THEME 2

MATERIALS

ACTIVITY 7

What we have to do?

Let us explore fabrics that are obtained from fibre.

What do we need?

A cotton duster (the one we use in kitchen) or mop cloth (used for floor moping), a needle, a pair of scissors.

How do we proceed?

1. Spread the given piece of cloth on your table.
2. Cut the sides with the help of scissors to loosen the network of threads (Fig. 7.1).
3. Pull out the threads (yarn) from the cloth using a needle. (Fig. 7.2)
4. Keep the thread on the table and hold it at one end with your hand and scratch it with your nail and observe what happens. (Fig. 7.3 and Fig. 7.4)

Figure 7.1
Cutting a piece of cloth

Figure 7.2
Pulling a thread from cloth

Figure 7.3
Splitting the yarn into thin strands

Figure 7.4
Yarn splits up into thin strands

What do we observe?

It is observed that a thread (yarn) from the cloth splits into many strands/fibres on scratching with nail.

What do we conclude?

- Cloth is made of ____________________.
- Yarn is made of several ____________________.
- Strand of yarn is made of ____________________.

Let us answer

1. What is the difference between yarn and strand?
2. What difference do you find between strand and fibre?
3. What is the ultimate constituent of cloth?

What more can we do?

- Take some other types of clothes and try to find out whether the yarn is made of single strand or many strands.

Note for the teacher

- Make sure that students note that thread (yarn) of the cloth is not made of several strands in each case.

Notes ____________________

ACTIVITY 8

What we have to do?

Classify the given materials on the basis of properties, such as hardness, solubility in water, floats in water, and transparency.

What do we need?

Wax, glass piece (with blunt edges), oil coated paper, sugar, green leaf, piece of coal, piece of wood, a coin, a piece of sponge, a container, water, spoon/glass rod, a sheet of white paper.

How do we proceed?

1. Take the given materials one by one and observe the materials which are compressed on applying some pressure. Record your observations in a Table 8.1.
2. Take a container (like beaker, glass bowl, etc.) and fill it half with water. Add any given material and see whether it floats or sinks (Fig. 8.1). Now stir it with a spoon or glass rod and check if it is soluble or insoluble. Repeat the same steps with other materials also. Record your observations in the Table 8.1.
3. Take a strip of white paper and make a dark spot on it (Fig.8.2). Place the given materials one by one on the spot and observe its visibility whether you can see it clearly (Fig. 8.3), not clearly (Fig. 8.4) or not able to see it at all (Fig.8.5). Record your observations in the Table 8.1.

Figure 8.1
Some objects flaot in water while others sink in it

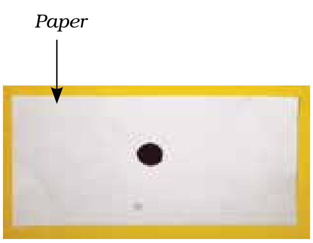

Figure 8.2
Paper with a dark spot

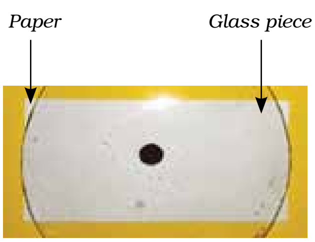

Figure 8.3
Transparent material kept on dark spot

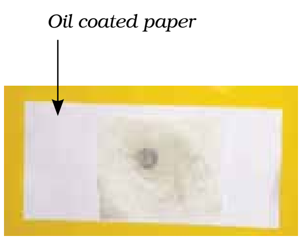

Figure 8.4
Translucent material kept on dark spot

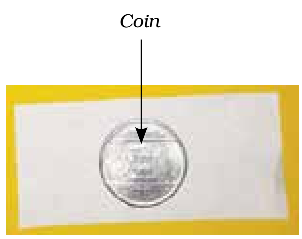

Figure 8.5
Opaque material kept on dark spot

What do we observe?

Record all the observations in a Table 8.1.

Table 8.1

Material	Properties			
	Hard/Soft	Soluble/Insoluble in water	Sinks/Floats in water	Transparency (transparent/ translucent/ opaque)
Wax				
Glass piece				
Oil coated paper				
Sugar crystals				
Green leaf				
Coal				
Wood				
Coin				
Piece of sponge				

What do we conclude?

- Materials which were easy to press are soft, such as wax, green leaf, sponge, etc. Materials which were difficult to press are hard, such as glass piece, sugar crystals, coin, coal and wood.
- Materials which dissolved in water are called soluble materials, such as sugar. Materials which did not dissolve in water after stirring for a long are called insoluble materials, such as wax, glass piece, coin, coal, wood, green leaf, sponge etc.
- Some materials float in water such as wax, wood and coal. Some materials sink in water, such as sugar, coin, glass piece.
- Materials through which you can see clearly are transparent, such as glass piece. Materials through which you cannot see clearly are transluscent, such as oil coated paper.Materials through which you cannot see at all are opaque, such as coal, wood, sugar, wax, coin, and sponge.

We conclude that materials are classified on the basis of their properties.

Let us answer

1. Mention any two properties of sugar that you have identified from this activity?
2. You are advised to drive your bicycle slowly on a foggy day. Why?
3. Find the odd one out from the following-

   Coal, wood, glass piece, sugar, candle.

   Justify your answer.

What more can we do?

- A project can be done on this concept.
- Collect samples (at least 10) of different materials from your surroundings and classify them on the basis of their properties.

Note for the teacher

- Give freedom to students to explore and observe.
- Kindly see that the materials used in the activity should not harm the user.
- Students may take materials of their choice, but see that these materials show all the properties.

Notes ______________________________

ACTIVITY 9

What we have to do?

A mixture of iron, sand and common salt is provided to you. Separate the three components of this mixture.

What do we need?

A mixture of iron filings, sand and common salt, magnet, filter paper, funnel, two beakers, Petri plate, spoon/glass rod, heating device, tripod stand, wire gauze, a sheet of paper, match box.

How do we proceed?

Step I. Take a little amount of the given mixture of iron fillings, sand and common salt and keep it separately. Spread rest of the mixture on a sheet of paper or in a Petri plate (Fig. 9.1). Move a magnet over the surface of the mixture (Fig. 9.2). What happens? Do you find that iron fillings are removed from the mixture with the help of a magnet?

Figure 9.1
Mixture of iron fillings, sand and common salt

Figure 9.2
Iron fillings get attracted towards magent

Step II. Take the remaining mixture from which iron filling have been removed in a beaker. Add sufficient amount of water to cover the mixture. Stir the contents of the beaker with a spoon/glass rod for some time.

Filter the content with the help of a funnel and filter paper (Fig. 9.3). Record your observations.

Step III. Heat the filterate obtained in step II using a heating device (Fig. 9.4). Heat the content till most of the water evaporates.

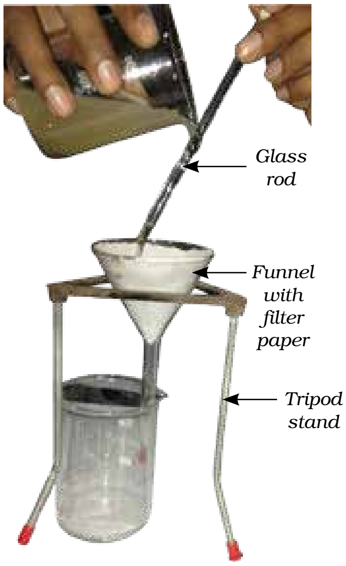

Figure 9.3
Filtration using a filter paper

FIg. 9.4
Heating a beaker containing salt water

What do we observe?

Step I. Iron fillings stick to the magnet and are thus separated.

Step II. Sand remained undissolved in water and is separated by filtration.

Step III. On heating the filtrate, water is evaporated and a white coloured substance (common salt) is left at the bottom of the beaker.

Compare the separated components with the mixture you left aside.

What do we conclude?

- Magnetic substances like iron are separated by a magnet.
- Substances which are insoluble in water (such as sand) can be separated by filteration.
- Substances which are soluble in water (such as common salt) can be separated by evaporation.

Let us answer

1. Is there any method other than filtration by which we can separate sand from water? Explain.
2. Why does the filter paper permits the passage of the salt solution, whereas it retains the sand?
3. The filtrate containing salt when heated becomes dry. Where has the water gone and why?
4. Suggest a method to collect and use the water which disappears on boiling?

What more can we do?

- List the methods which are used at your home to separate components of mixtures.
- Find out the ways used to purify water which is supplied at your home from water station.

Note for the teacher

- You can make various types of mixtures and give opportunities to students to use different methods of separation based on their different properties.
- Let the students discuss their findings in the class.

Notes

ACTIVITY 10

WHAT WE HAVE TO DO?

Let us explore the nature of the following changes whether they can be reversed or not?

(a) Disappearance of common salt on dissolving in water.

(b) Cutting of potato

WHAT DO WE NEED?

Common salt, water, glass tumbler, heating device, china dish, wire gauze, tripod stand, potato, knife. match box.

HOW DO WE PROCEED?

a) Take a tea spoon of common salt in a glass tumbler and dissolve it in minimum amount of water. (Fig. 10.1)

- Where has the salt gone?

  Can we get the disappeared salt back?

- Transfer the content of glass tumbler in a china dish and heat it till water evaporates completely (Fig. 10.2).

What do you observe?

Figure 10.1 Dissolving salt in water

Figure 10.2 Heating a china dish containing salt water

b) Take a potato (Fig. 10.3). Cut it into small pieces with the help of a knife (Fig. 10.4a) (be careful while using a knife).

- Can you get the potato back in its original form from these pieces (Fig. 10.4b)?

Figure 10.3 A potato

(a) (b)

Figure 10.4: A potato cut into pieces

What do we observe?

- Common salt dissolved in water and thus disappeared. It was recovered back by the evaporation of water.
- On cutting the potato it was converted into pieces. However, there was no way to get back the material (potato) to its original shape and size.

What do we conclude?

- Dissolution of common salt in water is a change, which can be reversed because salt can be obtained back on evaporation of water.
- Cutting a potato into pieces is a change which cannot be reversed.

Let us answer

1. Making of roti from dough and baking of a roti are two changes. Are these changes similar or different? Justify your answer.
2. Raw mango ripens with time. Is this a reversible/non-reversible change?
3. Classify the following changes into reversible/non-reversible.

(a) Wetting of cement	(b) Drying of a wet cloth
(c) Squeezing of lemon	(d) Opening of a window

What more can we do?

Look at your surroundings. List at least ten changes which can be reversed and ten changes which cannot be reversed.

Note for the teacher

While dealing with the chapter on "Changes Around Us", it is suggested to take students outside the classroom and let the children explore, observe, record and discuss the changes taking place.

ACTIVITY 11

What we have to do?

Reaction between an acid and a base to show the process of neutralisation.

What do we need?

Dilute hydrochloric acid, dilute sodium hydroxide solution, phenolphthalein indicator, test tubes, dropper, test-tube stand.

How do we proceed?

1. Take about 5 mL of dilute hydrochloric acid in a test tube. (Be careful while handling the acid solution)
2. Add 1-2 drops of phenolphthalein indicator to the solution and note down if any change in colour.
3. Take about 10 mL of dilute sodium hydroxide solution in another test tube.
4. Take out sodium hydroxide solution with the help of a dropper and start adding this solution drop wise into the test tube containing hydrochloric acid till a change in colour is observed (Fig.11.1).
5. What colour do you get?
6. With the help of another dropper, take out hydrochloric acid and start adding it drop wise into the coloured solution obtained above. Note your observations.

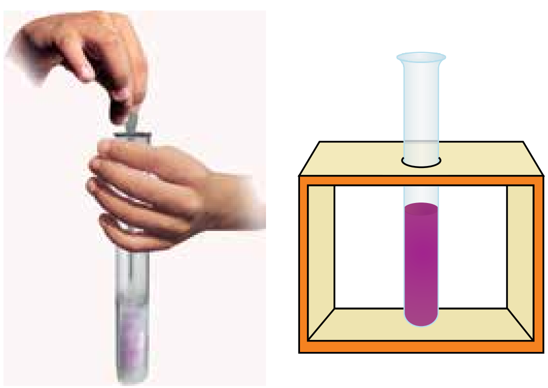

Figure 11.1 Process of neutralisation

What do we observe?

- Colour of the hydrochloric acid solution does not change on addition of phenolphthalein indicator.
- On adding nearly 5 mL sodium hydroxide solution to the mixture of hydrochloric acid and phenolphthalein solution, the colour of the mixture changes to pink.
- On addition of hydrochloric acid solution to the pink solution, the colour starts fading gradually and finally the solution becomes colourless.

What do we conclude?

- Phenolphthalein indicator remains colourless in the acidic solution while its colour changes to pink in basic solution.
- It is found that on adding a base in an acid, a stage reaches when effect of acid is neutralised by base and vice-versa as indicated by colour change of indicator.

Let us answer

1. What is the colour of phenolphthalein solution?
2. Can you name any natural indicator?
3. What products are formed when hydrochloric acid neutralises sodium hydroxide solution?
4. Suggest a way to obtain solid salt from the neutral solution obtained in this activity.
5. Why are you advised to take antacid solution/tablet when you suffer from acidity?

What more can we do?

- Look for some home remedies used for treating
  (i) indigestion and (ii) ant bite
- Make indicator solutions from *Jamun*, Red cabbage, Periwinkle *(Sadabahar)*, Rose and check their colour in solutions of some acidic and basic substances.

Note for the teacher

- While concluding, the teacher must emphasise the process of neutralisation in which an acid reacts with a base to form salt and water.

  Acid + Base → Salt + Water

  In such reactions heat is also produced.
- To prepare 1 litre dilute hydrochloric acid, take nearly 5 mL of concentrated hydrochloric acid and 995 mL of water. Add acid to water slowly. The dilute hydrochloric solution is ready to use.
- To prepare 1 litre dilute sodium hydroxide solution, dissolve 2g sodium hydroxide pallets in 1 litre water.
- To prepare 1% solution of phenolphthalein, dissolve 1g of the solid phenolphthalein in 100 mL of ethyl alcohol.

Notes

ACTIVITY 12

WHAT WE HAVE TO DO?

Identification of the acidic/basic/neutral nature of the salt solutions.

WHAT DO WE NEED?

Ferric chloride, sodium acetate, sodium chloride, water, litmus paper (red and blue), dropper, test tubes, test tube stand, watch glass.

HOW DO WE PROCEED?

1. Take about 1 mL of ferric chloride solution in a watch glass. Take a piece of blue litmus paper and dip it in this solution.

   Do you observe any change in the colour of blue litmus paper? Similarly, dip a piece of red litmus paper in the solution and observe the change.
2. Repeat the above steps with sodium acetate solution and sodium chloride solution, respectively. Note the observations.

WHAT DO WE OBSERVE?

- Ferric chloride solution turns blue litmus paper red but it does not change the colour of red litmus paper (Fig. 12.1).
- Sodium acetate solution turns red litmus paper blue but does not change the colour of blue litmus paper (Fig. 12.2).
- Sodium chloride solution does not change the colour of either red or blue litmus paper (Fig 12.3).

Figure 12.1
Testing of litmus papers in ferric chloride solution

Figure 12.2
Testing of litmus papers in sodium acetate solution

Figure 12.3
Testing of litmus papers in sodium chloride solution

What do we conclude?

- Ferric chloride solution is acidic.
- Sodium acetate solution is basic.
- Sodium chloride solution is neutral.

Let us answer

1. Name any two natural products which are acidic in nature.
2. Do you know any indicator other than litmus used to differentiate an acidic substance from a basic substance?
3. What colour does an acidic, a basic and a neutral salt give when a drop of their solution is placed on a red litmus paper. Give reason for your answer.
4. Name two flowers which we can use to prepare indicator solutions.

What more can we do?

A number of indicators can be prepared from subtances such as red cabbage, beet root, rose, bougainvillea, etc.

Note for the teacher

- Prepare a solution of sodium acetate by dissolving a pinch of solid sodium acetate in 5 mL of distilled water in a test tube.
- Similarly, prepare solutions of ferric chloride and sodium chloride salts.
- Label all the test tubes with the names of the salts (Fig. 12.4).
- The salts can be tested for their acidic, basic and neutral nature with other natural indicators also.
- Always prepare fresh salt solutions in water. In place of ferric chloride, you can take copper sulphate also.

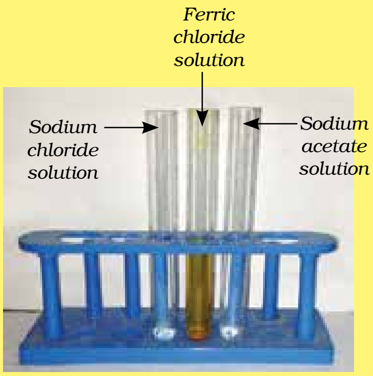

Figure 12.4

ACTIVITY 13

What we have to do?

Differentiate amongst the changes such as folding of paper, tearing of paper and burning of paper.

What do we need?

Used papers, candle/spirit lamp, match box, steel plate/Petri plate, a pair of tongs.

How do we proceed?

Step I. Take a used paper and fold it (Fig. 13.1). How many times you were able to fold the paper? Unfold the paper.

Do you get the paper in its original shape and size?

Step II. Take the same paper and tear it into as many pieces as you wish (Fig. 13.2). Now try to get the paper in its original shape and size. Are you successful in doing this?

Do you think that in the above two steps any new substance is formed?

Step III. Take a few pieces of the paper and burn them. Collect the product formed in a steel plate or Petri plate (Fig. 13.3). (Be careful while burning the paper).

Compare the product formed with the original pieces of paper.

What do you observe?

Do you think a new substance has been formed in this change?

Figure 13.1
Folding a paper

Figure 13.2
Pieces of a paper

Figure 13.3
Burning of a paper

What do we observe?

Step I. On folding the paper, one can fold it 6 to 7 times.

On unfolding the paper, it regained its original shape and size.

Step II. The pieces of paper can be joined with the help of glue. However, one cannot get the paper in its original form.

The changes observed in Steps (I) and (II) do not give any new substance/ product.

Step III. On burning the pieces of paper, they turned black, whereas original paper pieces were white in colour. Smoke was also observed during burning of the paper pieces. This shows new substances (solid and gaseous) were formed in this change.

What do we conclude?

- In Step I and Step II only change in physical state/property was noticed and no new substance is formed. Hence, these are physical changes.
- However, in Step III new substances are formed. Hence, it is a chemical change.

Let us answer

1. Are the changes observed in the above three steps reversible/non-reversible?
2. Is burning of crackers-
   (a) Physical change which can be reversed
   (b) Physical change which cannot be reversed
   (c) Chemical change which can be reversed
   (d) Chemical change which cannot be reversed.
3. Comment on the following changes –
   (a) Boiling of an egg
   (b) Beating of an egg
   (c) Knitting of a sweater
   (d) Greying of hair.

WHAT MORE CAN WE DO?

Make a list of different changes taking place in your surroundings. Categorise them as physical and chemical changes giving appropriate reasons.

NOTE FOR THE TEACHER

- Teacher can arrange a field trip for the students to observe various types of changes. Let the students categorise these into physical and chemical changes. At the same time these changes can be categoried as reversible or non-reversible.
- Teacher should focus on the importance of conserving resources, such as saving of paper, etc.
- The concept of desirable changes (such as baking of food materials) and undesirable changes (such as rottening of food) may be highlighted and discussed in the class. The undesirable changes should be discouraged, as these may be responsible for the wastage of valuable materials and may be harmful. For example, rottening of food stuff at homes and food grains in the godowns may be a great loss to the country.

NOTES

ACTIVITY 14

What we have to do?

Compare the water absorption capacity of fibres obtained from plants, animals and synthetic sources.

What do we need?

2 × 2 cm pieces of cotton, wool and nylon fabrics, beakers/glass tumblers, funnel, tripod stand, water, weighing balance.

How do we proceed?

1. Take the cotton fabric (2 × 2 cm) and weigh it.
2. Immerse the fabric in water filled in a beaker (Fig. 14.1).
3. Pour out the excess water by tilting the beaker (Fig. 14.2).
4. Place a funnel on a tripod stand and keep a beaker or glass tumbler under the stem of the funnel.
5. Take out the wet fabric from the beaker and put it in the funnel (Fig. 14.3).
6. Wait till water stops dripping out from the fabric.
7. Now weigh the wet fabric and note your observation in the Table 14.1.
8. Repeat the same steps for the woolen and nylon fabrics.

Figure 14.1
Fabric immersed in water in a beaker

Fi.g 14.2
Pouring out the excess water by tilting the beaker

Figure 14.3
Wet fabric placed in a funnel

What do we observe?

Table 14.1

S.No.	Material	Mass of dry fabric (A g)	Mass of wet fabric (B g)	Mass of water absorbed by fabric (B-A) g	Mass of water absorbed by 1g of fabric $\left(\frac{B-A}{A}\right)g$
1	Cotton (Plant fabric)				
2	Wool (Animal fabric)				
3	Nylon (Synthetic fabric)				

What do we conclude?

Water absorption capacity of fibres is in the order: Cotton > Wool> Synthetic

Let us answer

1. In the above activity we could see that fabric can hold water. Do they hold air likewise?
2. Why do different fibres differ in water holding capacity?
3. Why cotton clothes are preferred to synthetic clothes in summer season?
4. Why do wet cotton clothes take longer time for drying than nylon clothes?

What more can we do?

Students may collect different sample of fabric from a tailor shop/ home and look for their water absorption capacity.

Note for the teacher

- Teacher may initiate a discussion among children regarding the application of fabrics used in different seasons.

ACTIVITY 15

What we have to do?

Differentiate between natural and man-made fibres.

What do we need?

Threads of cotton, wool, polyester and nylon, spirit lamp, forecep, match box.

How do we proceed?

1. Take the woollen thread and hold it with a forecep (Fig. 15.1).
2. Burn it in the flame of a heating device (Fig. 15.2).

   What do you observe?
3. Repeat the above steps for other threads and note your observations.

Figure 15.1 Holding a woollen thread with a forecep

Figure 15.2 Burning of a woollen thread

What do we observe?

Natural fibres (cotton, wool) burn without melting while man-made fibres (polyester, nylon), first become soft and then melt to form a lump before burning.

What do we conclude?

The fibres which are converted into ash on burning are natural fibres and those which melt and form a bead before burning are man-made (synthetic) fibres.

Let us answer

1. Why are we advised not to wear synthetic clothes while working near a flame?
2. Why are parachutes made of synthetic fibres?

What more can we do?

You may check for the bio-degradability of natural and synthetic fibres by performing the following project.

- Place two earthen pots in the school garden.
- Mix various samples of cotton, silk, jute, etc. fabrics which you can collect from a tailor shop or home with moist soil and put in one earthen pot and label it as "A".
- Label the second pot as 'B' and put various samples of synthetic fibres such as nylon, polyester, etc. in it after mixing with moist soil.
- Leave these two pots undisturbed for at least a month and take care that soil remains moist throught out the span of the experiment. After that take out the fabrics and note their conditions.

Prepare a project report on your observations.

You should compare the two types of fabrics before and after completing the project and discuss the findings in your class.

Note for the teacher

- Children should collect the pieces of natural and synthetic fibres well in advance.
- You can show children various materials made of synthetic fibres and natural fibres.
- Teacher may initiate discussion on pollution due to synthetic materials.

Notes ______________________________

ACTIVITY 16

What we have to do?

Show that metallic oxides are basic in nature.

What do we need?

Magnesium ribbon, distilled water, red and blue litmus papers, sand paper, spirit lamp, watch glass, a pair of tongs, match box.

How do we proceed?

1. Take about 5 cm of magnesium ribbon. Clean it properly with a sand paper if it is not shiny.
2. Hold magnesium ribbon with the help of a pair of tongs.
3. Bring the free end of magnesium ribbon near the flame of the spirit lamp and let it burn (Fig. 16.1). (Do not stare at the burning magnesium).
4. Collect the powdery ash (formed on burning of magnesium ribbon) in a watch glass.
5. Add small amount of distilled water to the ash and stir it.
6. Dip one by one blue and red litmus papers in the solution and observe the change in colour of litmus papers (Fig. 16.2).

Figure 16.1 Burning of magnesium ribbon

Figure 16.2 Testing of solution of ash with litmus papers

What do we observe?

- There is no change in colour of blue litmus paper.
- The red litmus paper turns blue.

What do we conclude?

The magnesium oxide after dissolving in water shows basic character.

On burning, magnesium forms magnesium oxide (ash), when this is dissolved in water it forms magnesium hydroxide (basic in nature).

Magnesium + Oxygen (air) → Magnesium oxide

Magnesium oxide + Water → Magnesium hydroxide

Let us answer

1. Why should we clean the magnesium ribbon before burning?
2. What is the name of the product obtained on burning of magnesium ribbon?
3. Name the product obtained on dissolution of ash (formed in this activity) in water.
4. Why there is no change in colour of the blue litmus paper when it is dipped into the oxide solution ?
5. Why does the solution of magnesium oxide turn red litmus paper blue?

What more can we do?

Test the solution of ash with other indicators like turmeric powder, extracts of some flowers.

Note for the teacher

- It is dangerous to look continuously for long at the burning magnesium ribbon. The teacher should advice children not to stare at the burning ribbon.
- If the magnesium ribbon is not shining, it may take a long time to ignite, so it is better to clean the ribbon with a sand paper.
- Basic nature of iron oxide can also be tested by taking rust.
- Avoid using candle to burn magnesium ribbon.

ACTIVITY 17

What we have to do?

Show that non-metallic oxides are acidic in nature.

What do we need?

Powdered sulphur, water, glass tumbler/gas jar, lid, watch glass, red and blue litmus papers, deflagrating spoon, spirit lamp, match box.

How do we proceed?

1. Take some sulphur powder in a deflagrating spoon (Fig. 17.1) and heat it over a spirit lamp.
2. Introduce the spoon with burning sulphur into a glass tumbler/jar containg some water (Fig. 17.1). Take care that spoon should not dip in the water.
3. Cover the tumbler/jar with a lid to stop the escape of gas produced during buring of sulphur.
4. Remove the spoon after some time.
5. Shake the covered tumbler well to dissolve the gas in water.
6. Transfer the solution in watch glass (Fig.17.2a).
7. Dip one by one red and blue litmus papers in the solution (Fig.17.2b) and observe the change in the colour of the litmus papers.

Figure 17.1
Burning of sulphur powder

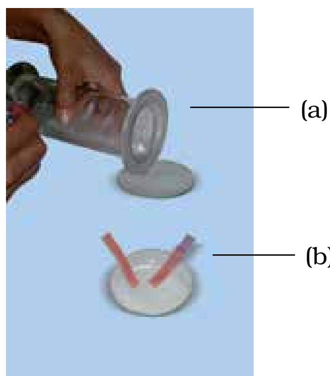

Figure 17. 2
Testing of solution with litmus papers

What do we observe?

- There is no change in the colour of red litmus paper.
- Blue litmus paper turns red.

What do we conclude?

The non-metallic oxide after dissolving in water shows acidic character. Sulphur on burning in air forms sulphur dioxide gas, which dissolves in water and form sulphurous acid.

Sulphur + Oxygen (from air) → Sulphur dioxide

Sulphur dioxide + Water → Sulphurous acid

Sulphurous acid turns the colour of blue litmus paper red.

Let us answer

1. Write the name of the gas formed on burning of sulphur?
2. Write the name of the acid which is formed on dissolving the gas produced on burning of sulphur in water.

What more can we do?

Perform the activity with carbon and with other non-metals if available. Use other indicators also to show their acidic character.

Note for the teacher

- Do not take too much sulphur to burn. It pollutes air. Effect of environmental pullution should be discussed in the class.
- You can make an improvised spoon. Take a metallic cap of any bottle and wrap the cap with metallic wire and bend it as shown in the figure 17.3.

Figure 17.3 Improvised spoon

ACTIVITY 18

What we have to do?

Show that iron is more reactive than copper.

What do we need?

100 mL beaker, shaving blades or iron nails, copper sulphate, distilled water, blue and red litmus papers, dilute sulphuric acid, dropper.

How do we proceed?

1. Take 100 mL beaker and add about 50 mL of water in it.
2. Pour about a tea spoonful of copper sulphate in water and shake well to dissolve it.
3. Add a few drops of dilute sulphuric acid to the solution by using dropper.
4. Drop a shaving blade into the solution. Handle the shaving blade carefully.
5. After nearly half an hour observe the change in the colour of blade as well as of copper sulphate solution (Fig. 18.1).

Figure 18.1
Change in colour of the copper sulphate solution due to reaction with iron (shaving blade)

What do we observe?

The blue colour solution of copper sulphate first fades and then changes to green and a brown deposit is formed on the shaving blade.

What do we conclude?

Copper metal which is brown in colour is deposited on shaving blade due to its displacement from copper sulphate by iron. Green colour of the solution is due to the formation of iron sulphate.

Copper sulphate	+	Iron	→	Iron sulphate	+	Copper
Blue		Grey		Light green		Brown

LET US ANSWER

1. Why does the colour of the shaving blade placed inside copper sulphate solution becomes brown after sometime?
2. Why does the blue colour of copper sulphate solution ultimately changes to green?

WHAT MORE CAN WE DO?

- The activity can be repeated using iron nails in place of shaving blade.
- Take the solutions of other metal salts and add different metals and note down if displacement reaction takes place.

NOTE FOR THE TEACHER

We should prepare nealy 5% solution of copper sulphate. Too much concentrated solution will mask the green colour of iron sulphate formed and with very dilute solution reaction will be very slow.

NOTES ______________________________

ACTIVITY 19

What we have to do?

Show that hydrogen gas is evolved by the action of acids on some metals.

What do we need?

Aluminium foil, dilute hydrochloric acid, conical flask, rubber cork, glass tube, match box, candle.

How do we proceed?

1. Take few small pieces of aluminum foil in a dry conical flask.
2. Pour 2-3 mL of dilute hydrochloric acid in the above conical flask and set up the appratus as shown in Fig. 19.1.
3. Observe, what is happening.
4. Take a burning match stick or burning candle near the mouth of the glass tube (Fig 19.2).

Figure19.1 Formation of hydrogen gas

Figure19.2 Testing hydrogen gas by burning

What do we observe?

- On adding acid into a conical flask containing aluminium foil, bubbles of some gas evolve.
- On bringing ignited candle near the mouth of the glass tube, the gas burns with "Pop" sound.

What do we conclude?

- Hydrogen gas is evolved in the reaction between aluminium and dilute hydrochloric acid.

  Aluminium + Dilute Hydrochloric acid → Aluminium chloride + Hydrogen gas.

- Hydrogen gas burns forming water, producing a sound, generally called pop sound.

  Hydrogen gas + Oxygen gas (from air) → Water (pop sound is produced)

Let us answer

1. What substance is produced when hydrogen gas burns with "Pop" sound?
2. Name the component of air which reacts with the gas produced by the reaction of aluminium and dilute hydrochloric acid forming water when ignited candle is brought near the mouth of test tube.
3. Will the component of air react with the gas if burning match stick does not come in contact with the gas?
4. Give at least two uses of aluminium.

What more can we do?

- The reaction of aluminium with strong base like sodium hydroxide can also be shown for the liberation of hydrogen gas.
- Repeat the activity by taking a non-metal (say coal, sulphur, etc.)

Note for the teacher

- Teacher should discuss and show the reaction of other metals with different acids in class.
- On the basis of the activity the teacher may initiate discussion on differentiation between metals and non-metals.

ACTIVITY 20

What we have to do?

Show the electric conductivity of metals and non-metals.

What do we need?

Electric cell, bulb, copper wire, iron nail, zinc granules, sulphur lump, coal piece.

How do we proceed?

1. Make an electric circuit by connecting an electric cell, a bulb with copper wires as shown in Fig. 20.1.
2. Bring one by one free ends of the wires of the circuit in contact with the two ends of the different samples of metals (such as iron nail, zinc granules) and non-metals (such as coal piece, sulphur lump) and observe, the cases in which the bulb glows (Fig. 20.2).

Figure 20.1
Electric tester

Figure 20.2
Testing whether the bulb glows when the tester is in contact with a iron nail

What do we observe?

- Bulb in the circuit glows in case of iron nail and zinc granule.
- Bulb does not glow in case of sulphur lump and coal piece.

What do we conclude?

Iron nail and zinc granule being metals are good conductors of electricity, while sulphur lump and piece of coal which are non-metals do not conduct electricity.

Let us answer

1. Will the bulb glow if we use painted piece of iron? Justify your answer.
2. Why do we use plastic coated wires while making electrical connections?
3. Why are we advised to wear shoes having rubber soles while working with electric appliances?

What more can we do?

We should perform this activity using alloys of metals such as brass, stainless steel and other materials like a piece of paper, a piece of cloth, a drinking straw, etc.

Note for the teacher

The students should be informed that graphite is made up of carbon which is a non-metal but is a good conductor of electricity while other forms of carbon such as diamond, coal and charcoal are non- conductors of electricity.

Notes

ACTIVITY 21

What we have to do?

Show that oxygen is necessary for the combustion of a substance.

What do we need?

Two candles, match box, glass jar or a beaker.

How do we proceed?

1. Light the two candles and fix them on a table (Fig. 21.1).
2. Let both the candles burn for some time.
3. Now cover one of the candles with a glass jar or beaker and observe it for some time (Fig. 21.2).

Figure 21.1
Burning candles

Figure 21.2
Burning candle covered with a breaker

What do we observe?

- It is found that the candle which is not covered continues burning.
- The candle which is covered, continues burning for some time and gets extinguished (Fig. 21.3).

Figure 21.3
Covered candle extinguishes

What do we conclude?

This activity shows that oxygen is necessary for combustion process.

Candle continues burning for some time until the whole oxygen (present in the air) available in the jar or beaker is consumed. After that it stops burning due to non-availability of oxygen.

Let us answer

1. Is combustion a physical change or a chemical change?
2. Name a gas which helps in extinguishing fire?
3. If you cover a burning kerosene lamp with a jar, will it also stop giving light after some time? Justify your answer.
4. Why do we cover a person with blanket when his/her clothes catch fire?

What more can we do?

Carbon dioxide extinguishes fire. Perform an activity to show it.

Prepare carbon dioxide gas by adding half tea-spoon of baking soda (sodium hydrogen-carbonate) in a test tube filled one-third with vinegar. Now bring an ignited match stick to the mouth of the test tube. The flame will be extinguished at once.

Note for the teacher

- While discussing the role of oxygen in combustion,discuss the role of carbon dioxide in extinguishing fire also.
- Show the students a fire extinguisher and discuss its working.

ACTIVITY 22

What we have to do?

Show that fuel/substance should be heated to its ignition temperature to make it burn.

What do we need?

Paper, candle, water, match box.

How do we proceed?

1. Make two paper cones.
2. Heat one empty paper cone on the flame of candle and observe (Fig 22.1a).
3. Fill the other paper cone one-third with water and heat it on the flame and observe (Fig 22.1b).

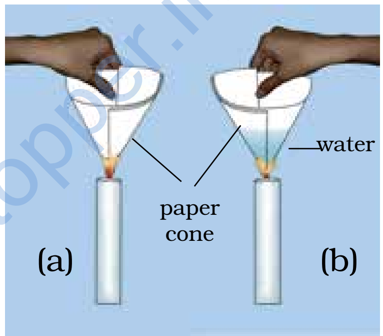

Figure 22.1
Heating (a) empty paper cone (b) water in a paper cone

What do we observe?

The empty paper cone starts burning immediately but the paper cone filled water does not burn and water in it becomes hot.

What do we conclude?

- A substance burns when the temperature reaches to its ignition temperature.
- The empty paper cone starts burning immediately because its ignition temperature is reached fast.
- The paper cone filled with water does not burn because the heat is transferred to water and the ignition temperature is not reached.

Let us answer

1. Why do we observe forest fires generally after autumn?
2. Why is it difficult to burn a heap of green leaves, but dry leaves catch fire easily?
3. Why do we pour water on the fire caused by non-electrical appliance?

What more can we do?

- Try to burn paper, wood and card board. Note the time taken by the substances to catch fire. Which of these substances has lowest ignition temperature?

Note for the teacher

- The teachers can take students to fire station to make them aware of different methods of extinguishing fire and different types of fire extinguishers.
- Persons from fire station may be called to school to give lecture and train the children to learn preventive measures from fire disaster.
- For making paper cones, ask the students to use waste papers. This helps in saving the papers and focuses on the concept of reuse.
- When children are heating paper cones, the teacher should caution them to be careful.

Notes

ACTIVITY 23

What we have to do?

Measure the temperature of water when it is being heated, when it is boiling and when it is cooling.

What do we need?

A laboratory thermometer, a container to heat water, a source of heat and a stop watch.

How do we proceed?

1. Fill the container about half with water.
2. Put it on a stove or some other source of heat.
3. Measure the temperature of water every two minutes. Remember that we always use Celsius scale of temperature.

CAUTION. You must use **laboratory thermometer** for measuring temperature of water and not **Clinical thermometer.** A clinical thermometer is used to measure our body temperature. It is marked from 35°C and 42°C. It could break if used for measuring temperatures much higher than 42°C.

The thermometer should be immersed in the liquid. It should be vertical and should not touch sides and the bottom of the container (Fig 23.1).

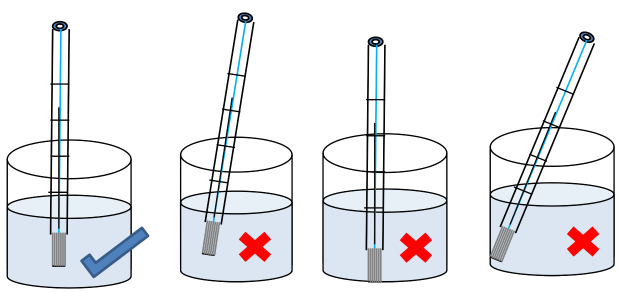

Figure 23.1. The correct way of placing the thermometer in a liquid.

- The thermometer should be held vertical.
- You must read while the bulb of the thermometer is immersed in the liquid.
- You must read the mark at the end of the shining mercury thread.
- Your eye should be right in front of the mark to be read (Fig. 23.2).

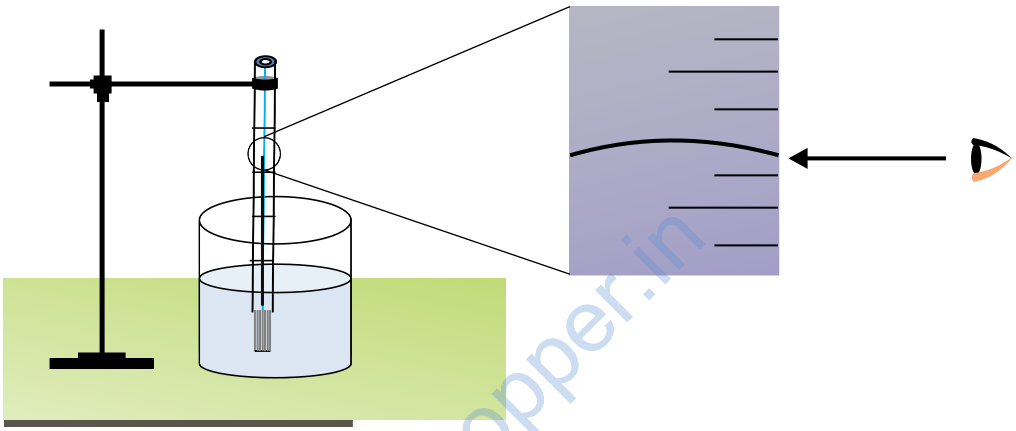

Figure 23.2 Correct method of reading thermometer

4. Record your observations in the Table 23.1. You can add as many rows as you need.

Table 23.1 Temperature of water

S.No	Time (min)	Temperature (^oC)
1.	0	30 (Room Temperature)
2.	2	
3.	4	

5. Let the water boil. Keep measuring the temperature of boiling water. Insert your observations in the Table 23.1.
6. Having taken a few observation while the water is boiling, remove the container from the source of heat.
7. Measure the temperature of the cooling water a few times. Insert your observations in the Table 23.1.
8. Draw a graph of your observation. It will look something like that shown in Fig. 23.3.

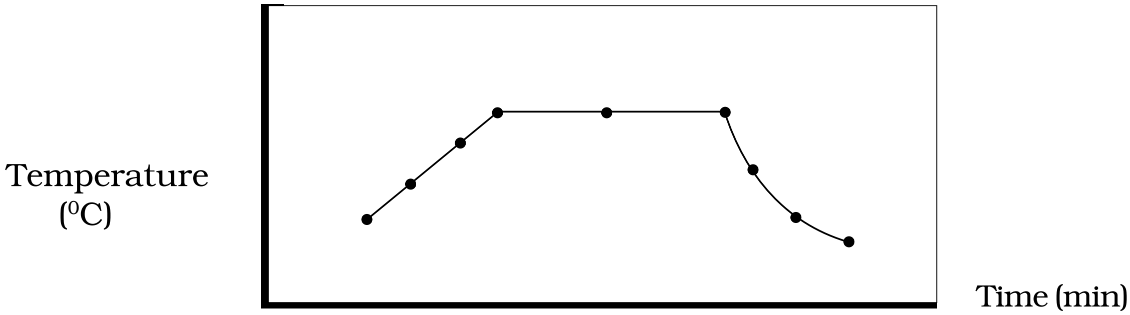

Figure 23.3

What do we observe?

- We have noted down the temperature of water while it is being heated, while it is boiling and while it is cooling.
- We found that at first the temperature of water increases, the temperature reamains constant when water is boiling and then it comes down when heating in stopped.
- We have also drawn a graph of our observations.

What do we conclude?

We find that as long as the water is boiling, there is no change in its temperature. The temperature of boiling water remained constant.

At my place the temperature of boiling water is °C.

Let us answer

1. Why should the bulb of the thermometer be immersed in the liquid while we read the temperature? You should see what happens when you take the thermometer out of the liquid and try to read the temperature.
2. Why should your eye be exactly in front of the mercury thread to be read? What happens if the position of your eye is on one side of the mark or the other?
3. Is the cooling part of your graph similar to the heating part of the graph?
4. Is the temperature of boiling water at your place different from 100 °C? If yes, why is it so? Discuss with your teacher.
5. Can this thermometer be used to measure our body temperature? If not, give reasons.

WHAT MORE CAN WE DO?

- Melt a little ice in a cup. Find the temperature of ice when it is melting. Record your observations in a Table as in the above Activity. In the light of your observations, discuss if the temperature of melting ice can be taken as another fixed point of the temperature scale.
- Find the temperature of tea when you are ready to drink it.
- Find the temperature of hot water which you use for your bath on a winter day.

Temperature of your favourite cold drink (*lassi*/sherbet/coffee/fresh lemon/...).

NOTE FOR THE TEACHER

It will be better if the teacher forms groups of two students each. In a group, one student holds the thermometer correctly (see Fig. 23.1) while her partner notes down the temperature at regular intervals. After the observations of one member are complete, she holds the thermometer correctly and her partner notes down the temperature. However, both of them make their own observations and draw their own graphs.

Discussion on the Activity can be held collectively when the whole class has finished its work.

When children are heating the water, the teacher should caution them to be careful. She should herself be alert so that any mishap is prevented.

To lead the discussion in the class, the teacher may find the following points helpful:

- A mobile phone can also be used as a stop watch.
- As far as possible the observations should be taken at regular intervals. This makes Table appear more organised and drawing the graph easier.
- Help students in placing the thermometer correctly in the liquid. If some students find it difficult to read the temperature correctly, draw their attention to Fig. 23.2.
- Help children in drawing graphs. The subject may have to be revisited.

- Remember that when water is boiling, the temperature does not change because the heat supplied goes into changing water into steam.
- Water does not cool linearly. At first the cooling is fast and then it becomes slow.
- Explain that water does not always boil at 100°C because the special conditions are not satisfied. For the same reason, the boiling point of water varies from place to place. Discourage students from cramming that water boils at 100°C. It is sufficient for them to know the temperature at which water boils **at their place.**
- Draw the attention of the students to the fact that the laboratory thermometer usually has marking from -10°C to 110°C. In contrast, the clinical thermometer has markings only between 35°C and 42 °C. If students are not able to understand why it is so, explain that the body temperature is in this range most of the time.
- Explain that we have adopted the Celsius scale in this country. Therefore, the students should use this scale to express temperatures.

Notes

ACTIVITY 24

WHAT WE HAVE TO DO?

To distinguish between good conductors and poor conductors of heat.

WHAT DO WE NEED?

We need three objects, material of one should be metal and of the other two could be plastic, rubber or wood. The objects should roughly be of the same length, thickness, wildth, etc. The possibilities for the objects are spoons, narrow strips, rods or tubes.

HOW DO WE PROCEED?

1. Fill half of a large glass tumbler, a large plastic mug, or a large beaker with hot (not boiling) water.

   Be Careful if you are heating water in the glass.

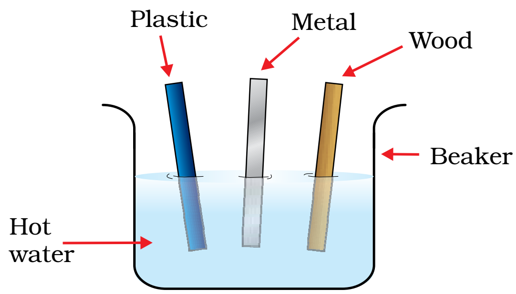

Figure 24.1

2. Place the three objects in water in such a way that one end of each is out of water (Fig. 24.1).
3. After two minutes touch the ends of the objects which are out of water (exposed ends) one by one.

   Repeat this observation after two more minutes.
4. Record your observations in Table 24.1

Table 24.1

Material	Had become hot/had not become hot	
	After 2 min	After 4 min

What do we observe?

- The exposed end of the object made of metal became hot almost immediately.
- The exposed end of the object made of glass became warm after almost minutes.
- The exposed end of the object made of wood/rubber did not become hot even after four minutes.

What do we conclude?

We conclude that the exposed ends of objects made of metal become hot while the exposed ends of objects made of plastic/wood/rubber do not become hot. Object made of glass may become warm after some time. That means in some materials like metals, heat can travel easily from one end to the other while in others like plastic it does not travel so easily. Materials in which heat can travel easily are called **good conductors of heat**, or simply **conductors of heat**. Materials in which heat cannot travel easily are called **poor conductors of heat**, or **insulators of heat.**

Let us answer

1. Why are handles of cooking metal utensils made of plastic or wood?
2. In her kitchen, Ishita has utensils of the same size made of copper, aluminium and stainless steel. Which of these utensils should she use for heating water so that minimum amount of fuel is used?
3. Why did we want that all objects be roughly of the same length, thickness and width in this activity ?
4. Is the temperature of the hotter ends of objects higher or lower than the temperature of your body?
5. If we do not wish to touch the exposed ends of objects, which instrument can tell us if the end is hot or not?
6. In your experience, are good conductors of heat also good conductors of electricity? (Hint: Think of the plastic handle of a screw driver).

What more can we do?

Perform the activity with carbon and with other non-metals if available.

Note for the Teacher

- If the water is being heated in the glass, the teacher must be alert so that no untoward incident takes place.
- The teacher should make sure that the water is not too hot to cause any harm to students.
- Waiting for two minutes before touching the objects is to ensure that there is sufficient time for the heat to travel to the exposed end. Repeating observation after a few more minutes is to allow long enough time for the heat to travel to the exposed end.
- By requiring all the objects to be roughly of the same size, we have tried to remove all other variables to be able to study the relationship between only time and conductivity of the material. A general principle of science is that the effect of only one variable on another should be studied at a time.
- The teacher should remind students that heat flows from a higher temperature to a lower temperature. The object that appears hotter to us is at a higher temperature than our body and heat flows from it to our body.
- The teacher may use the occasion to discuss why iron objects feel colder than wooden objects on a cold winter day, and hotter on a hot summer day.
- Conductivity of copper is $1\frac{1}{2}$ times that of aluminium and about 20 times that of stainless steel.

Notes ______________________________