

Electric Current and Its Effects

Learning Objective

1. Introduction
2. Electric circuit and symbols for electrical components
3. Heating effect of electric current
 - Electric fuse
 - Electric bulb
 - CFL
4. Magnetic effect of electric current
 - Electromagnet
 - Electric bell
5. Hazards, safety measures and conservation of electricity

INTRODUCTION

Electricity is one of the most versatile forms of energy. Electric current is the flow of negatively charged particles called electrons. Depending on whether the electrons remain stationary or move, electricity is classified as static or current electricity. The electric current is generated when electrons are in excess in an electrified object and are free to move towards an object which is less charged. The difference in charge between one object and another object creates potential difference when connected through a conducting wire.

Potential difference is the amount of work done per unit charge moved.

Do you know?

Both electron and proton have same amount of charge 1.6×10^{-19} C in magnitude but during positive or negative electrification, it is the electron and not proton that get transferred.

ELECTRIC CIRCUIT AND SYMBOLS FOR ELECTRICAL COMPONENTS

Current always flows in a closed loop. This closed loop is called electric circuit. A standard method of drawing an electric circuit is called electric circuit diagram. Symbols of various electric components like cell, wire, battery, and switch are used while sketching electric circuit diagrams. The following table gives the symbols of electrical components.

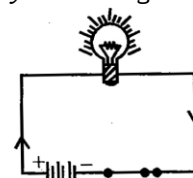
Electrical component

Connecting wire	
Bulb	
Cell	
Battery	
Key	
Open (OFF) Switch	
Closed (ON) switch	
Fuse	
Resistance	
Ammeter	
Voltmeter	

Note:- Ammeter is used for measuring current and voltmeter is used for measuring potential difference between two points in an electric circuit.

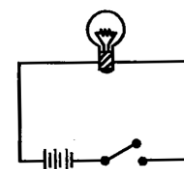
Closed and Open Circuit

When the switch is closed (ON), the circuit is closed. The electric current flows from the positive terminal of battery to the negative terminal instantly and bulb glows.



Closed Circuit

When the switch is open (OFF), the circuit is open. No electric current flows along this broken or incomplete path through any part of the circuit and the bulb do not glow.



Open Circuit

Do you know?

Conventional current flows from positively charged body to negatively charged body however, electronic current the real current flows from the negatively charged body to the positively charged body.

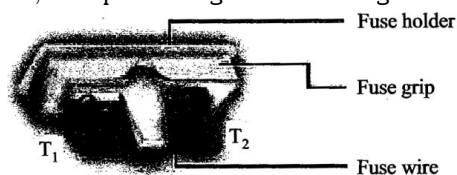
EFFECTS OF ELECTRIC CURRENT

The advantage of electricity is that it can be easily converted into other forms of energy like heat energy, light energy, magnetic energy, chemical energy depending upon the way we use it in a particular device.

Heating Effect of Electric Current

When current flows through a conductor, the resistance of the conductor converts some of the electrical energy into heat energy. The greater the resistance, the greater the heating effect. This principle is used to produce heat in household appliances like electric bulb, electric heater, iron, electric toaster, electric oven etc. The filaments used in these appliances are made of metals like tungsten and nichrome which have high resistance.

Electric fuse: To protect the electrical installations in houses or buildings, we use safety device called fuse in the circuit. It is made up of a suitable alloy which has low melting point. An electric fuse prevents a large amount of current from flowing into any appliance or device in your house as it cuts off the supply of electric current, thus preventing further damage.



Note: - MCB: Now-a-days a device called miniature circuit breaker (MCB) is usually connected in household circuits instead of fuses. It has a switch which goes off automatically if there is overloading. This breaks the circuit. The MCB can be reset by hand, and the circuit becomes complete once again



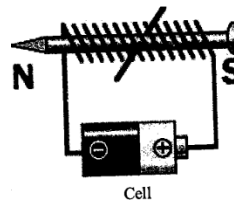
Electric bulb: The electric bulb consists of a coiled filament made of tungsten (high melting point and high resistance) in a evacuated and sealed glass bulb filled with a mixture of argon and nitrogen gas at a low pressure. So, when we switch on a light bulb, the filament or wire in it

gets hot and glows. Thus electricity can be used to produce both heat and light.

CFL: To reduce the heat produced in conventional bulbs Compact Fluorescent Lamps (CFL) are used. It uses 20% energy used by an ordinary bulb and provides the same amount of light.

Magnetic Effect of Electric Current

When current is passed through a conductor, a magnetic field developed around it. **Magnetism** produced by current is called electromagnetism. Electromagnet: When we wrap a wire around a soft iron piece (known as core) and electric current is passed through the wire, the iron piece behaves like a magnet. A magnet made using such an arrangement is called an electromagnet.



It is a temporary magnet. The strength of an electromagnet is directly proportional to the number of turns of the wire around the core and amount of current passing through it.

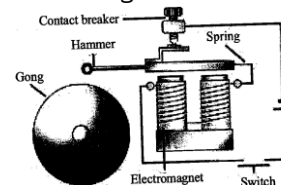
Do you know?

Magnetite (Fe_3O_4) is the world's first magnet. It is called natural magnet.

Uses of electromagnet:

1. Electromagnets are used in cranes to pick up heavy loads of iron and other magnetic substances.
2. Electromagnets are used in loudspeakers to amplify the input signals.
3. Electromagnets are used in electric motors which are used in electric fans, washing machines, refrigerators etc.
4. The receiver of telephone is made up of electromagnet.

Electric bell: Electric bell works on the principle of electromagnetism. It consists of a battery, an electric switch, an electromagnet, an adjusting screw, a soft iron strip, a hammer and a gong as shown in figure.



When the switch is closed, current flows through the electromagnet, causing the soft iron bar to get attracted to it. When the soft iron bar is pulled towards the electromagnet, the hammer attached to it hits the gong of the bell and produces a sound, which causing it to ring. As the soft iron bar moves away from the contact screw, the circuit is broken. The electromagnet loses its magnetism and the soft iron is pulled back to the contact point by the spring action. This completes the action and the cycle is repeated. Thus the hammer will vibrate against the gong and produces a continuous ringing as long as the switch is closed.

Do you know?

The first use of magnetism was in the magnetic compass.

Do you know?

The purest form of water (distilled water) is bad conductor of electricity.

Safety Measures

1. All electrical appliances must be properly earthed.
2. In case of any short circuiting or accidental contact of a person with a live wire, immediately switch off the main switch.
3. Wires of electrical appliances should be covered with good insulators.
4. All electrical connections at switches, plugs, sockets and junctions must be tight.

Conservation of Electricity

1. CFL and LED lightings should be used at the place of conventional bulb because it saves 80% electricity in comparison to conventional bulbs.
 2. All electrical appliances should be switched off when they are not in use.
 3. Use other sources of energy like solar energy.
- Note: - Safety Plug: A safety plug consists of a fuse and three wires, namely the live (brown), neutral (blue) and earth (green/yellow) wires. The plug is fitted with a fuse so that it only isolates the faulty appliance in case of excessive current flow, but other appliances connected to the mains can still function.

HAZARDS AND SAFETY MEASURES OF ELECTRICITY

1. Fires: Short-circuiting or overloading of an electric circuit may lead to fires.
2. Shock: Touching a live electric wire gives a dangerous shock. When current passes through our body, it damages the cells and tissues.
3. Water is a good conductor of electricity, so it is extremely dangerous to touch electrical appliances with wet hands.

CONCEPT MAP

