DECOMPOSTION REACTION

Activity 1.5:

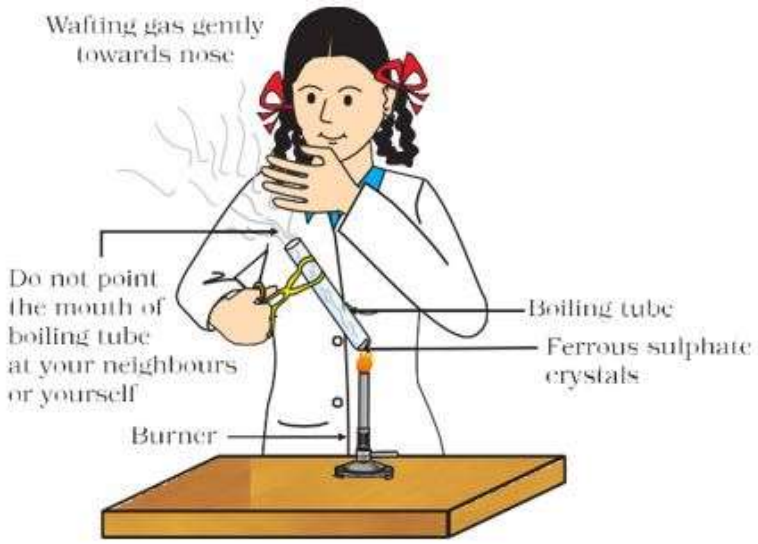

Figure 1.4: *Correct way of heating the boiling tube containing crystals of ferrous sulphate and of smelling the odour.*

* Take about 2 g ferrous sulphate crystals in a dry boiling tube.
* Note the colour of the ferrous sulphate crystals.
* Heat the boiling tube over the flame of a burner or spirit lamp as shown in Fig. 1.4.
* Observe the colour of the crystals after heating.

Have you noticed that the green colour of the ferrous sulphate crystals has changed? You can also smell the characteristic odour of burning sulphur.

$$2FeSO_{4\,(s)} \longrightarrow Fe_2O_{3\,(s)} + SO_{2\,(g)} + SO_{3\,(g)} \quad \text{-----} \ (1.19)$$

(Ferrous sulphate) (Ferrous oxide)

In this reaction you can observe that a single reactant breaks down to give simpler products. This is a decomposition reaction. Ferrous sulphate crystals ($FeSO_4$, $7H_2O$) lose water when heated and the colour of the crystals changes. It then decomposes to ferric oxide (Fe_2O_3), sulphur dioxide (SO_2) and sulphur trioxide (SO_3). Ferric oxide is a solid, while SO_2 and SO_3 are gases.

Decomposition of calcium carbonate to calcium oxide and carbon dioxide on heating is an important decomposition reaction used in various industries. Calcium oxide is called lime or quick lime. It has many uses – one is in the manufacture of cement. When a decomposition reaction is carried out by heating, it is called thermal decomposition.

$$CaCO_{3\,(s)} \longrightarrow CaO_{\,(s)} + CO_{2\,(g)} \quad \text{----- (1.20)}$$

(Limestone) (Quick lime)

Another example of a thermal decomposition reaction is given in Activity 1.6.

Activity 1.6:

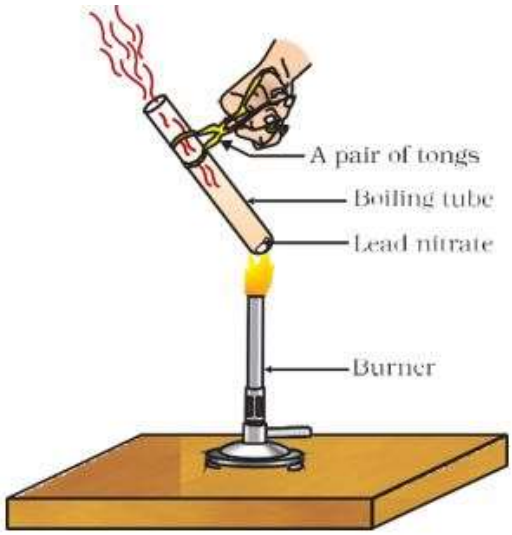

Figure 1.5: *Heating of lead nitrate and emission of nitrogen dioxide.*

* Take about 2 g lead nitrate powder in a boiling tube.
* Hold the boiling tube with a pair of tongs and heat it over a flame, as shown in Fig. 1.5.
* What do you observe? Note down the change, if any.

You will observe the emission of brown fumes. These fumes are of nitrogen dioxide (NO_2). The reaction that takes place is

$$2Pb(NO_3)_2 \longrightarrow 2PbO_{(s)} + 4NO_{2\,(g)} + O_{2\,(g)} \text{ -----(1.21)}$$

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

Let us perform some more decomposition reactions as given in Activities 1.7 and 1.8.

Activity 1.7:

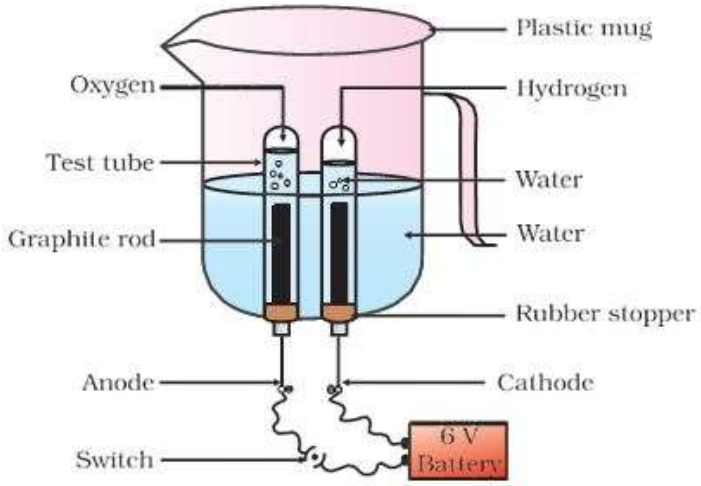

Figure 1.6: *Electrolysis of water*

* Take a plastic mug. Drill two holes at its base and fit rubber stoppers in these holes. Insert carbon electrodes in these rubber stoppers as shown in Fig. 1.6.

* Connect these electrodes to a 6 volt battery.

* Fill the mug with water such that the electrodes are immersed. Add a few drops of dilute sulphuric acid to the water.

* Take two test tubes filled with water and invert them over the two carbon electrodes.

* Switch on the current and leave the apparatus undisturbed for some time.

* You will observe the formation of bubbles at both the electrodes. These bubbles displace water in the test tubes.

* Is the volume of the gas collected the same in both the test tubes?

* Once the test tubes are filled with the respective gases, remove them carefully.

* Test these gases one by one by bringing a burning candle close to the mouth of the test tubes.

CAUTION: This step must be performed carefully by the teacher.

* What happens in each case?
* Which gas is present in each test tube?

Activity 1.8:

Figure 1.7: *Silver chloride turns grey in sunlight to form silver metal*

* Take about 2 g silver chloride in a china dish.
* What is its colour?
* Place this china dish in sunlight for some time (Fig. 1.7).

Observe the colour of the silver chloride after some time.
You will see that white silver chloride turns grey in sunlight. This is due to the decomposition of silver chloride into silver and chlorine by light.

$$2AgCl_{(s)} \longrightarrow 2Ag_{(s)} + Cl_{2(g)} \quad \text{----- (1.22)}$$

Silver bromide also behaves in the same way.

$$2AgBr_{(s)} \quad 2Ag_{(s)} + Br_{2(g)} \quad \text{----- (1.23)}$$

The above reactions are used in black and white photography.

What form of energy is causing these decomposition reactions?

We have seen that the decomposition reactions require energy either in the form of heat, light or electricity for breaking down the reactants. Reactions in which energy is absorbed are known as endothermic reactions.

Carry out the following Activity

Take about 2 g barium hydroxide in a test tube. Add 1 g of ammonium chloride and mix with the help of a glass rod. Touch the bottom of the test tube with your palm. What do you feel? Is this an exothermic or endothermic reaction?

Questions:

1. A solution of a substance 'X' is used for whitewashing.

i. Name the substance 'X' and write its formula.

ii. Write the reaction of the substance 'X' named in (i) above with water.

2. Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.