pair of scissors, a sheet of transparent glass or plastic which is a little bit bigger than the lid of the box, binder gum/ cello tape, an aluminum foil< black paint and a paint brush, a PVC pipe(about 25 cm long and the diameter about 4 cm.)

- Make two holes as shown in the figure on one side of the box. (They must be equal in size to the plastic tube)
- Paste the aluminum foil inside the box.

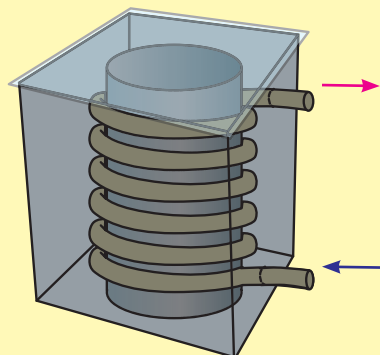


Fig 9.6

- Wind the plastic tube around the PVC tube and apply black paint on the PVC tube, plastic tube and aluminum foil in the box.
- Paste the PVC tube vertically in the box.
- Keep the glass sheet instead of the lid of the box and fix it with gum tape. Now you have finished making the solar water heater. Let's check how it works.
- Keep it under direct sunlight.
- Fix the rare end of the plastic tube to a tap and let some water pour in.
- Now check whether the water which comes out of the other end is hot.



Assignment 9.1

List out the instances where the solar power is used at your home.

Other than the sun, there are a number of other sources of energy. We can produce heat even by combusting fossil fuels. Wood, coal, kerosene oil, natural gases are commonly used as fuels.

Look for some sources of heat that you can find at home. You will find that apart from combusting fuel, heat is generated in electrical appliances.



Assignment 9.2

Find such an appliance which is not in use and examine it well. You will find that there is a heating coil in it to generate heat.



Activity 9.4

Let's make a heating coil.

You will need : A thin enameled copper wire (about 30 cm long), a paper cutter, two dry cells, a pencil

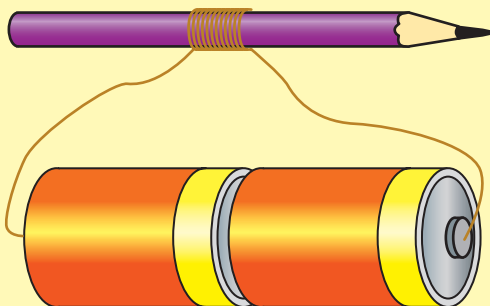


Fig 9.7

Method :-

- Wind the wire around the pencil overlapping one another.
- Connect the cells to the two ends of the wire for about one minute.
- Check carefully whether the coil is heated.



Assignment 9.3

We all have seen many instances where heat is produced by rubbing two substances. It is sometimes a disadvantage. List out such instances where we consider this as a disadvantage.

9.2 Effects of Heat

During day time the environment becomes hot. At night, it becomes cold. When we take an ice cube out of the refrigerator, it turns into water. Before fixing a rim to a cart wheel rim is heated well. All these are phenomena which are related to heat. We can observe changes in an object, not only when we supply heat to it, but also when the heat is removed from the particular object. Now let us learn more about effects of heat.

1. Increase of temperature



Activity 9.5

Let's observe how temperature of water is changed

You will need :- A beaker with water, a tripod, a spirit lamp, a thermometer

Method :-

- Prepare the setup as shown in Fig 9.8.
- Light up the spirit lamp and observe the change of temperature mentioned in the thermometer.
- Then, blow out the spirit lamp and observe how temperature changes.

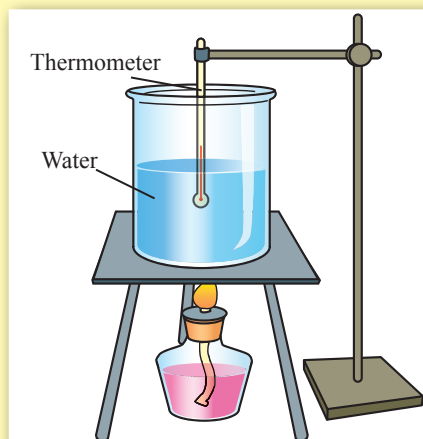


Fig 9.8

When heat is supplied, temperature of water increases. Although the heat is provided while water is boiling temperature doesn't change. When heat is supplied to an object, it becomes hot.

The amount of heat of an object is known as temperature. Heat can be measured by using a thermometer. You know that the temperature of food increases when it is cooked. In the same way, when the heat is released the temperature reduces. According to this, we can come to a conclusion that when heat is supplied the temperature increases, when heat is released, the temperature decreases.



Assignment 9.4

Take two equal sized beakers and put equal volume of water to one beaker and coconut oil into the other beakers. Heat them using two equal sized candles. Both the vessels should be heated for an equal period of time. Identify what is heated more. Even though both beakers are heated equally their temperatures have not increased in equal amounts.

2. Expansion

Have you observed that rails of a railway track have been fixed keeping a gap between them? What is the reason for this. You can find the answer to it by doing the following activity.



Activity 9.6

Let's learn about the expansion of solids

You will need :- A marble, a small loop made using an iron wire (it should be smaller than the marble), a wooden handle that can be fixed to the other end of the wire

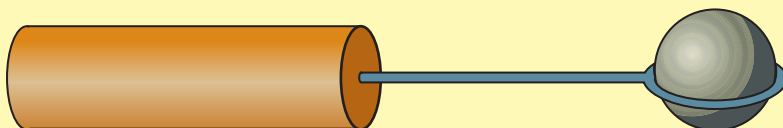


Fig 9.9

Method :-

- Fix the iron wire with the loop to the wooden handle as shown in the figure.
- Heat the loop using a flame.
- Now check whether the marble can be sent through the loop.

How can we remove a metal lid from a bottle? Heat the lid for a few minutes. You will be able to remove the lid easily. It was easy because the lid is expanded. If something becomes larger in size after heating, it is called as expansion. When the heat is taken off (cools) the things get contracted. Now you can also understand the reason for heating the rim of the wheel of a cart before fixing it and keeping a gap between rails.



Activity 9.7

Let's investigate the expansion of liquids

You will need :- A glass bottle, a rubber cork that can be fixed to the bottle, a tube of a pen, a beaker with hot water, small amount of ink.

Method :-

- Take a rubber cork and make a hole in the middle.
- Put the tube of pen through the hole.
- Put ink into the bottle with water.
- Fix the cork to the bottle.
- Place the bottle in the hot water beaker.

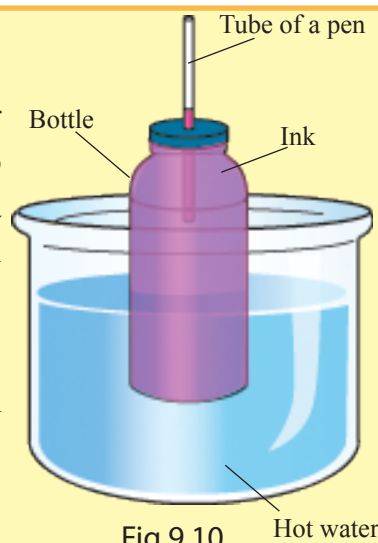


Fig 9.10

For further study :- This setup can be used to observe the expansion of different types of liquids. You can use bottles which are similar to the bottle to which a pen is fixed. Put equal amounts of coconut oil < kerosene oil < alcohol to bottles and keep them in hot water for the same time.

You can observe the level of ink increases in the tube of pen during the activity 9.7. That means water has expanded as it has obtained heat.

Thermometer consists of alcohol or mercury. What happens to the liquid when the temperature increases? We can explain using the expansion of liquids.

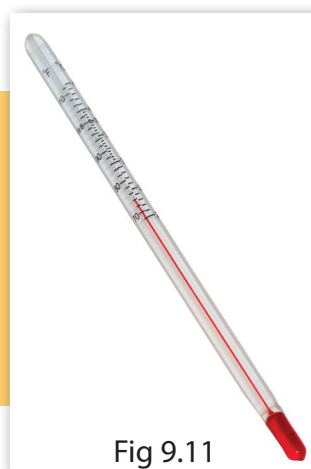


Fig 9.11



Activity 9.8

Let's learn about expansion of gases

You will need :-

A glass bottle, a coin and a beaker with hot water

Method :-

- Take a bottle without a lid and apply some water in the mouth of the bottle.
- Then keep the coin on the mouth of the bottle and close the mouth.
- Place the bottle in the beaker with hot water.
- Observe what happens to the coin.

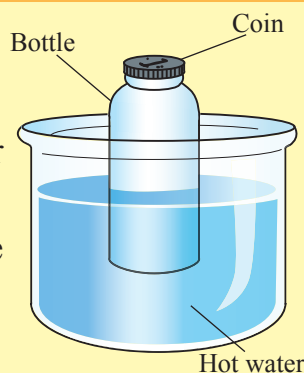


Fig 9.12

You will observe that the coin moves due to the expansion of gas.

Blow a balloon and tie the mouth of it tightly. Then, keep it in a place where sunlight falls. See what will happen to the balloon. Explain about your observation.



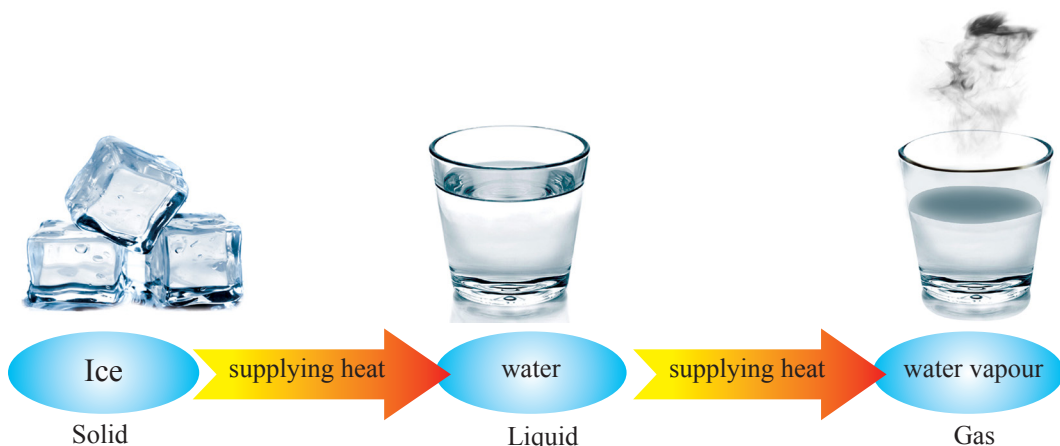
Assignment 9.5

Search the instances where the expansion takes place. List out the instances in the given table.

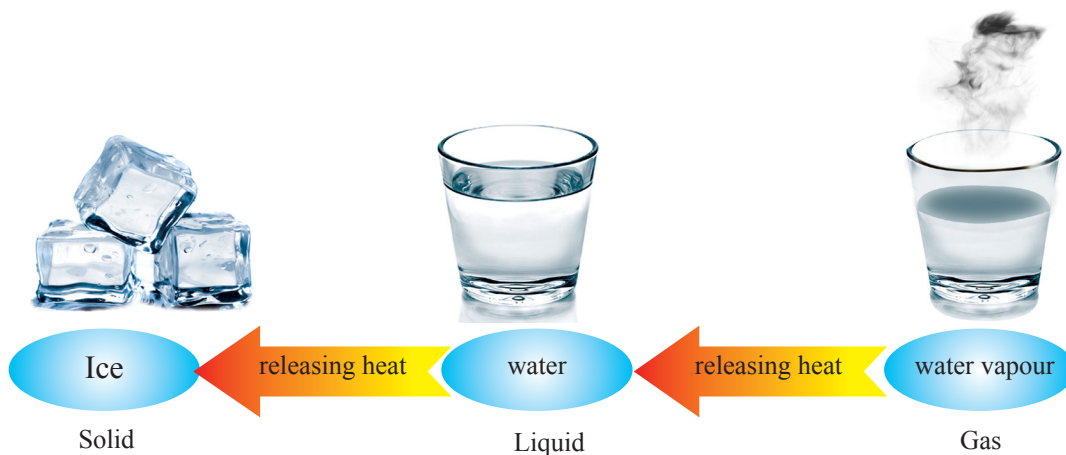
Object	How did you identify that it is expanded.

3. Change of states of matter

Heat changes the nature of objects. Ice is changed into water because of the heat. What happens when water is boiled? Water is changed into water vapour. Here water has turned to the gaseous state. These type of changes are known as changes of state.



Change of state can occur due to release of heat. When water vapour is cooled, it turns into water. When water becomes cold, it turns into ice.



Assignment 9.6

Given below are some instances of changes of state. Write the change of state in front of it.

Instances	Change of state
Water converting to water vapour	liquid $\longrightarrow$ air
Lead turning to liquid	
Iron turning to liquid	
Frost	
Producing ice cubes	



Activity 9.9

Let's observe changes of state

You will need : a candle, a box of matches, a piece of white cardboard, a small metal tube

Method :-

- Candle is made up of solidified wax.
- Liquid wax can be observed when the candle is lighted up.
- Wax vapour is seen in the dark region which is in the middle of the flame. Enter one end of the metal tube into middle of the flame and keep another flame near the other end of the tube. (Get the help of teacher)
- Keep the piece of cardboard on the flame for a short period of time.
- Then, check the piece of cardboard carefully.

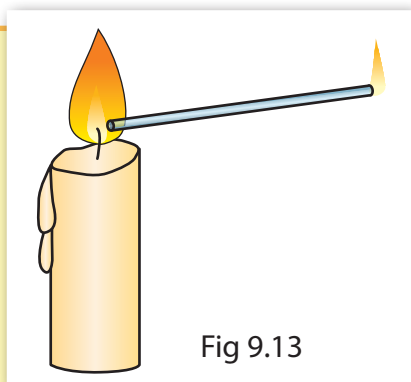


Fig 9.13



Assignment 9.7

Hold a plate to the steam that goes out from a spout of a kettle. Report your observations. (Get the help of an adult)

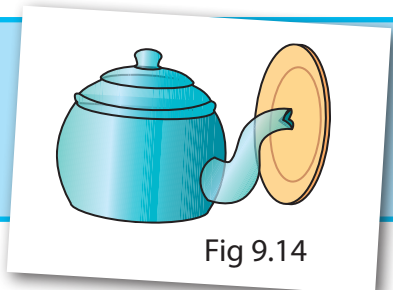


Fig 9.14



Assignment 9.8

Take some wax, camphor balls, jak latex and tar. Keep them in a lid of a tin and heat. What melts quickly? (Get the help of an adult)

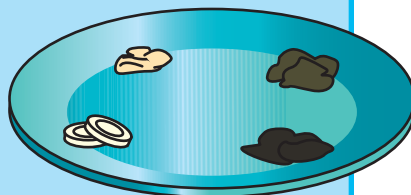


Fig 9.15

4. Colour change

In a smithy, when a piece of metal is heated, first it turns to red and then to orange. When it is heated further, it turns to yellow. A similar phenomenon occurs when electric energy is provided to a filament of a bulb. Supply electric energy to a small torch bulb and observe the colour of its filament.

First it will turn to red, orange, yellow respectively and at last it will turn to white. The reason for this colour change is the transformation of electric energy to heat energy.



Activity 9.10

Activity (Teacher Demonstration)

You will need: A filament bulb of 2.5 V, two dry cells of 1.5 V, a variable resistor, a switch.

- Prepare a circuit using above materials
- Control the current with the variable resistor and increase the current gradually and observe the change of colour of the filament.

9.3 The Effects of heat to the Environment

You may have seen the effect of sunlight during a drought. Think of the changes that occurred in your environment. Tanks dry out. The water level of wells go down. The land gets dry severely. The whole environment gets covered with dust. Forest fires also may occur due to severe heat. These forest fires spread very easily as the trees are dry.



Assignment 9.9

Take some clay and spread it on a lid of a tin. Leave it at a place where plenty of sunlight falls. Observe the changes.



Fig 9.16 ▲ Occurrence of a drought



Fig 9.17 ▲ Occurrence of a forest fire



Assignment 9.10

List out the environmental changes that take place during a drought.

You know that water is recycled on the earth. This process is called the water cycle. The heat of the sun affects the water cycle. Water on the earth evaporates due to sun's heat. The evaporated water in the atmosphere gets cool and falls back on the earth as rain.

It is identified that there are currents in oceans which are almost similar to large rivers. They are also occurred due to heat. Water in oceans near the equator is warmer than the water in oceans in Northern and Southern poles. Warm water flows towards the poles as well as cold water flows towards the equator.

Scientists have revealed that the temperature of the earth is rising gradually. They have found many reasons for this. The main reasons are too much combustion of fossil fuels and deforestation.

Due to such human activities many serious problems may occur in the future.

When the temperature rises, the glaciers of the poles start melting which results in the rise of the sea level. And you know that water gets expanded when it is heated. It is also one of the reasons for the rise of the sea level. Because of this many of the small islands face the threat of being drowned in the sea.



Assignment 9.11

Find out how Global warming occurs. Write an article to a Science magazine about Global warming.



Summary

- Heat is needed for the existence of life and for various phenomena to take place in the environment.
- The main source of heat is the sun.
- We can obtain heat from combusting fossil fuels.
- We can use heat to generate electricity.
- Heat can be obtained from electricity.
- Heat is the reason for increase and decrease of the temperature of substances.
- The reason for expansions and contractions of substances is heat.
- Change of states of matter occurs due to heat.
- Heat affects the properties of substances.
- Heat affects the colour change of substances.
- Heat must be used efficiently and with caution.

Exercises

01. Underline the most appropriate word to fill in the blank.
 - i) The warmth of an object is called (heat, temperature)
 - ii) When we heat up a container with boiling water its temperature (rises, does not change)
 - iii) (Ice, steam) forms when heat is released from water.
 - iv) When heat is released from a solid substance, it (expands, contracts)
 - v) When iron is heated thoroughly it turns (red, white) first.
 - vi) In room temperature mercury is in the (liquid, solid) state.
 - vii) (Currents, Tsunami) occurs as a result of the changes in the temperature of sea water.
02. i) What is our main source of heat?
 ii) What are the instances where we use heat in our day-to-day life?
03. i) What is the reason to leave a little space among the rail tracks when they are made?
 ii) What is the strategy used in electric irons to control the heating?

Glossary

Heat	-	நாபய	-	வெப்பம்
Temperature	-	உஷ்ணத்தவய	-	வெப்பமானி
Expansion	-	புராரணய	-	விரிவு
Colour	-	வர்ண	-	நிறம்
Friction	-	ஃர்ஷணய	-	உராய்வு
Thermometer	-	உஷ்ணத்தவமாதய	-	வெப்பநிலை
Sources of Heat	-	நாபய புறவ	-	வெப்பமூதல்
Change of state	-	அவஸ்தா விபர்யாச	-	நிலைமாற்றம்