Class 8 Physics Chemical Effects of Electric Current Introduction

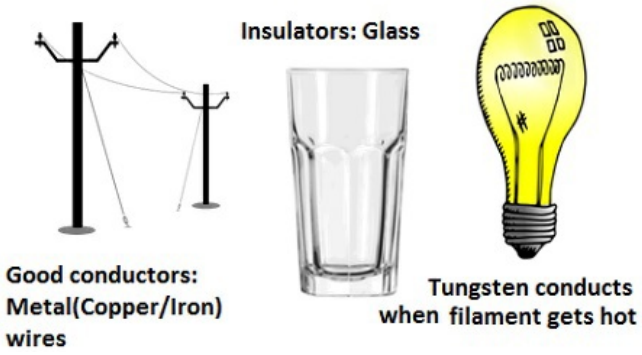
Introduction

Generally exercise a lot of caution when dealing with electric current. We are told not to touch current wires, particularly with wet hands. We are told not to stand under a tree when it is raining and there are thunderstorms. These are because of **electric current** and its properties. In this chapter, let us study about the **'Chemical Effects of Electric Currents'**

Class 8 Physics Chemical Effects of Electric Current Conductors and Insulators

Conductors and Insulators

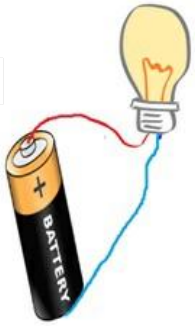
- The materials which conduct electricity are called good conductors of electricity. Eg: Iron, copper, aluminum, iron, human body etc
- The materials which don't conduct electricity at all are bad conductors of electricity. Eg: plastic, glass, rubber.
- There are also some materials which conduct electricity under specific conductions. They are not completely bad conductors. Eg: Tungsten filament in a bulb.



Tester 1: Conventional Electric Tester:

Construction of a Conventional Electric Tester

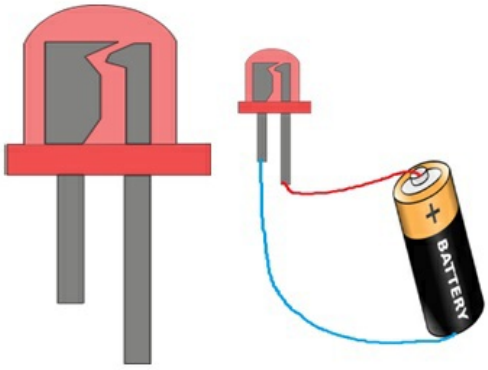
- Take a cell.
- Tie an electric wire to the any one side of the battery and leave it open
- Tie an electric wire to the another side of the battery and connect it to a electric bulb.
- Tie another electric wire to the other terminal of the electric bulb and leave it open.



Construction of a Conventional Electric Tester

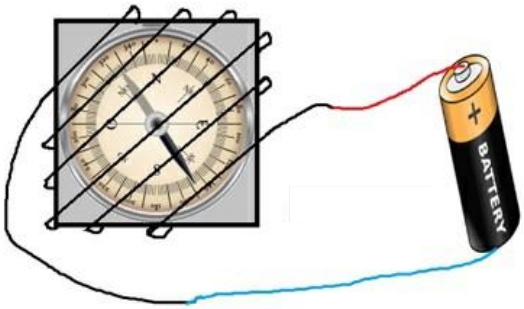
The two open ends when connected would allow current to pass through it and hence the bulb would glow. This traditional electric tester cannot detect weak currents. So, we can use an LED bulb to detect a weak current.

Tester 2: LED Tester :



- The LED has 2 wires , called **Leads** attached to an LED
- One LED is slightly longer than the other. The **longer lead** is connected to the **positive terminal** of the battery and the **shorter lead** is connected to the **negative terminal** of the battery as shown in the figure
- This LED tester can detect **weak currents**

Tester 3: Tester Using Magnetic Compass

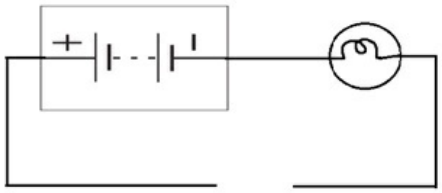


- Take a small magnetic compass needle and place it inside a small cardboard box.
- Wrap an electric wire a few times around the small cardboard box.
- Connect the free end of the electric wire to any one terminal of a battery.
- Leave the other end open.
- Tie another piece of electric wire to the other terminal of the battery.

When the two open ends are connected momentarily, the **magnetic compass needle would deflect**. This is the magnetic effect of electric current. This can also detect weak currents.

General Representation of a Tester Circuit.

Note: From here onwards, we will symbolically represent a tester as follows. Note that any of the 3 testers could be used depending on the scenario.



Symbolic Representation of an Electric Tester

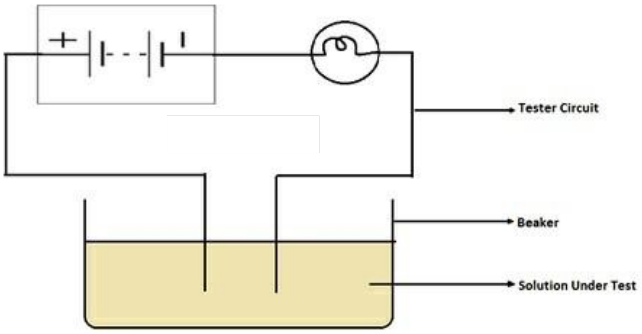
Note: From here onwards, we will symbolically represent a tester as follows. The **Rectangular box** and its components represent the **battery** and the circular box and its components represent the **bulb** (or **LED or magnetic compass, depending on the type of tester used**)

Class 8 Physics Chemical Effects of Electric Current Conductors of Electricity

Good and Poor conductors of Electricity

Here we try to understand whether some commonly used **liquids** are good or poor conductors of electricity.

The free ends of **'Tester Using Magnetic Compass'** is dipped in a beaker containing the solution under test. If the solution is a **good conductor of electricity**, the magnetic needle **deflects**. If the solution is a **bad conductor of electricity**, the magnetic needle does not **deflect**. (Alternately, we could use the LED tester too)



Material under test	Does the magnetic compass deflect? Yes/No	Good conductor/Poor conductor
Distilled water	No	Poor conductor
Tap water	Yes	Good conductor
Lemon juice	Yes	Good conductor
Vinegar	No	Poor conductor
Cooking Oils	Yes	Good conductor
Milk	Yes	Good conductor
Honey	No	Poor conductor
Soda compounds	Yes	Good conductor
Mercury	Yes	Good conductor
Fuels	No	Poor conductor

Note the following:

- For any **solution to conduct, you need ions or free electrons**
- Pure water does not conduct electricity, but naturally occurring water (rain water, tap water etc) contain salts (ions) dissolved in it and this makes it a good conductor of electricity
- Soda compounds (a common name for chemicals mostly containing sodium) contain ions when dissolved in water and ions help conduct electricity.
- Milk is a good conductor of electricity because it contains water and lactic acids and other salts.
- Honey is a solution of sugars. So, it does not conduct because it does not have ions or charged particles.

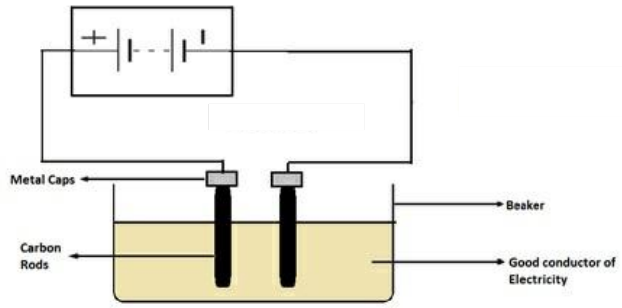
Good conductor of electricity: Rain water

Poor conductor of electricity: Honey

Class 8 Physics Chemical Effects of Electric Current Chemical Effects of Electric Current

Chemical Effects of Electric Current

We have understood from previous classes that electric current produces many effects (heating, magnetic etc). Here we will explore what happens when electricity flows through a conducting solution.



Experiment

- Take **2 carbon rods** from two discarded cells. (These 2 rods are called as **electrodes**.)
- Clean their metal caps. Wipe them dry.
- Tie **copper wires** around the metal caps of the carbon rods.
- Join the ends of the copper wires to a battery as shown
- Take a **solution which is a good conductor of electricity** (tap water, lemon juice) Immerse the rods in the solution such that the metal caps are outside the water.
- Now the circuit is complete. Wait for about 5 minutes.

Observation

- **Bubbles** are observed near the electrodes when current passes through them.

Analysis

The above changes are seen due to the **Chemical Effects of Electric Current** The passage of electric current through a conduction solution causes one or any of the following reactions depending on the solution and electrode used

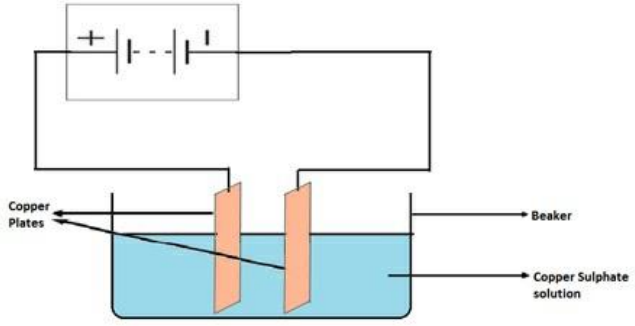
- **Bubbles of gas** are seen on the electrodes.
- **Metal deposits** can be seen on the electrodes

The solution could change **colors**

Class 8 Physics Chemical Effects of Electric Current Electroplating

Electroplating

We have seen many times wherein artificial jewellery is shining when it is new and after sometime it begins to lose its shine. Same case with bicycle handle bars, nuts, bolts etc. This is because these metals are coated with another metal to give it their lustrous appearance and still keep it cost effective.



Experiment

- Take **distilled water in a beaker** and dissolve some **copper sulphate** in it. Add a few drops of **dilute sulphuric acid** to it to make it more conducting.
- Take **2 clean copper plates**. (Clean it with sandpaper, then rinse them with water and dry them)
- Connect the copper plates to the **terminals of the battery.**
- Immerse them in the copper sulphate solution.
- Allow the current to pass through the circuit for 15 minutes.
- Remove the electrodes and observe them.

Observation

- The plate connected to the **positive terminal** looks **corroded**.
- The plate connected to the **negative terminal** has a thin **layer of metal** on its surface.

Analysis

The above changes are seen due to the **Chemical Effects of Electric Current**

- When **electric current** passes through the **copper sulphate solution**, the copper sulphate dissociates into **copper and sulphate**.
- The free **copper** gets attracted towards the **negative terminal** and is **deposited** on the **plate** connected to the **negative terminal**.
- The **copper** present in the **copper plate** which is connected to the **positive terminal** gets **dissolved** in the copper sulphate solution, thus replacing the loss of copper from the solution.
- And this process continues.

This process is called **Electroplating**

Class 8 Physics Chemical Effects of Electric Current Applications of Electroplating

Applications of Electroplating

- **Artificial jewelry**, usually made of less expensive metals is often plated with a thin layer of a precious metal like **gold and silver** to make it more lustrous, appealing but cheaper.

- **Many industrial applications** use electroplating to create a protective barrier on a metal substrate. The protective barrier in this case **prevents tarnishing and gives a glossy appearance**. Eg: **Chromium plating** is done on car spare parts, taps, wheel rims etc. Chromium is very expensive and the whole part cannot be made of chromium. So, it is coated with chromium to give it a shiny appearance.

- **Tinning (electroplating of tin)** is a very cost-effective electroplating solution. Tin is relatively cheaper and is used for electroplating **electronic components, hardware products, fasteners, screws, nuts, bolts and food cans**. If food is stored in iron cans, it would tend to get spoilt over a period of time. But, when iron is electroplated with tin, it prevents the food from getting spoilt. Tinning offers resistance against corrosion

- **Zinc electroplating** offers excellent adhesion and resistance to corrosion. So, it is used to **electroplate automobile parts and body, transmission components, defense carriers and tanks**.