ELECTRIC CURRENT & ITS EFFECT

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ELECTRIC CELL

An electric cell is a device which converts chemical energy into electric energy.

The cell has two different metal plates – one is the positive terminal and the other is the negative terminal. These plates are kept inside a chemical called electrolyte. The cell is a source of electric current. Electric current is the flow of electrons or charge.

ELECTRIC CIRCUIT

An electric circuit is the closed path along which electric current flows from the positive terminal to the negative terminal of the cell.

◈ **A circuit generally has:**

(a) a source of electric current - **a cell or battery**.

(b) **connecting wires** for carrying current.

(c) a device which uses the electricity - a **bulb etc.**

(d) **a key or a switch** – This may be connected anywhere along the circuit to stop or allow the flow of current.

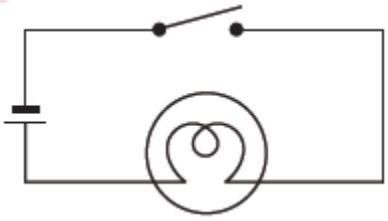
(A) Battery :

The positive terminal of one cell is connected to the negative terminal of the next cell. Such a combination of two or more cells is called a battery. Many devices such as torches, transistors, toys, TV remote controls, use batteries.

Connecting two cells together to make a battery

(B) Bulb :

In the bulb there is a thin wire, called the filament, which glows when an electric current passes through it. When the bulb gets fused, its filament is broken.

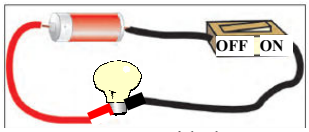


(C) Electric switch :

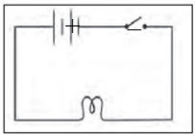
An electric switch is a device that opens or closes an electric circuit.

When the switch (key) K is closed, the circuit is complete; current flows through the circuit and the bulb glows.

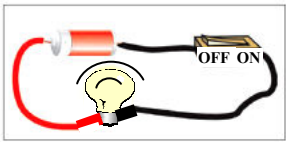
When the switch (key) K is open, the circuit is not complete; current does not flow through the circuit and the bulb does not glow.



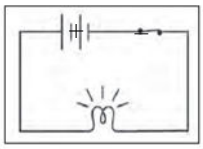
A current with the switch in the OFF position



Circuit with symbols (OFF position)

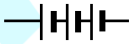


A circuit with the switch in the ON position


Circuit with symbols (ON position)

➢ SYMBOLS OF ELECTRIC CIRCUIT

Some common electric components can be represented by symbols.

S.N.	Electric component	Symbol
1.	1. Electric cell 	
2.	Electric bulb 	
3.	Switch in 'ON' position 	
4.	Switch in 'OFF' position 	
5.	Battery 	
6.	Wire 	

➢ CONDUCTORS AND INSULATORS

CONDUCTORS : The materials which allow electric current to pass through them.

Ex. All metals like Copper, Iron, Silver and Human body.

INSULATORS : The materials which do not allow electric current to pass through them.

Ex. Plastic, Wood, Rubber and Glass.

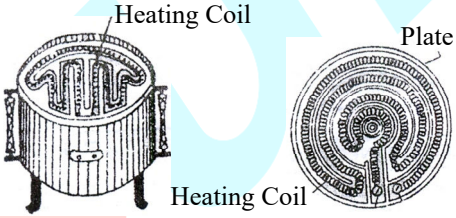
➢ EFFECT OF ELECTRIC CURRENT

(A) HEATING EFFECT OF CURRENT :

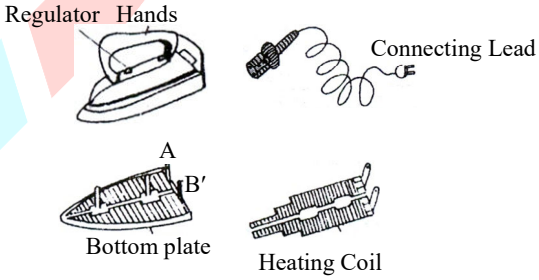
The wire which are not very good conductors gets hot when an electric current passes through it. This is the heating effect of the electric current.

Ex.

(i) Electric Heater :



(ii) Electric Iron :



The amount of heat produced in a wire depends on its material, length and thickness. Thus, for different requirements, the wires of different materials and different lengths and thickness are used.

(iii) Electric bulb :

The filament of an electric bulb gets heated to such a high temperature that it starts glowing.

(B) CHEMICAL EFFECT OF CURRENT (ELECTROPLATING)

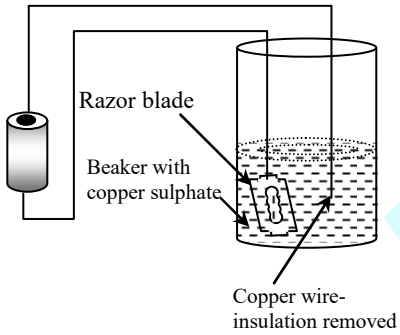
The method of plating one type of over another by means of electricity is called electroplating.

Ex. To electroplate a stainless steel razor blade with copper.

Materials required : Glass beaker, copper sulphate solution, two pieces of connecting wire (50 cm long), a cell, stainless steel razor blade.

Method : Remove the insulation from the ends of both wires. Tie one end of a wire to the stainless steel razor blade and tape the other bare end to the negative terminal of the cell. Tape one end of the other wire to the positive terminal of the cell and dip its other end into the copper scrub the razor blade clean and dip it in the solution.

After electricity passes through the circuit for some time you will find a reddish-brown deposit on the blade. This is the coating of copper.



(C) MAGNETIC EFFECT OF CURRENT :

The needle of a compass is a tiny magnet, which points in north-south direction. When we bring a magnet close to it, the needle gets deflected. Similarly we can also seen that compass needle gets deflected when the current flows in a nearby wire. **Hans Christian Oersted** was the first person who noticed the deflection of compass needle every time the current was passed through the wire. So, when electric current passes through a wire, it behaves like a magnet. This is the magnetic effect of the electric current. In fact, an electric current can be used to make magnets.

◆ **Factors which effect the strength of magnetic effect by current :**

(i) Magnetic effect of current depends on number of turns.

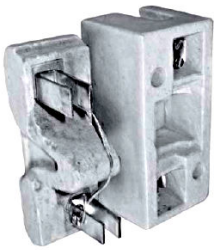
(ii) Magnetic effect of current depends the value of current.

(iii) Magnetic effect of current depends on the nature of core inside the coil.

➢ APPLICATION OF HEATING & MAGNETIC EFFECT OF CURRENT

◆ **Electric Fuse :**

Wires made from some special materials melt quickly and break when large electric currents are passed through them. These wires are used for making *electric fuses,(*figure). In all buildings fuses are inserted in all electrical circuits. There is a maximum limit on the current which can safely flow through a circuit. If by accident the current exceeds this safe limit, the wires may become overheated and may cause fire. If a proper fuse is there in the circuit, it will blow off and break the circuit. A fuse is thus a safety device which prevents damages to electrical circuits and possible fires.

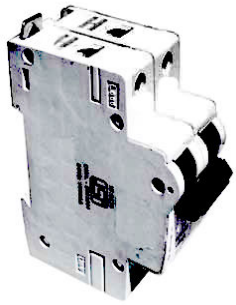


Fuse used in building

Fuses used in electrical appliances

◆ **MCB :**

These days Miniature circuit breakers (MCBs) are increasingly being used in place of fuses. These are switches which automatically turn off when current in a circuit exceeds the safe limit. You turn them on and the circuit is once again complete.

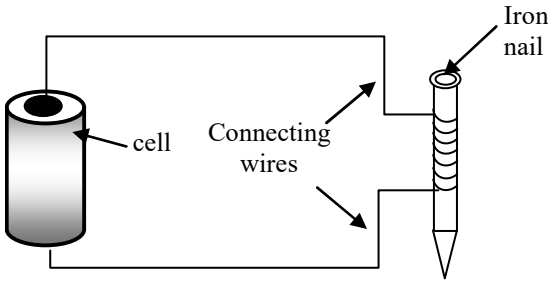


Miniature circuit breaker (MCB)

◆ **Electromagnet :**

Wind the wire tightly around the nail in the form of a coil. Connect the free ends of the wire to the

terminals of a cell through a switch as shown in Fig.

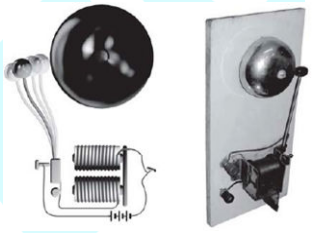


The coil behaves like a magnet when electric current flows through it. When the electric current is switched off, the coil generally loses its magnetism. Such coils are called **electromagnets**. The electromagnets can be made very strong and can lift very heavy loads. The electromagnets are also used to separate magnetic material from the junk. Doctors use tiny electromagnets to take out small pieces of magnetic material that have accidentally fallen in the eye. Many toys also have electromagnets inside them.

- **Electric bell :**

It consists of a coil of wire wound on an iron piece. The coil acts as an electromagnet. An iron strip with a hammer at one end is kept close to the electromagnet. There is a contact screw near the iron strip.

When the iron strip is in contact with the screw, the current flows through the coil which becomes an electromagnet. It, then,



Circuit of an electric bell

pulls the iron strip. In the process, the hammer at the end of the strip strikes the gong of the bell to produce a sound. However, when the electromagnet pulls the iron strip, it also breaks the circuit & the current through the coil stops flowing. The coil is no longer an electromagnet & it no longer attracts the iron strip. The iron strip comes back to its original position and touches the contact screw again. This completes the circuit. The current flows in the coil and the hammer strikes the gong again.

This process is repeated in quick succession. The hammer strikes the gong every time the circuit is completed. This is how the bell rings.

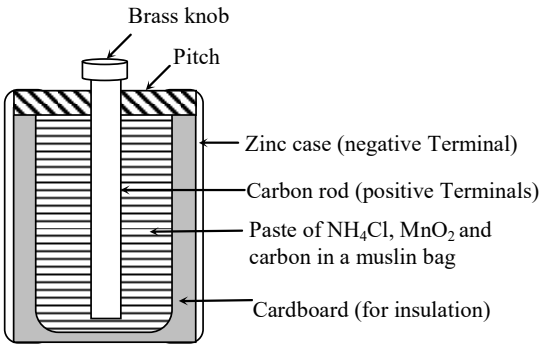
➢ ELECTRICAL CELLS : TYPES & STRUCTURE

Electrical cells are the sources of electric current. Electrical cells are of two types primary and secondary. Voltaic, Daniel and dry cells are examples of primary cells, while Edison cell, lead-acid accumulator are example of secondary cells.

(A) Primary Cells :

The cells which cannot be charged again and again are known as primary cells.

- **Dry Cell :** The outer case of the cell is made of zinc. The cylindrical sides are covered with thick cardboard or paper, while the bottom which is the negative terminal is bare. Inside the zinc container, is a most paste of ammonium chloride. A carbon rod is placed at the centre of the zinc container with a brass knob protruding out at the top. This is the positive terminal of the cell. It is surrounded by a closely packed mixture of graphite and manganese dioxide in a muslin bag. The top is sealed to avoid evaporation of moisture, but leaving a small hole for the escape of ammonia gas.



A dry Cell

The strength of a fresh dry cell is 1.5 V. Cells of this kind which become useless once the chemicals inside them are used up are known as primary cells.

(B) Secondary cell :

Some cells can be reused by recharging them from an external electrical source. Such cells are called secondary cells, storage cells or accumulators.

◆ **Lead accumulator (Reusable and rechargeable cells) :**

The secondary cell is one which consists of a vessel made of a hard rubber, glass or celluloid, containing dilute sulphuuric acid. It are immersed two lead grids, one containing lead dioxide (positive terminal) and the other made up of lead (negative terminal). Six such storage cells connected in series makes up your motor car battery. Each cell has a strength of about 2V. together they make up 12 V. After the cell is used up. it can be recharged and reused.