CLASS 8
PHYSICAL SCIENCE
CHAPTER 6: EFFECTS OF ELECTRIC CURRENT
RUNNING NOTES

MAGNETIC EFFECT OF ELECTRIC CURRENT

Magnetic Effect of Electric Current: When electric current flows through a conductor, it produces a magnetic field around it. This phenomenon is called the magnetic effect of electric current.

Hans Christian Oersted:

- Hans Christian Oersted (1777–1851) was a Danish scientist.
- In 1820, he discovered the relationship between electricity and magnetism.
- He observed the deflection of a magnetic compass needle when electric current flowed through a nearby wire.

Activity – Magnetic Effect of Current:

- Connect an electric cell, switch and wire in a circuit.
- Place a magnetic compass near the wire.
- Switch ON the circuit and observe the compass needle.
- The needle gets deflected.
- Switch OFF the circuit. The needle returns to its original direction.

Observation:

- Current flowing → Compass needle deflects.
- Current stopped → Needle returns to its original position.

Conclusion: Electric current produces a magnetic field around a conductor.

Magnetic Field: The region around a magnet or current-carrying conductor where its magnetic effect can be felt is called a magnetic field.

Electromagnet: A coil of insulated wire that behaves like a magnet when electric current flows through it is called an electromagnet.

Making an Electromagnet:

- Take an insulated copper wire and an iron nail.
- Wind the wire around the nail to form a coil.
- Connect the ends of the wire to a cell through a switch.
- Switch ON the circuit.
- The iron nail attracts iron pins or paper clips.

Electromagnet with Iron Core:

- When an iron nail is inserted inside a current-carrying coil, the magnetic effect becomes stronger.
- The iron core increases the strength of the electromagnet.
- When the current is stopped, the magnetic effect disappears.

PROPERTIES AND APPLICATIONS OF ELECTROMAGNETS

Properties of Electromagnets:

- They act as magnets only when electric current flows through them.
- They have two poles: North and South.
- Their magnetic strength can be changed.
- Their polarity can be reversed by changing the direction of current.
- Their strength increases by increasing the number of turns of the coil.
- An iron core makes the electromagnet stronger.

Factors Affecting the Strength of an Electromagnet:

- Number of turns in the coil.
- Amount of electric current flowing through the coil.
- Presence of an iron core.

Magnetic Poles:

- Every magnet has two poles: North and South.
- Like poles repel each other.
- Unlike poles attract each other.
- The polarity of an electromagnet can be reversed by reversing the direction of current.

Lifting Electromagnets:

- Powerful electromagnets are used in cranes.

- They are used to lift and move heavy iron and steel objects.
- When the current is switched ON, the crane attracts iron objects.
- When the current is switched OFF, the objects are released.

Applications of Electromagnets:

Maglev Train: Uses magnetic forces for levitation and movement.
Electric Bell: Uses an electromagnet to produce sound.
Electromagnetic Crane: Lifts heavy iron and steel objects.
Loudspeaker: Uses magnetic effects to produce sound.
Electric Motor: Converts electrical energy into mechanical energy.
Magnetic Separation: Separates magnetic materials from non-magnetic materials.

Simple Electric Motor:

- An electric motor is a device that converts electrical energy into mechanical energy.
- It works due to the interaction between the magnetic field of a current-carrying coil and a permanent magnet.
- This interaction produces a force that makes the coil rotate.

HEATING EFFECT OF ELECTRIC CURRENT

Heating Effect of Electric Current: When electric current passes through a conductor, heat is produced due to its resistance. This phenomenon is called the heating effect of electric current.
Resistance: The opposition offered by a conductor to the flow of electric current is called resistance.
Nichrome Wire:

Nichrome is an alloy used as a heating element.
It has higher resistance than a copper wire of the same size and length.
When current flows through nichrome wire, it becomes hot.

Activity – Heating Effect of Current:

- Take a nichrome wire and connect it to an electric cell through a switch.
- Switch ON the circuit for about 30 seconds.
- Observe the wire carefully.
- The nichrome wire becomes warm.

Observation: The wire gets heated when electric current passes through it.
Conclusion: Electric current produces heat in a conductor.
Factors Affecting Heat Produced:

The heat generated in a wire depends on:

- Magnitude of electric current.
- Material of the wire.
- Thickness of the wire.
- Length of the wire.
- Duration of current flow.

Applications of Heating Effect:

Appliance	Application
Electric iron	Ironing clothes
Electric stove	Cooking food
Electric kettle	Heating water
Water heater	Heating water
Electric heater	Heating rooms
Hair dryer	Drying hair
Incandescent lamp	Producing light by heating its filament

Heating Element: A specially designed wire or coil used to produce heat in electrical appliances is called a heating element.
Safety Precautions:

- Avoid unnecessary heating of electrical wires.
- Use proper insulation.
- Avoid overloading electrical circuits.
- Use safety devices in electrical circuits.
- Damaged plugs and sockets may cause fire or electric shock.

Industrial Application: In steel manufacturing industries, electric current is used to produce high temperatures to melt and recycle scrap steel.

CHEMICAL EFFECTS OF ELECTRIC CURRENT

Chemical Effect of Electric Current: When electric current passes through a conducting liquid, it produces chemical reactions. This phenomenon is called the chemical effect of electric current.
Conducting Liquids: Liquids that allow electric current to pass through them are called conducting liquids or electrolytes.
Examples: Lemon juice, Salt solution, Vinegar, Copper sulphate solution
Non-Conducting Liquids: Liquids that do not allow electric current to pass through them are called non-conducting liquids.
Examples: Distilled water, Vegetable oil, Sugar solution
Activity – Testing Conductivity of Liquids:

- Prepare a simple electric circuit using a cell, bulb, wires and switch.
- Connect two electrodes and dip them into a liquid.
- Observe whether the bulb glows.
- Repeat the activity with different liquids.

Observation:

- Lemon juice, vinegar and copper sulphate solution allow current to pass.
- Distilled water, vegetable oil and sugar solution do not allow current to pass in the textbook activity.

Electrodes: The conducting plates or rods through which electric current enters or leaves a conducting liquid are called electrodes.
Electrolytes: Substances that conduct electricity in solution through the movement of ions are called electrolytes.
Chemical Effects Observed:
When electric current passes through a conducting liquid, the following changes may occur:

- Formation of gas bubbles.
- Deposition of metal on electrodes.
- Change in colour of the solution.
- Formation of new substances.

Electrolysis: The chemical decomposition of a substance by passing electric current through it is called electrolysis.

ELECTROLYSIS AND ELECTROPLATING

Electrolysis of Water:

- Take salt water in a container.
- Insert two graphite electrodes into the solution.
- Connect them to a battery through a switch.
- When current flows, gas bubbles are formed at both electrodes.

Observations:

- More bubbles are observed at the negative electrode (Cathode).
- The gas released at the cathode is Hydrogen.
- The gas released at the positive electrode (Anode) is Oxygen.

Electrodes:
Anode: Positive electrode in the electrolysis arrangement described in the textbook.
Cathode: Negative electrode in the electrolysis arrangement described in the textbook.
Electroplating: The process of coating one metal with another metal using electricity is called electroplating.
Activity – Electroplating Copper:

- Take copper sulphate solution in a beaker.
- Connect two copper plates to a battery.
- Connect one plate to the positive terminal (Anode).
- Connect the other plate to the negative terminal (Cathode).
- Dip both plates into the solution.
- Switch ON the circuit.

Observations:

- Copper gets deposited on the plate connected to the negative terminal.

- The positive copper plate gradually dissolves.
- Copper ions from the solution move towards the cathode and get deposited as copper metal.

Applications of Electroplating:

- To protect iron objects from rusting.
- To make artificial jewellery attractive.
- To coat objects with gold or silver.
- To make surfaces shiny and durable.
- To provide a protective coating to metals.

Examples: Chromium plating on objects, Zinc plating for protection, Gold or silver plating for jewellery.

Purification of Metals:

- Electrolysis is used to purify metals.
- Impurities are removed during the process.
- Copper can be purified by electrolysis to obtain pure copper.

ELECTRIC CELLS AND BATTERIES

Electric Cell: An electric cell is a device that generates electric current due to chemical reactions taking place inside it.

Battery: A combination of two or more electric cells is called a battery.

Voltaic Cell:

- A Voltaic cell is also known as a Galvanic cell.
- It contains two different metals dipped in an electrolyte.
- A chemical reaction between the electrodes and electrolyte produces electricity.
- When the circuit is connected, current flows through it.
- After the chemicals are used up, the cell stops working and is called a dead cell.

Alessandro Volta and Luigi Galvani:

- Alessandro Volta and Luigi Galvani were Italian scientists.
- Their investigations contributed to the development of the first electric cell.
- Volta developed an early electric cell.

Dry Cell:

- A dry cell is a commonly used electric cell.
- It is called a dry cell because its electrolyte is not a liquid but a thick moist paste.
- It consists of a zinc container, carbon rod and electrolyte paste.
- The zinc container acts as the negative terminal.
- The carbon rod with its metal cap acts as the positive terminal.

Rechargeable Batteries:

1. Rechargeable batteries can be recharged and reused multiple times.
2. They are used in mobile phones, laptops, inverters and electric vehicles.
3. After repeated charging and use, their capacity gradually decreases.

Lithium-ion Batteries:

1. Lithium-ion (Li-ion) batteries are commonly used rechargeable batteries.
2. They are found in mobile phones, laptops and other electronic devices.
3. They are widely used because of their useful energy-storage properties.

Future Batteries: Scientists are developing solid-state batteries.

- They use solid materials instead of liquid or paste-like electrolytes.
- They are expected to be safer.
- They may charge faster and last longer.