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Chapter – 11

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CHEMICAL EFFECTS

OF

ELECTRIC CURRENT

CONDUCTORS AND INSULATORS

The materials, which allow electric current to pass through them, are good conductors of electricity. For example, the metals such as copper and aluminium allow electricity to pass through them easily (or conduct electricity), so they are good conductors of electricity.

On the other hand, materials, which do not allow electric current to pass through them easily, are poor conductors of electricity. Rubber, plastic and wood do not conduct electricity or Insulators.

Do Liquids Conduct Electricity

Just as some of the solids conduct electricity, in the same way, some of the Liquids also conduct electricity. The liquids that conduct electricity are solutions of acids, bases and salts in water. For example, a solution of sulphuric acid, hydrochloric acid, or any other acid, in water conducts electricity. Vinegar contains acetic acid and lemon juice contains citric acid. Vinegar and lemon juice also conduct electricity (because they are solutions of acids). Similarly, a solution of sodium hydroxide, potassium hydroxide, or any other soluble base in water conducts electricity. And a solution of copper sulphate, common salt (sodium chloride), or any other salt in water also conducts electricity. There are, however, some important differences in the conduction of electricity by solids (such as metals) and liquids (such as solutions of acids, bases and salts).

The liquids which conduct electricity are called conducting liquids (or conducting solutions). When electric current (or electricity) is passed through conducting liquids, then chemical changes take place. The chemical changes which take place in conducting liquids on passing electric current through them are called chemical effects of electric current.

A liquid (or solution of a substance) which can conduct electricity is called an electrolyte. In other words, a conducting liquid is called an

electrolyte (A conducting liquid means a liquid which conducts electricity). The solutions of acids, bases and salts in water are electrolytes.

Electrolytes are of two types: strong electrolytes and weak electrolytes. A strong electrolyte is a liquid (or solution) which conducts electricity very well. A strong electrolyte is a very good conductor of electricity because it contains a lot of ions in it. Some of the examples of strong electrolytes are: Sulphuric acid solution, Hydrochloric acid solution, Nitric acid solution, Sodium hydroxide solution, Potassium hydroxide solution, Common salt solution (Sodium Chloride solution), Copper sulphate solution and Silver nitrate solution.

A weak electrolyte is a liquid (or solution) which conducts electricity to a lesser extent. A weak electrolyte is a weak conductor of electricity because it contains lesser number of ions. Some of the examples of weak electrolytes are Vinegar (acetic acid solution), Lemon juice (citric acid solution), Carbonic acid solution, Ammonium chloride solution, Ordinary water (Tap water) and Rain water.

A solid electrical conductor through which an electric current enters or leaves something like a dry cell or an electrolytic cell, is called an electrode. Electrodes are carbon rods or metal rods depending upon where they are being used. Electrodes are of two types anode and cathode. The electrode which is connected to the positive terminal of the battery gets positively charged. The positively charged electrode is called anode. The electrode which is connected to the negative terminal of the battery gets negatively charged. The negatively charged electrode is called cathode.

An arrangement having two electrodes kept in a conducting liquid (or electrolyte) in a vessel is called an electrolytic cell.

The Case of Distilled Water, Tap Water, Sea Water and Rainwater

If we take some distilled water in a beaker and pass electricity through it, we will find that there is no deflection in the magnetic needle of compass. This shows that distilled water does not conduct electricity.

Thus, distilled water is pure water and it does not conduct electricity. We can make distilled water (or pure water) to conduct electricity in the following ways:

(i) We can dissolve some common salt (or any other salt) in distilled water or pure water to make it a good conductor of electricity.

(ii) We can add a little of acid (such as dilute sulphuric acid, lemon juice or vinegar) in distilled water or pure water to make it a good conductor of electricity.

(iii) We can add a little of a base (such as sodium hydroxide or potassium hydroxide) in distilled water or pure water to make it a good conductor of electricity.

The water that we get from sources such as taps, hand pumps, wells and ponds, etc., is not pure: The water of taps, hand pumps, wells and ponds contains small amounts of several salts which are naturally present in it. So, water from all these sources is a conductor of electricity.

Rainwater is said to be pure water. But when rainwater falls to the earth through the atmosphere, it dissolves an acidic gas carbon dioxide from the air and forms a weak acid called carbonic acid. The rainwater may also dissolve other acidic gases such as sulphur dioxide and nitrogen oxides (which are present in polluted air) to form small amounts of other acids such as sulphuric acid and nitric acid. Due to the presence of small amounts of acids in it, rainwater becomes a conductor of electricity.

ELECTROLYSIS

The chemical decomposition produced by passing an electric current through a conducting liquid is called electrolysis. The decomposition of acidified water into hydrogen and oxygen by passing an electric current (or electricity) an example of electrolysis.

ELECTROPLATING

The process of depositing a layer of any desired metal on another material by means of electricity is called electroplating. It is one of the most common applications of chemical effects of electric current.

USES OF ELECTROPLATING

Electroplating is a very useful process. It is widely used in industry for coating metal objects (or metal articles) with a thin layer of a desired metal. The metal which is deposited in the form of a thin layer has some desired properties which the metal of the object does not possess.

(i) Chromium plating is done on many objects such as car parts, bath taps, kitchen gas burners, bicycle handlebars, wheel rims and many others. Chromium has a shiny appearance. It does not corrode.

(ii) Tin metal has a shiny appearance, it does not corrode and it is non-poisonous. It is less reactive than iron. Tin cans used for storing food are made by electroplating tin metal on to iron. Due to tin plating over the surface of iron, the food does not come in contact with iron and is protected from getting spoilt. In fact, the less reactive and give them an attractive finish.

(iii) Electroplating is used to give objects made of a cheap metal a coating of a more expensive metal to make them look more attractive.