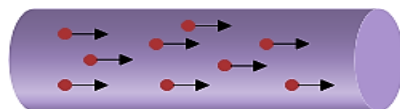


Chemical Effects of Electric Current**Introduction**

Electricity can be defined as a kind of energy formed by moving charges. Metals are considered a good conductor of electricity due to the flow of electric charges in them.

Electric Current-It can be defined as the flow of electrons. An electric current can produce chemical, heating and magnetic effects.



Electron Flow

Electric current cannot flow on the conductor on its own. An electric circuit, which is a closed-loop path made up of electric components like wire, battery, switch, bulb etc is needed for current to flow in a wire or conductor.

Conductors and Insulators

Based on the conductivity, substances are divided into two

1. Conductors –

- Substances that allow electric current to pass through them are called conductors.
- For example – Metals like gold, silver and copper etc are some examples of good conductors.

2. Insulators –

- Substances that do not allow an electric current to pass through them are called insulators.
- An insulator is a bad conductor.
- For example – rubber, wood, plastic, glass etc. are bad conductors of electricity.

Liquids conduct electricity

Most liquids can conduct electricity because they have free electrons or ions that carry the electricity through the liquid. Solutions of acids, bases and salts in water conduct electricity and hence are called **electrolytes**. For example- Lemon juice, sodium hydroxide and Tap water, Milk, Vinegar.

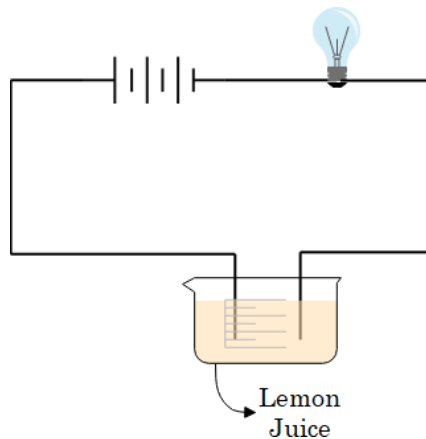
Whereas distilled water doesn't conduct electricity as it doesn't contain salts hence distilled water is a bad conductor of electricity. Oil, petrol and kerosene are poor conductors of electricity as they do not have free electrons or ions to conduct electricity.

Note – Milk is a good conductor of electricity because it contains water and lactic acids.

Test for conductivity of liquids

The conductivity of a liquid can be tested by the tester. Testers are used to test whether a particular material allows the electric current to pass through it or not.

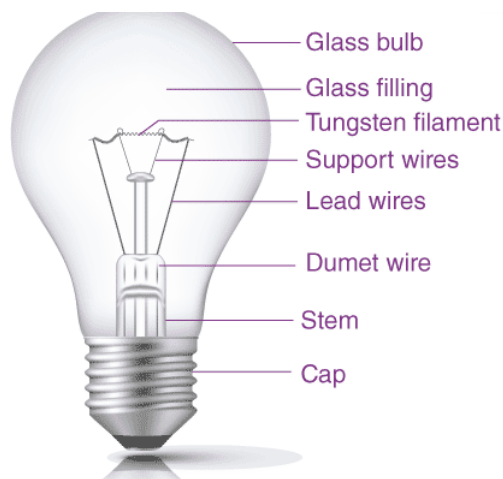
- Firstly take a liquid like lemon juice in a container.
- When an electric current passes through a conducting liquid, it gets decomposed into ions.
- It is a good conductor of electricity as it contains citrus acid having H^+ ions which are responsible for conduction.
- If the electric bulb glows in this arrangement this means our liquid is a good conductor of electricity.
- The more ions in liquids lead to a better conductor of electricity.



Lemon juice conducts electricity

Heating Effect of Electric Current

- Heat is produced when an electric current flows through a conductor.
- This is referred to as the heating effect of electric current.
- The glowing of the bulb is caused by the heating effect of the current flowing through it.



Structure of an electric bulb

To determine if a substance conducts or not by the heating effect:

- When current is passed through the bulb, the filament (tungsten) heats up to a high temperature, causing the bulb to glow.
- However, if the current is extremely small, the filament will not be heated to a high temperature and will thus not glow as a result of this.

LED bulbs are more suitable for testing the electrical conductivity of liquids:

As the LED bulbs can detect the flow of even a small amount of electric current. The electric current causes a heating effect due to which the filament of the bulb gets heated up and glows. Some liquids are capable of conducting electricity but they are weak conductors of electricity and the current that passes through them are not that strong enough to heat up the filament. But the use of LED bulbs overcome this situation.



LED Light

Chemical Effects of Electric Current

- The chemical effects of electric current can be defined as the passage of an electric current through a conducting solution or an electrolyte that causes chemical changes.
- This is because of chemical reactions that take place when an electric current passes through a solution.

Applications of Chemical Effect of Electric Current

1. Extraction of metals from their ores.
2. Purification of metals
3. Production of compounds.
4. Decomposition of compounds.

Note- William Nicholson, was the first to discover the chemical effect of current. He discovered that if electrodes were immersed in water, and a current was passed they dissociate into hydrogen ions and oxygen ions.

Electrode and Electrolyte

Electrode

An electrode is a conductor of electricity that can carry electric current into non-metals and other poor conductors of electricity.

Electrolyte

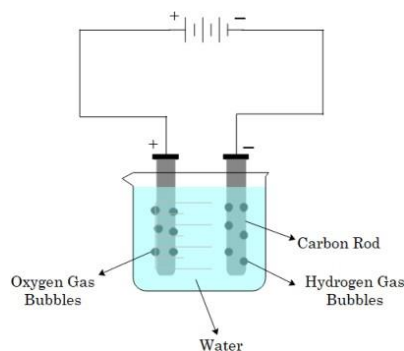
The electrolyte can be defined as the liquids which allow an electric current to pass through them and split themselves on the passage of electric current.

Electrolysis

The production or occurrence of chemical change in an electrolyte when an electric current is passed through it. The process of electrolysis shows the following things Depending on the nature of the solution and the electrode.

1. Release of gas bubbles on the electrodes.

- When current is conducted through water, oxygen and hydrogen bubbles are created.
- On the positive electrode, oxygen bubbles will be present, whereas hydrogen bubbles will be present on the negative electrode.
- Chemical reaction takes place when an electric current passes through a conducting solution.
- As a result, gas bubbles could form on the electrodes.



Release of bubbles when current passes through liq

2. Deposits of metal on electrodes.

3. Change of colour of solution depending upon the electrodes.

Cathode and Anode

The electrode connected to the negative terminal of the battery is called the **cathode** (negative electrode).

The electrode connected to the positive terminal of the battery is called an **anode** (positive electrode).

Applications of electrolysis

1. Electroplating
2. Purification of metals
3. Extraction of metals from metallic ores.

Electroplating or Electro-deposition

The process by which a layer of metal is deposited over another metal by the passage of electric current. The kind of metal that is usually electroplated are gold, silver, tin, zinc, copper, chromium.

Reason for electroplating

Electroplating is a very useful process and widely used in industry. Electroplating is a technique for depositing a layer of metal with desired properties on another metal that is utilized in various industries. The main reason is as follows

- To protect the metal object by coating different metal on the metal object.
- Cost-efficient for example since chromium is a costly metal, the objects are made of a cheaper metal and a chromium coating is applied for a shiny appearance.
- Prevent metal from corrosion

Applications of electroplating

1. Jewellery makers electroplate silver and gold on less expensive metals.
2. Medical equipment is made up of nickel which is harmful to the human body hence to avoid it from coming in contact with the body a coating of platinum or gold is applied on the surface of the nickel.
3. Tin cans used to store food are made of iron coated with zinc. As zinc is less reactive than iron.
 4. Thus, the food is prevented from coming in contact with iron and getting spoilt.
5. Iron is used in bridges and automobiles to provide strength. However, iron tends to corrode and rust. So, a coating of zinc is deposited on iron to protect it from corrosion and the formation of rust.

6. Because of its shiny appearance, chromium plating is used for vehicle parts and bath fittings.
7. Galvanization – Coating of zinc is deposited on iron to protect it from corrosion.
8. Bridges and various parts of automobiles are made up of iron and are coated with zinc in order to prevent rust (Galvanization) because it provides strength.

Methods of electroplating

Electroplating is based on the chemical effects of electricity. Electroplating helps to prevent rusting.

To get the coating of a different metal the following is the process

- Two electrodes should be made of different metals.
- The metal on which coating is to be done should be used as a cathode while the metal to be deposited should be made the anode.
- The electrolyte should be a solution of the metal to be coated. For example - The coating of zinc over a copper object, the copper object is used as a cathode and a zinc plate as an anode and zinc sulphate as the electrolyte.
- The container or vessel consisting of the cathode, anode and electrolyte is called an electrolytic cell.

Deposition of one layer of metal on the top of another metal:

When an electric current is passed through the copper sulphate solution, copper sulphate dissociates into copper and sulphate. The free copper gets drawn to the electrode connected to the negative terminal (cathode) of the battery and gets deposited on it. The process of electroplating takes some time to complete. The time taken by the process depends upon the strength of the current and also on the concentration of the electrolyte. These two help to increase the speed of electroplating. We should make sure that the electrode should be clean. The electrodes used are made up of different materials. One of the electrodes is of the same metal of which the electrolyte solution is. The second electrode needs to be the material on which coating takes place.



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