# Electricity and Magnetism

- **Magnetite** is a rock that has the property to attract objects made of iron.
- The substance that can attract iron, cobalt, or nickel is known as a **magnet**.
- Magnet was discovered by a shepherd named **Magnes** around 2000 B.C. who lived in **Magnesia**, Greece.
- With the passage of time, people learned to make magnets from iron pieces. These magnets are known as **artificial magnets**.

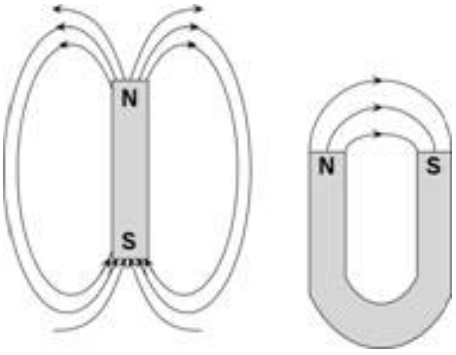
- Materials that get attracted towards the magnets are the magnetic materials.
- Materials that do not get attracted towards the magnets are the non-magnetic materials.
- Pin-holders, screwdrivers, refrigerator stickers, junkyard cranes, etc. consist of magnets.
- There are two poles of a magnet – North Pole (N) and South Pole (S).
- A large number of iron filings stick at the two poles of a magnet in comparison to the rest of the magnet body.

- There are two poles of a magnet – **North Pole** (N) and **South Pole** (S).
- A large number of iron filings stick at the two poles of a magnet in comparison to the rest of the magnet body.
- A freely suspended bar magnet always aligns along **North-South direction**.
- The direction at a place can be identified with the help of a bar magnet or a **magnetic compass**.
- A magnetic compass consists of a **magnetic needle** that always comes to rest in the North-South direction.
- In older days, sailors found direction by suspending bar magnets.

- There are two poles of a magnet – **North Pole** (N) and **South Pole** (S).
- **Like poles** of two magnets always **repel** each other.
- **Unlike poles** of two magnets always **attract** each other.
- A magnetic compass works on this principle because the earth is considered as a huge bar magnet with its North and South poles aligned along the geographical South and North Poles respectively.
- **Repulsion** is considered the sure way for testing magnets.

- **Properties of Magnetic field lines**
    - Originate from the North pole and end at the South pole [outside the magnet]
    - They are closed continuous lines
    - Density of the lines increases near the poles and decreases away from the poles

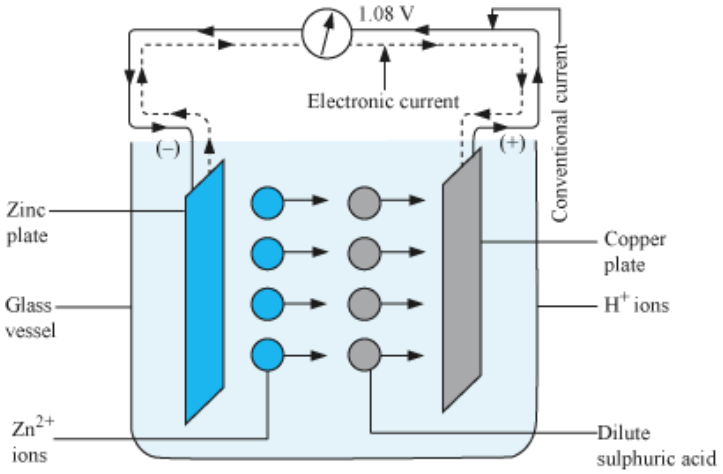
- Lines never cross each other




- Like poles repel and unlike poles attract each other.
- The region where magnetic field lines are crowded has relatively greater strength
- The magnetic poles of the Earth continuously change their position with time i.e., the magnetic North Pole becomes the magnetic South Pole and vice-versa. This phenomenon of flipping of poles is known as **magnetic reversal**.
- The angle of the horizontal plane between the geographic North (true North) and the magnetic North is known as **magnetic declination**.

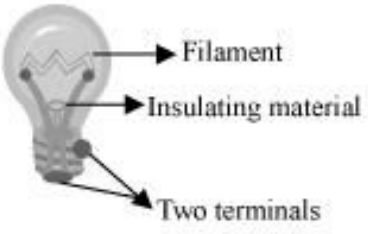
1. When an electric current flows through a wire, it behaves as a magnet. This is called the magnetic effect of electric current.
2. **Electric bell** works on the principle of magnetic effect of electric current.
3. A **compass needle** shows deflection when brought near a current carrying wire.
4. An iron nail behaves as a electromagnet when a current is allowed to flow through a wire, which is wrapped around the nail.
5. Magnet is used to separate iron objects from a heap of garbage.
6. **Types of electromagnet :** Bar-shaped or I-shaped electromagnet and Horse-shoe or U-shaped electromagnet
7. An electric bell works on the principle of electromagnetism.

- Electricity is the flow of electric charges when the negative and positive terminals of an electric cell are connected by a certain substance.
- A simple cell consists of a vessel with two metal rods or plates, known as electrodes, and a chemical substance known as electrolyte.



- **Electric cell:** It is a source of electricity. There are two terminals of a cell – Positive (+) and Negative (–).


- Electricity is generated in a cell because of chemical reactions that take place inside it.
- When all the chemicals stored inside it are used, the cell stops generating electricity.
- **Electric Bulb**




**An electric bulb**

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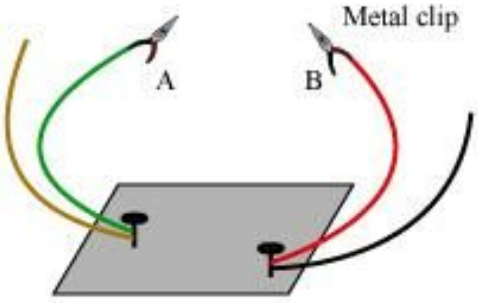
    - A bulb has a filament and two terminals.
    - The filament gives off light when an electric current flows through it.
- **Electric switch:** A switch either breaks or connects the circuit.




**A simple switch**

- The **electric circuit** provides a complete path for electricity to pass between the two terminals of the electric cell.
- In an electric circuit, the **direction of current** is taken from the **positive to the negative terminal** of a cell that is connected to the circuit.

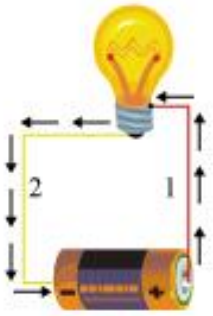
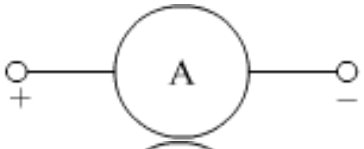
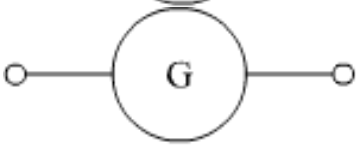
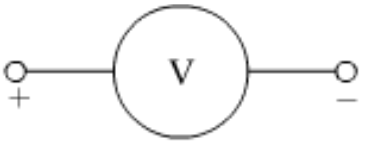



Figure showing direction of current

- A **fused bulb** does not emit light, as no current flows through its filament.
- The main electric component of a **torch** are a cell or a battery, a bulb, and a switch.

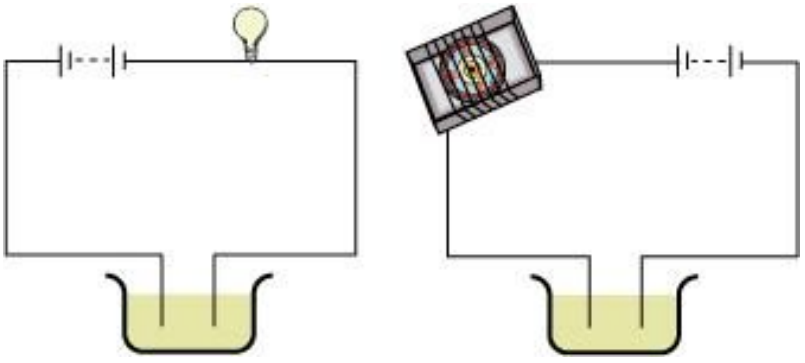
1. **Symbols of Electric components**

| **Electric component** | **Symbol** |
|---|---|
| Electric cell |  |
| Electric bulb |  |
| Battery |  |
| Wire |  |
| Switch in ON position |  |
| Switch in OFF position |  |
| Ammeter |   |
| Galvanometer |   |
| Voltmeter | |




2. **Combination of cells**

Positive (or negative) terminal of a cell is connected to the negative (or positive) terminal of the other cell. This combination is called a **battery**.
3.An unbroken path or line that makes electrical current flow possible through conducting wires connected to other resistances is known as an electric circuit.
4. The circuits where the appliances in connection operates simultaneously once the switch is closed are known as series circuits. In series circuit, the working of each appliance is dependent on each other.
5. The circuits where the working of each appliance present in the circuit is independent on each other are known as parallel circuits.



- The bulb will glow or the magnetic needle will show deflection if the liquid in the beaker is a good conductor of electricity.
- Greater the deflection of needle or brighter the light, better is the conductivity of the liquid.

| Good conductor | Poor conductor |
|---|---|
| Lemon Juice | Coal tar |
| Vinegar | Distilled water |
| Acid solutions | Honey |
| Basic solutions | Vegetable oil |
| Salty water | Kerosene |

- Conducting liquids are also called electrolytes.
- The electric current passing through a conducting liquid (electrolyte) causes chemical reactions (electrolysis).

- Materials which allow electric current to pass through them are called **conductors** of electricity.

- Materials which do not allow electric current to pass through them are called **insulators**.
- Differences between Conductors and Insulators:

| **Electrical conductors** | **Electrical insulators** |
|---|---|
| Electricity can pass through certain materials. These materials are known as electrical conductors. | Electricity cannot pass through certain materials. These materials are known as electrical insulators. |
| All metals (for example, aluminium, copper, iron, and steel) are good conductors of electricity. Therefore, electrical wires are made up of metals such as aluminium and copper. | Few examples of good electrical insulators are plastic, wood, glass, and rubber. Therefore, plastic or rubber is often used to cover electrical wires. |

- Conductors and insulators are equally important for us.