SUBJECT: BASIC SCIENCE
TERM: THIRD
CLASS: JSS 3

MAGNETISM

A magnet is an object which attracts iron filling (small pieces of iron) and settles in a definite North-South direction when freely suspended.

The origin dates back to the early century (about 600 B.C) when a shepherd called magnes was on mount Ida on the Island of Greece. He was strongly attracted to the ground by the tip of his iron staff and the nails in his shoes that he had difficulty in moving away. On digging into the ground to find out the cause, he found a stone with the most amazing property of attracting iron. He called it loadstone meaning leading the way. This is later found to be a naturally occurring magnet, occurring as a mineral ore called Magnetite with the formula Fe_3O_4.

Artificial magnets are obtained when iron metals are stroked with a magnet in one direction or by passing a direct electric current round the iron materials. The artificial magnet also have the properties of natural magnet which are attracting pieces of iron and settles in north-south pole direction when freely suspended.

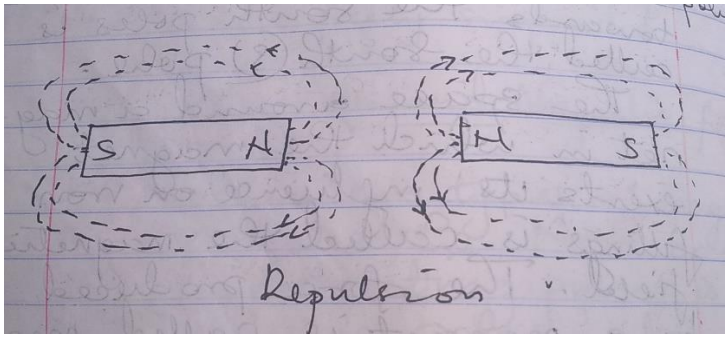
Magnetic Poles and Magnetic Field

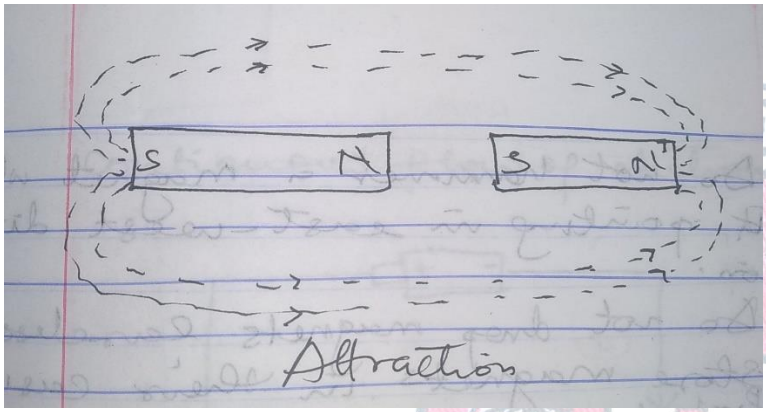
There are two types of magnetic poles, the North and South. Attracting power is greatest at these poles. When a bar magnet is brought near iron filling, the iron fillings are attracted mainly to the end of the bar magnet. A bar magnet suspended so that it swings freely on a horizontal plane will always come to rest with its axis pointing approximately North-South. The pole which is attracted towards the north poles of the earth is called the North (N) pole. The other end (pole) which is attracted towards the south poles is called the South(S) pole.

The space around a magnet in which the magnet exerts its influence on iron fillings is called the magnetic field. The force produced by a magnet is called magnetic force. Line of force is the curved lines made by movement of iron fillings. Several magnetic lines of force make up a magnetic flux.

Laws of Magnetism

Laws of magnetism states that like poles repel each other, unlike poles attract each other. Like poles are two North poles or two south poles. Unlike poles are North and South poles.





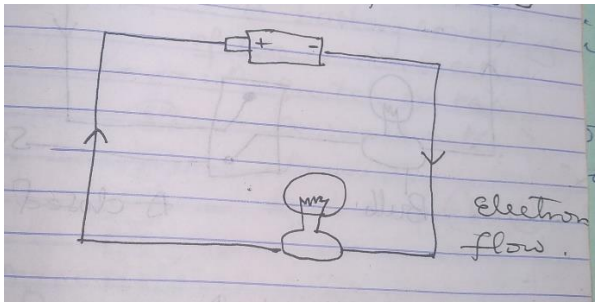
Care for Magnets

A magnet loses its magnetic power with time. This loss of power by a magnet is brought about by a process called demagnetization. When a magnet is carelessly handled, there is a possibilities of losing its magnetic power. In order to protect a magnet from demagnetization the following measure should be taken.

1. Avoid heating or bringing a magnet near fire.
2. Do not hammer a magnet when pointing in east-west direction.
3. Do not drop magnets carelessly
4. Store magnets in their casings.
5. Protect magnets with magnetic keepers when not in use.

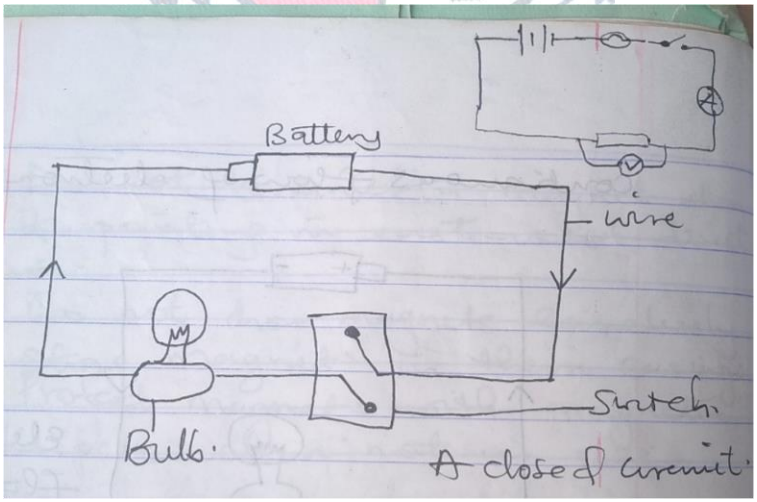
ELECTRICAL ENERGY

The charges that flow through the electric wire are electrons. The flow of electrons gives us electricity. When the two ends of a battery are connected with a wire, current flows from the positive terminal of the battery to the negative terminal. But in actual fact, electrons flow from the negative terminal to the positive terminal giving electricity. An electric current is a continuous flow of electrons.



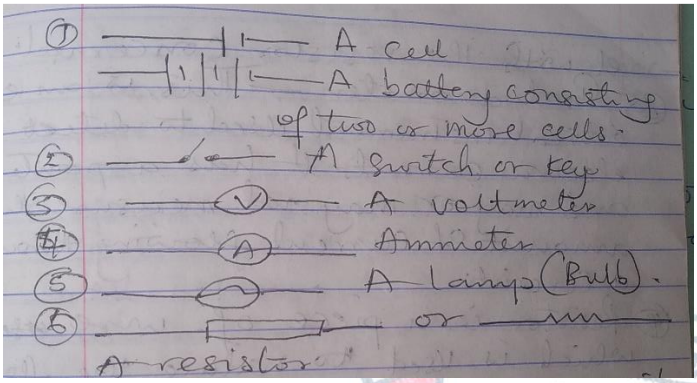
Simple Electrical Circuit

For current to exist there must be a complete path. The complete path through which current passes is called an electric circuit. It is also referred to as a closed circuit. When the path is broken, it is known as an open circuit. A switch is used to make or break a circuit.



Circuit Diagrams

These are diagrams that represent components of a circuit. Different components or pieces of apparatus are indicated by symbols and arranged according to their positions whereby serve specific functions. The following are some of the standard symbols used to represent basic items in a circuit diagram.

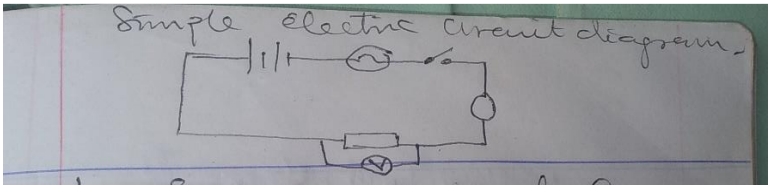


Functions of Some Circuit Components

1. Cell or battery: Each produces electric current and provides driving driving force round the entire circuit(electromotive force)
2. Voltmeter: This is an electrical device that measures the potential difference across a resistor in a circuit. It is always connected in parallel with the resistor concerned.
3. Galvanometer: This is an electrical instrument used to detect an electric current. It has a pointer and may or may not measure the amount of current flowing through a circuit.
4. Resistor is a piece of wire which is used to reduce the flow of current because it opposes the normal flow of current through it.
5. Fuse: This is a safety device that protects electric circuit against over loading ,ie, excess voltage charge within the system.-

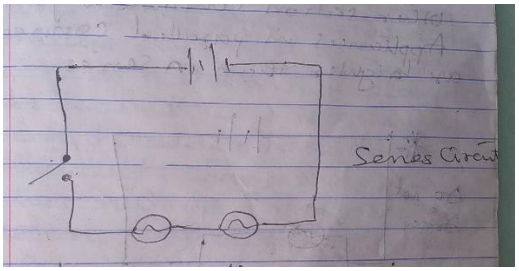
   -Series and Parallel Connection

   Electric circuits may be connected in series or parallel.

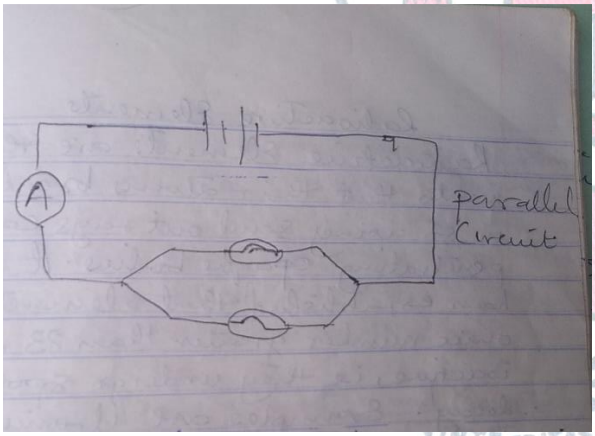


In series connections, electrical components are arranged one after the other. There is only one path for the current and the same amount of current

flows in all sections of the circuit. When one is switched off, the entire circuit is cut off.



In parallel connections there is more than one path for the current flow. Here the bulb are connected side by side, that is, in parallel and their corresponding ends joined together so that the same potential difference is applied to each of them. The current passing through different section is not the same. Household circuit is connected in parallel so that when a section is switched off the other section continue to function. Appliances in parallel connections are brighter than in series.



RADIOACTIVITY

This is the spontaneous disintegration and emission of radiation from a radioactive element or substance. It is a spontaneous process because it is not usually influenced by changes in external factors such as temperature and pressure. Radioactivity takes place at the nuclear level and brings about changes in the composition of the atomic nucleus.

Radioactive elements

Radioactive elements are those elements that their atoms break up and in so doing send out rays capable of penetrating opaque bodies. It has been established that elements of atomic number greater than 83 are radioactive,

ie, they undergo spontaneous decay. Examples are Uranium, Thorium, Protactinium, Radium, Radon, Polonium, Bismuth. Apart from these radioactive elements of heavy atomic nuclei, other examples of radioactive element of light nuclei include isotopes of carbon (carbon-14), Iodine, phosphorus and tritium (heavy hydrogen).

Every radioactive substance is characterized by a period known as its half-life period. Half-life is the period during which half the atoms of a given sample of a radioactive element will disintegrate. It vary with different element from a few minutes to millions of years. E.g. half period of radium is 1620 years.

Types of Radiation and Properties.

It was found that radio-active substances could emit three different kinds of rays which are Alpha (α) rays, Beta (β) rays, and gamma (γ) rays.

Alpha (α) rays are positively charged, hence they are deflected towards the negative plates in an electromagnetic field. They were identified as heavy helium nucleus. They are slow in moving, hence have low penetrating power. They are highly ionizing because they easily attract electrons even from air.

Beta (β) rays are negatively charged in the form of stream of electrons. They move faster with more penetrating power than alpha rays. They are less ionizing. They are negatively charged, hence they deflect towards the negative plate.

Gamma (γ) rays are in form of electromagnetic waves moving with high speed, hence they possess great energy and penetrate most. They have no charge, hence pass through electromagnetic field undeflected. They have weak ionizing power because they are neutral.

Uses of Radioactivity

1. Radioactivity is useful in generation of electricity.
2. Some radioactive elements e.g. Uranium are used in the production of nuclear weapon such as atomic bomb and missiles.
3. High energy gamma rays are used to kill tumors in cancer treatment.
4. It is also useful in detecting fractured bones and examination of internal organs.
5. Gamma rays are used to destroy insect, pest and bacterial pathogens.
6. Radioactive particles are used as tracers to study reaction pathways in researches.
7. Radioactivity is useful in measuring thickness of pipe and detecting leakages in pipelines.

8. Gamma rays can be used to sterilize surgical equipment.
9. Thorium is used in making manths for gas and kerosene lamps because thorium oxide glows brightly when heated.
10. Intravenous injection of phosphorus -32 is a standard method of treating leukemia and other blood diseases.

Dangers of Radioactive Rays

1. Beta rays and gamma rays easily penetrate the body and cause cancer of the various body organs.
2. Increased dosage of radiation in human body can destroy tissues/cells.
3. Radiation may lead to mutation, that is, adverse changes in genetic composition of cells and may lead to undesirable hereditary affects.
4. High-energy radiation from atomic bomb can lead to decimation of life and upset of the ecosystem.
5. Exposure to radiation can cause skin burns.
6. Radium used in paint can cause cancer if paint is ingested.