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$$\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \xrightarrow{\text{Heat}} \text{CuSO}_4 + 5\text{H}_2\text{O}$$

(Blue) (White)

Repeat the above activity for Ferrous sulphate, sodium carbonate and write chemical equations. Take 'x' as a coefficient for H_2O .

On heating, the crystalline structure of blue vitriol broke down to form a colourless powder and water came out. This water was part of the crystal structure of blue vitriol. It



Apparatus : Evaporating dish, Bunsen burner, tripod stand, wire gauze, etc.
Chemicals : Alum.

Ionic compounds are crystalline in nature. These crystals are formed as a result of definite arrangement of ions. In the crystals of some compounds water molecules are also included in this arrangement. That is the water of crystallisation. The water of crystallisation is present in a definite proportion of the chemical formula of the compound. It is indicated in the chemical formula as shown below.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Crystalline blue vitriol – $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ 2. Crystalline ferrous sulphate (Green vitriol) – $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ 3. Crystalline washing soda – $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ 4. Crystalline alum – $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ | <ol style="list-style-type: none"> 1. Crystalline substances contain water of crystallisation. 2. The molecules of water of crystallisation are part of the internal arrangement of the crystal. 3. On heating or just by keeping, the water of crystallisation is lost and the crystalline shape of that part is lost. |
|--|--|

The diagram shows an electrolysis setup. A beaker containing a solution of sodium chloride is placed on a support. Two electrodes are immersed in the solution. The circuit is connected to a 6V battery, a switch, and a light bulb. The positive terminal of the battery is connected to the anode (labeled 'A'), and the negative terminal is connected to the cathode (labeled 'C').

Activity : Prepare a solution of 1g sodium chloride in 50ml water. Take two electrical wires. Connect one wire to the positive terminal of a 6V battery. While connecting the other wire to the negative terminal of the battery, include one switch and one holder with an electric bulb. Remove the insulating cladding from 3cm portion of the other free ends of the two wires. Take the salt solution in a 100ml capacity beaker and immerse the uncovered ends of the two wires in it keeping the wire erect with the help of a support. Switch on the current. Note whether the bulb glows. Repeat the same procedure using solutions of 1g copper sulphate, 1g glucose, 1g urea, 5ml dilute H_2SO_4 and 5ml dilute NaOH each in 50ml

conducting wire is called a **cathode** and the electrode connected to the positive terminal of a battery is called an **anode**.

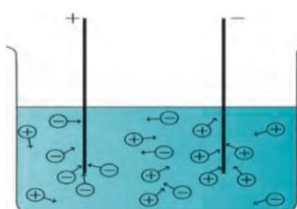
Why does the electric circuit get completed on immersing the electrodes in certain liquids or solutions? In order to understand this phenomenon, let us look more closely at the solutions in the above activity, which were found to be electrical conductors.

Dissociation of ions and electrical conductivity

In the above activity it was found that the aqueous solutions of the compounds NaCl, CuSO₄, H₂SO₄ and NaOH are electricity conductors. Out of these NaCl and CuSO₄ are salts, H₂SO₄ is a strong acid and NaOH is a strong base. We have seen that salts, strong acids and strong bases dissociate almost completely in their aqueous solutions. Therefore, the aqueous solutions of all these three contain large numbers of cations and anions.

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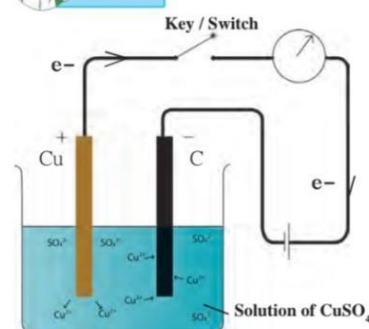
A characteristic of the liquid state is the mobility of its particles. Due to this mobility, the positively charged cations in the solution are attracted towards the negative electrode or cathode and move towards the cathode; on the other hand, the negatively charged anions move in the direction of the anode. The movement of ions in the solution towards the respective electrodes amounts to the conduction of electricity through the solution. From this, you will understand that those liquids or solutions which contain a large number of dissociated ions conduct electricity.



5.9 Dissociation of ions



Try this



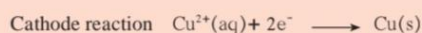
5.10 Electrolysis

Electrolysis

Procedure : Take a solution of 1g copper sulphate in 50ml water in a 100ml capacity beaker. Use a thick plate of copper as anode and a carbon rod as cathode. Arrange the apparatus as shown in the figure and pass an electric current through the circuit for some time. Do you see any changes?

In the above activity copper appears to have deposited on the portion of the cathode immersed in the solution. How did this happen? When an electric current started flowing through the circuit, the cations, that is, Cu²⁺ ions in the solution got attracted towards the cathode. Cu atoms are formed when electrons coming out from the cathode combine with the Cu²⁺ ions. A deposit of the copper appeared on the cathode. Even though

the Cu²⁺ ions in the solution were used up in this manner, the colour of the solution remained the same. Because, while electric current was on, electrons were removed from the Cu atoms of the anode and sent to the battery through the electric wire. The Cu²⁺ ions formed in this manner, entered the solution. In this way decomposition of the solute in the solution took place due to the electric current. This is called electrolysis. There are two parts in the electrolysis process. These are the cathode reaction and the anode reaction. The two parts of the electrolysis process that take place in the above activity are shown below.



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Always remember

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Use your brain power !

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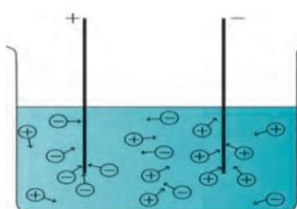
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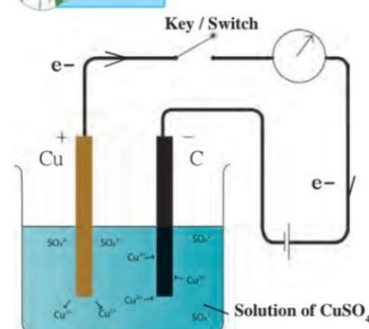
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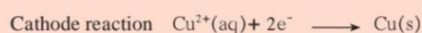
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**Always remember**

1. It is necessary for the liquid/solution to have a large number of dissociated ions for electrolysis to take place. Therefore, substances which undergo dissociation to great extent in the liquid state or a solution are called strong **electrolytes**. Salts, strong acids and strong bases are strong electrolytes. Their solutions have high electrical conductivity. In other words strong electrolytes are good conductors of electricity in their liquid or solution state. Weak acids and weak bases are weak electrolytes.
2. An assembly that consists of a container electrolyte and the electrodes dipped in it, is called an electrolytic cell.

**Use your brain power !**

1. In the above activity, if electric current passed through the electrolytic cell for a long time, what change would be seen at the anode?
2. Would water be a good conductor of electricity?

Website for more information

www.chemicalformula.org

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If pure water is used in an electrolytic cell, current does not flow even on putting on the switch. From this we learn that pure water is a bad conductor of electricity. And we have already seen the reason behind this. The concentration of H^{+} and OH^{-} ions formed by dissociation of water is very low, only $1 \times 10^{-7} \text{ mol/L}$ for each ion. However, the electrical conductivity of water increases on mixing a small amount of salt or a strong acid/base in it due to their dissociation and electrolysis of water takes place.