CLASS 10-SCIENCE
CHAPTER 1
CHEMICAL REACTIONS AND EQUATIONS
PART 4-NCERT INTEXT ACTIVITIES

ACTIVITY 1.1

Aim- To burn Magnesium ribbon in air and collect Magnesium Oxide in a watch-glass.

Material Required- Magnesium ribbon, sandpaper, watch-glass, burner, pair of tongs.

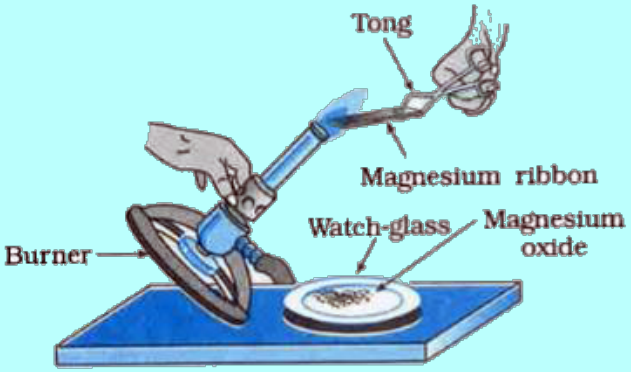
Procedure-

1. Take 3-4 cm long magnesium ribbon. Clean it by rubbing it with sandpaper to remove any unwanted particles or layer of magnesium oxide.
2. Hold it with a pair of tongs. Burn it using a burner or a spirit lamp.
3. Collect the white ash so formed by burning the ribbon in a watch-glass.

Observation- Magnesium is a highly reactive metal. It reacts spontaneously with oxygen present in the atmosphere to form white ash of Magnesium Oxide with the liberation of energy.

$2Mg + O_2 \longrightarrow 2MgO$

(White Ash)



This Magnesium Oxide formed if reacts with water produces Magnesium hydroxide. This is a combination as well as an exothermic reaction.

$MgO + H_2O \longrightarrow Mg(OH)_2$

Result- Burning Magnesium ribbon in the air gives white ash of Magnesium Oxide.

ACTIVITY 1.2

Aim- To observe what happens when an aqueous solution of lead nitrate mixes with an aqueous solution of potassium iodide.

Material Required- Test tubes, lead nitrate solution, potassium iodide solution, china dish.

Procedure-

1. Take lead nitrate solution in a test tube.
2. Add potassium iodide solution to it.
3. Stir the test tube and allow the reaction to take place.
4. Yellow coloured precipitate of lead iodide settles down at the bottom of the test tube.
5. Collect the dried precipitate of lead iodide in a china dish.

Observation- Lead nitrate and potassium iodide; both are colourless. They react with each other to form a yellow precipitate of lead iodide which settles down at the bottom of the test tube. This is a double displacement and precipitation reaction.

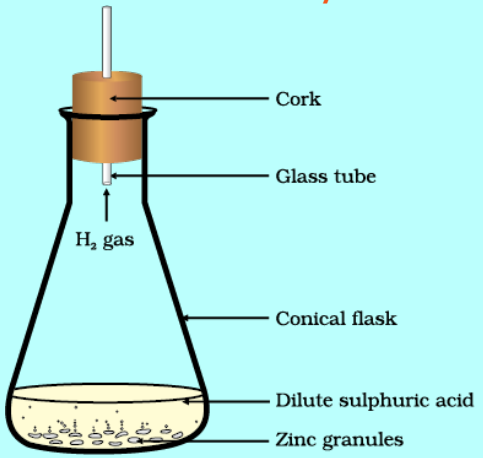
$$Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$$

Result- Aqueous solution of lead nitrate and potassium iodide react with each other to form a yellow precipitate of lead iodide.

ACTIVITY 1.3

Aim- To observe what happens when hydrochloric acid or sulphuric acid is added to zinc granules.

Material Required- Conical flask, cork, glass tube, zinc granules, dilute hydrochloric acid/dilute sulphuric acid



Procedure-

1. Take a few zinc granules in a conical flask.
2. Add some dilute hydrochloric acid or dilute sulphuric acid in it.
3. Put the cork on the conical flask with a glass tube in its centre.
4. Air bubbles come out from zinc granules.

Observation- Zinc granules react with dilute hydrochloric acid or dilute sulphuric acid to form hydrogen gas which comes out from the granules in the form of air bubbles. Also, the conical flask becomes warm as it is an exothermic reaction. This is also a displacement reaction.

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow + heat$

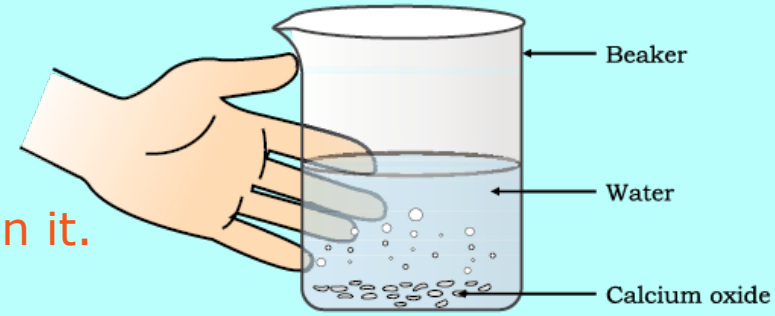
$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2\uparrow + heat$

Result- Zinc granules react with dilute hydrochloric acid or dilute sulphuric acid to form hydrogen gas and shows an exothermic reaction.

ACTIVITY 1.4

Aim- To observe the formation of slaked lime or calcium hydroxide by the reaction of quick lime or calcium oxide with water.

Material Required- Beaker, calcium oxide, water.



Procedure-

1. Take a beaker and put a small amount of calcium oxide or quick lime in it.
2. Slowly add water to the beaker.
3. Touch the beaker and observe any change.

Observation- Quick lime reacts vigorously with water to produce slaked lime releasing a large amount of heat and producing a hissing sound. This is an exothermic reaction, as a large amount of heat is released along with the formation of products which makes the reaction mixture warm. Also, calcium oxide and water combine to form a single product, calcium hydroxide. This is a combination reaction as two substances (reactants) combine to form a single product.

$$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2\ (aq) + Heat$$

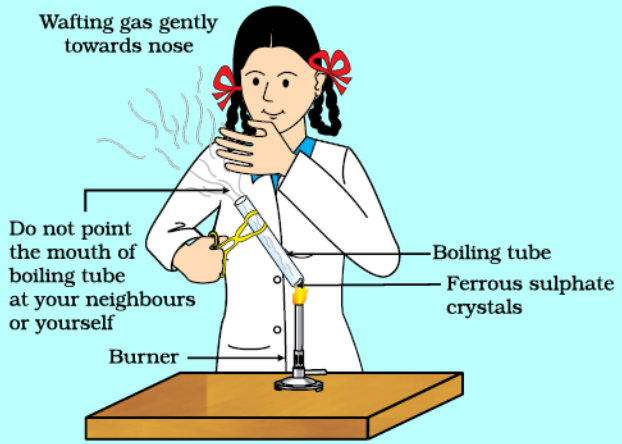
(Quick lime) (Slaked lime)

Result- Calcium oxide reacts with water to form calcium hydroxide by releasing a large amount of heat. This is a common example of exothermic reaction and combination reaction.

ACTIVITY 1.5

Aim- To observe the changes by heating ferrous sulphate crystals in a test tube.

Material Required- Boiling tube, burner, pair of tongs, ferrous sulphate crystals.



Procedure-

1. Take about 2 g ferrous sulphate crystals in a dry boiling tube.
2. Note the colour of the ferrous sulphate crystals.
3. Heat the boiling tube over the flame of a burner or spirit lamp.
4. Observe the colour of the crystals after heating.

Observation- Heating ferrous sulphate in a test tube leads to decomposition of green coloured ferrous sulphate into brown coloured ferric oxide. It also liberates sulphur dioxide and sulphur trioxide gases which have foul smell.

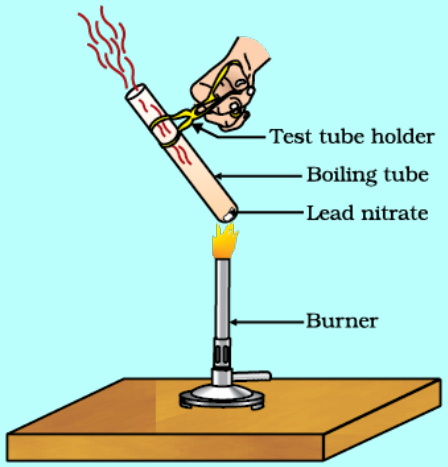
$$2FeSO_4\ (s) \xrightarrow{\text{Heat}} Fe_2O_3\ (s) + SO_2\ (g) + SO_3\ (g)$$

(Ferrous sulphate) (Ferric oxide)

This is a decomposition reaction as a single reactant breaks down to give simpler products. This is also an endothermic reaction.

Result- Heating changes green ferrous sulphate crystals to brown coloured ferric oxide through decomposition reaction and liberates sulphur dioxide gas with a foul smell.

ACTIVITY 1.6



Aim- To observe the changes on heating of lead nitrate in a boiling tube.

Material Required- Boiling tube, burner, pair of tongs, lead nitrate.

Procedure-

1. Take about 2 g lead nitrate powder in a boiling tube.
2. Hold the boiling tube with a pair of tongs and heat it over a flame.
3. Observe the changes in colour of powder and emission of fumes coming out on heating.

Observation- On heating, lead nitrate decomposes to form yellow precipitate of lead oxide. We also observe the emission of brown fumes of nitrogen dioxide gas with an irritating smell.

$$2Pb(NO_3)_2\ (s) \xrightarrow{\text{Heat}} 2PbO(s) + 4NO_2\ (g) + O_2\ (g)$$

(Lead nitrate) (Lead oxide) (Nitrogen dioxide) (Oxygen)

This is a thermal decomposition reaction as a single reactant breaks down to give simpler products by heating.

Result- Yellow precipitate of lead oxide and brown fumes with irritating smell of nitrogen dioxide gas are formed on heating of lead nitrate powder.

ACTIVITY 1.7

Aim- To observe electrolysis of water by using a battery and to find out the volume of gases liberated at anode and cathode. Also, observe what happens when the gases are brought near to the flame.

Material Required- Plastic mug, rubber stoppers, carbon electrodes, six-volt battery, water, dilute sulphuric acid, test tubes, burner.

Procedure-

1. Take a plastic mug. Drill two holes at its base and fit rubber stoppers in these holes. Insert carbon electrodes in these rubber stoppers.
2. Connect these electrodes to a 6 volt battery.
3. Fill the mug with water such that the electrodes are immersed. Add a few drops of dilute sulphuric acid to the water.
4. Take two test tubes filled with water and invert them over the two carbon electrodes
5. Switch on the current and leave the apparatus undisturbed for some time.
6. Observe the formation of bubbles at both the electrodes. These bubbles displace water in the test tubes.
7. Once the test tubes are filled with the respective gases, remove them carefully.
8. Test these gases one by one by bringing a burner close to the mouth of the test tubes.

ACTIVITY 1.7 *(CONT)*

Observation-

1)Gas collected at the cathode (-) is twice that of gas collected at the anode (+).

Explanation- Electricity decomposes water into its components. Hydrogen atoms in water receive an electron from cathode electrode and form hydrogen gas. Similarly, oxygen atoms in water lose electron at the anode and form oxygen gas.

$2H_2O\ (l) \longrightarrow 2H_2\ (g) + O_2\ (g)$

Here 2 molecules of hydrogen gas liberate with one molecule of oxygen gas. So, the volume of hydrogen obtained is double the amount of oxygen.

2) When the burner is brought near the mouth of the test tube removed from cathode electrode, the gas in it burns rapidly making a 'popping sound'. As we know that hydrogen gas burns with a popping sound, so the gas collected in the test tube over the cathode (-) electrode is hydrogen.

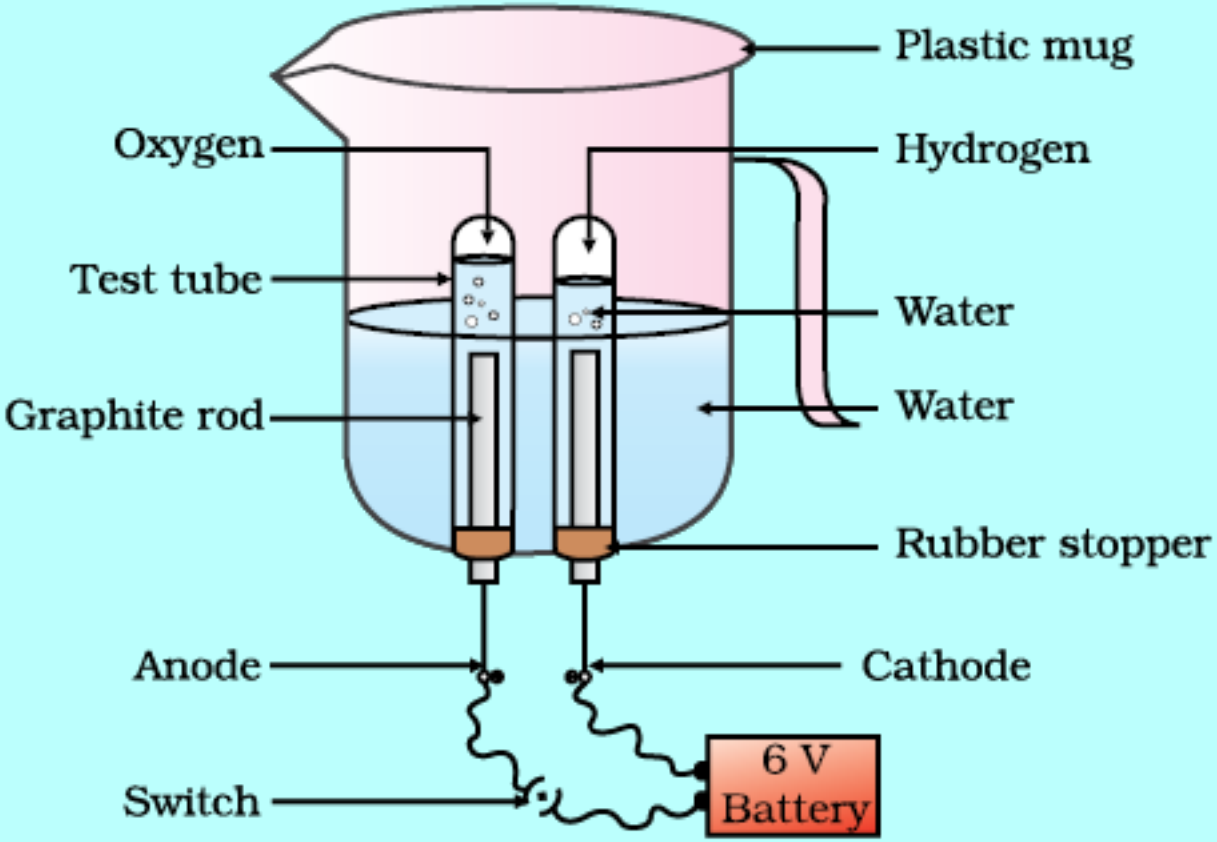
When the burner is brought near the mouth of the test tube removed from the anode electrode, the burner starts burning brightly. As we know that oxygen gas makes things burn brightly, so the gas collected in the test tube over the anode (+) electrode is oxygen.

This is a decomposition reaction as a single reactant breaks down to give simpler products.

Note- Water is not highly conductive so we use a few drops of sulphuric acid or hydrochloric acid so as to increase the electrical conductivity of water.

ACTIVITY 1.7 *(CONT)*

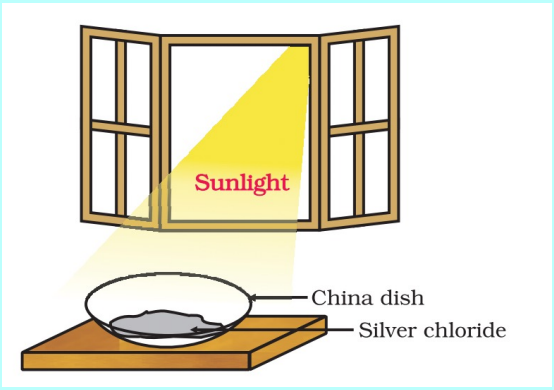
Result- Electrolysis of water using a battery results in the formation of hydrogen gas at cathode electrode and oxygen gas at anode electrode. Also, the volume of hydrogen gas obtained is double the volume of oxygen gas. Moreover, the hydrogen gas in the test tube over cathode electrode burns rapidly with a popping sound whereas oxygen gas in the test tube over anode electrode makes the burner burn more brightly.



ACTIVITY 1.8

Aim- To observe the changes that take place when silver chloride is kept in sunlight.

Material Required- Silver chloride, china dish



Procedure-

1. Take about 2g silver chloride in a china dish. It is white in colour.
2. Place this china dish in sunlight for some time.
3. Observe the change in colour of silver chloride after some time.

Observation- Colour of silver chloride turns grey from white due to the formation of silver metal. Silver chloride in presence of sunlight undergoes decomposition reaction and gives solid silver and chlorine gas.

$$2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2\ (g)$$

This is an endothermic decomposition reaction as energy is absorbed during this reaction.

Result- White silver chloride turns grey when kept in sunlight. It undergoes decomposition reaction.

ACTIVITY 1.9

Aim- To observe the change in colour of copper sulphate solution when iron nails are dipped in it.

Material Required- Iron nails, test tubes, thread, copper sulphate solution, stand.

Procedure-

1. Take three iron nails and clean them by rubbing with sand paper.
2. Take two test tubes marked as (A) and (B). In each test tube, take about 10 mL copper sulphate solution.
3. Tie two iron nails with a thread and immerse them carefully in the copper sulphate solution in test tube B for about 20 minutes. Keep one iron nail aside for comparison.
4. After 20 minutes, take out the iron nails from the copper sulphate solution.
5. Compare the intensity of the blue colour of copper sulphate solutions in test tubes (A) and (B).
6. Also, compare the colour of the iron nails dipped in the copper sulphate solution with the one kept aside.

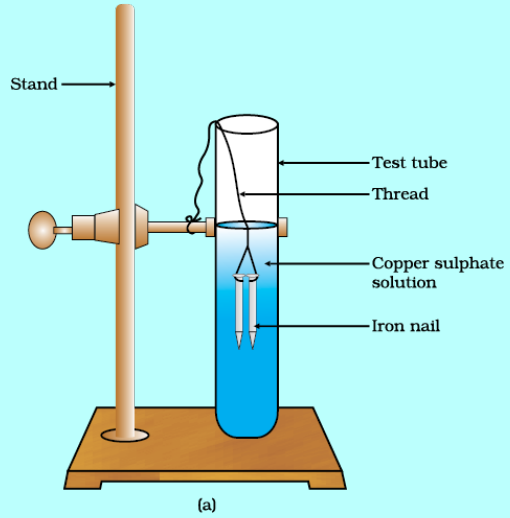
ACTIVITY 1.9 *(CONT)*

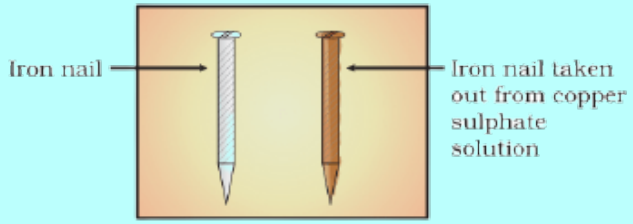
Observation- The colour of copper sulphate solution fades and nail becomes brown. This is so because iron in nail displaces copper from the copper sulphate solution. This is a displacement reaction which results in the formation of elemental copper that deposits on the nail and imparts a brown colour to the nail.

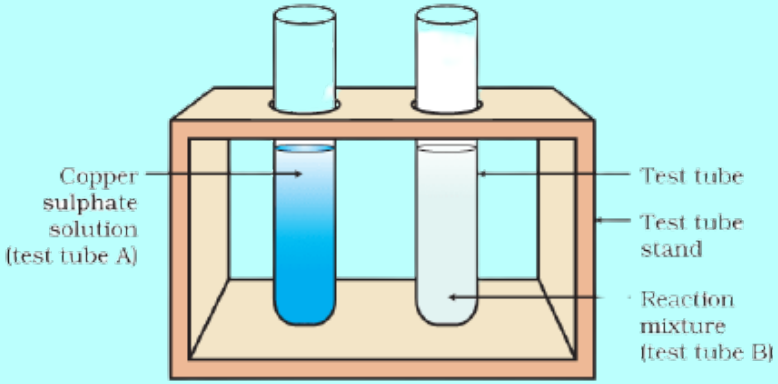
$Fe(s) + CuSO_4\ (aq) \longrightarrow FeSO_4\ (aq) + Cu(s)$

(Copper sulphate) (Iron sulphate)

Result- Colour of copper sulphate solution fades when iron nails are dipped in it. This is a displacement reaction where iron displaces copper from copper sulphate solution and forms elemental copper. The iron nail becomes brown in colour due to the deposition of copper on it.







Iron nails and copper sulphate solutions compared before and after the experiment

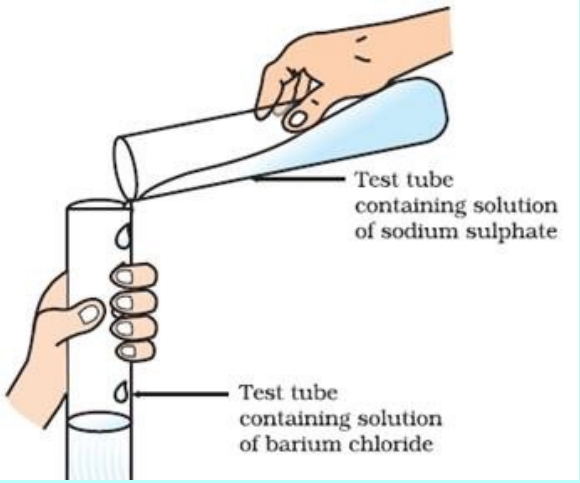
ACTIVITY 1.10

Aim- To observe the changes that take place when sodium sulphate solution is mixed with barium chloride solution.

Material Required- Test tubes, sodium sulphate solution, barium chloride solution

Procedure-

1. Take about 3 mL of sodium sulphate solution in a test tube.
2. In another test tube, take about 3 mL of barium chloride solution.
3. Mix the two solutions and observe what happens.



ACTIVITY 1.10 *(CONT)*

Observation- When barium chloride solution is mixed with sodium sulphate solution, a white coloured substance is formed which is insoluble in water. This substance is called precipitate. Any reaction that produces a precipitate can be called a precipitation reaction.

Na_2SO_4 (aq) + $BaCl_2$ (aq) $\longrightarrow$ $BaSO_4$ (s) + 2NaCl (aq)

(Sodium sulphate) (Barium chloride) (Barium sulphate) (Sodium chloride)

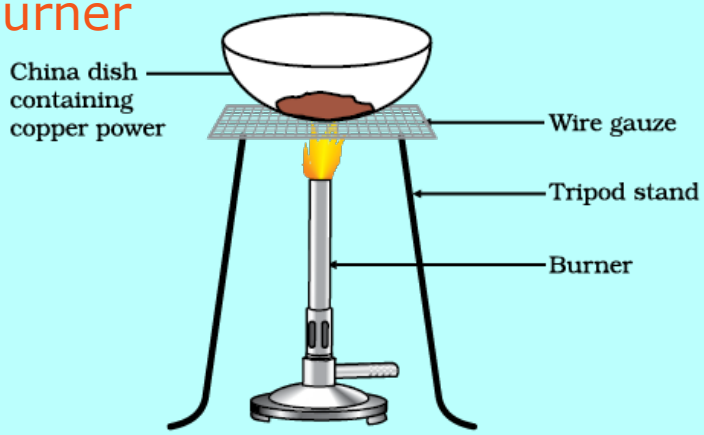
Moreover, the white precipitate of $BaSO_4$ is formed by the reaction of SO_4^{2-} and Ba^{2+}. The other product formed is sodium chloride which remains in the solution. Such reactions in which there is an exchange of ions between the reactants, are called double displacement reaction.

Result- Barium chloride solution when mixed with sodium sulphate solution forms a white coloured precipitate of barium sulphate and sodium chloride remains in the solution. This reaction is a precipitation reaction as well as a double displacement reaction.

ACTIVITY 1.11

Aim- To observe the changes that take place when copper powder is heated in a china dish.

Material Required- Copper powder, china dish, tripod stand, wire gauze, burner



Procedure-

1. Take 1g of copper powder in a china dish and heat it.
2. Observe the changes that take place.

Observation- The surface of copper powder becomes coated with black copper (II) oxide. This is because oxygen present in the atmosphere is added to copper and copper oxide is formed. If a substance gains oxygen during a reaction, it is said to be oxidised and the reaction is called oxidation reaction. Heating the metal fastens the reaction, so that we can easily observe the changes during heating.

$$2Cu + O_2 \xrightarrow{\text{Heat}} 2CuO$$

Result- Surface of copper powder becomes black on heating due to reaction with atmospheric oxygen, thus showing an oxidation reaction.

THANK YOU