DISPLACEMENT REACTION

Activity 1.9

(Iron displacing copper from copper sulphate solution):

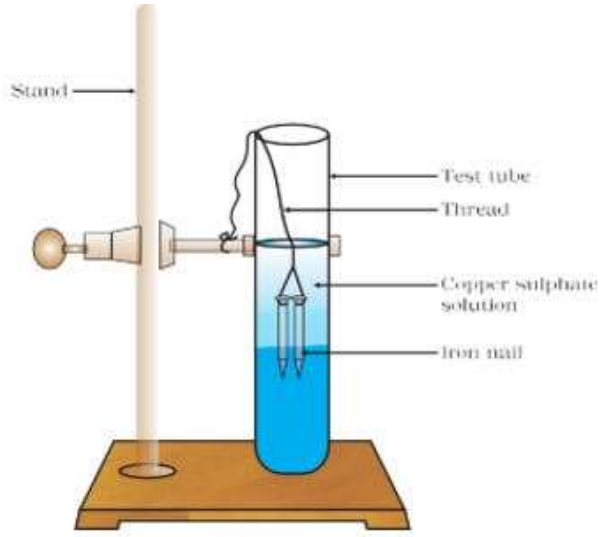

Figure 1.8(a): *Iron nails dipped in copper sulphate solution*

* Take three iron nails and clean them by rubbing with sand paper.
* Take two test tubes marked as (A) and (B). In each test tube, take about 10 ml copper sulphate solution.
* Tie two iron nails with a thread and immerse them carefully in the copper sulphate solution in test tube B for about 20 minutes [Fig. 1.8 (a)]. Keep one iron nail aside for comparison.
* After 20 minutes, take out the iron nails from the copper sulphate solution.
* Compare the intensity of the blue colour of copper sulphate solutions in test tubes (A) and (B) [Fig. 1.8 (b)].
* Also, compare the colour of the iron nails dipped in the copper sulphate solution with the one kept aside [Fig. 1.8 (b)].

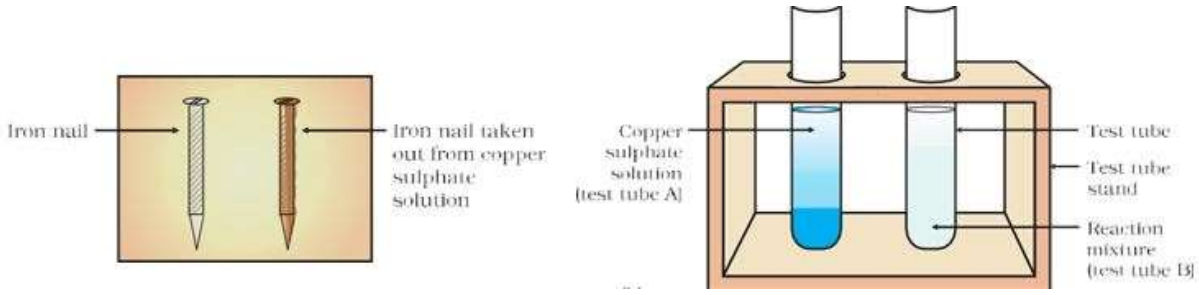

Figure 1.8(b):*Iron nails and copper sulphate solutions compared before and after the experiment.*

Why does the iron nail become brownish in colour and the blue colour of copper sulphate solution fades?

The following chemical reaction takes place in this Activity–

$$Fe_{(s)} + CuSO_{4\,(aq)} \rightarrow FeSO_{4\,(aq)} + Cu_{(s)}$$

(Copper sulphate) (Iron sulphate)

In this reaction, iron has displaced or removed another element, copper, from copper sulphate solution therefore this reaction is known as displacement reaction.

Other examples of displacement reactions are

$$Zn_{(s)} + CuSO_{4\,(aq)} \rightarrow ZnSO_{4\,(aq)} + Cu_{(s)}$$

(Copper sulphate) (Zinc sulphate)

$$Pb_{(s)} + CuCl_{2\,(aq)} \rightarrow PbCl_{2\,(aq)} + Cu_{(s)}$$

(Copper chloride) (Lead chloride)

Zinc and lead are more reactive elements than copper. They displace copper from its compounds.

DOUBLE DISPLACEMENT REACTION

Activity 1.10

(Double Displacement Reaction between Barium Chloride and Sodium Sulphate):

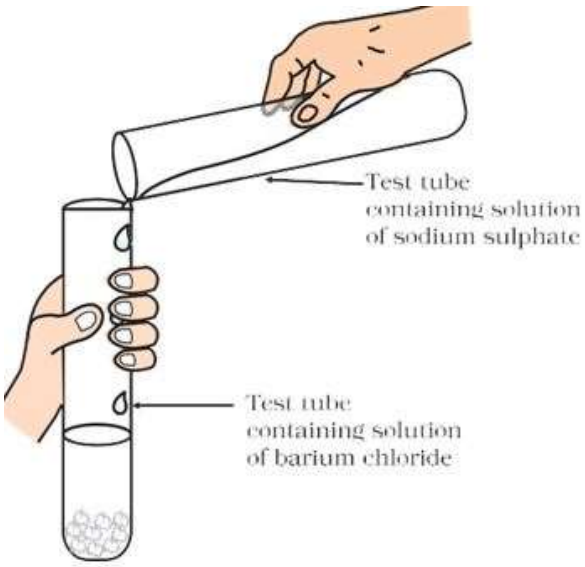

Figure 1.9: *Formation of barium sulphate and sodium chloride*

* Take about 3 ml of sodium sulphate solution in a test tube.
* In another test tube, take about 3 ml of barium chloride solution.
* Mix the two solutions (Fig. 1.9).
* What do you observe?

You will observe that a white substance, which is insoluble in water, is formed. This insoluble substance formed is known as a precipitate. Any reaction that produces a precipitate can be called a precipitation reaction.

$$Na_2SO_{4\,(aq)} + BaCl_{2\,(aq)} \rightarrow BaSO_{4\,(s)} + 2NaCl_{\,(aq)} \text{ -----(1.27)}$$

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

What causes this? 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 reactions.

Questions:

1. *Recall Activity 1.2*, where you have mixed the solutions of lead (II) nitrate and potassium iodide.

i. What was the colour of the precipitate formed? Can you name the compound precipitated?

ii. Write the balanced chemical equation for this reaction.

iii. Is this also a double displacement reaction?

Activity 1.2,

* Take lead nitrate solution in a test tube.

* Add potassium iodide solution to this.

* What do you observe?