MADHAV INTERNATIONAL SCHOOL
Affiliated to the Council for Indian School Certificate Examinations (CISCE) - GU031/2014
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Chapter 1: Physical Quantity and Measurement (GRADE-7)

- **Measurement of area: -** The area of plane figure is the measure of the surface enclosed by its boundary. This is called its surface area.
  - The SI unit of area is square metre (m^2).
  - Surface area enclosed by smooth lines or boundaries are called **regular surface area**.
  - Surface areas enclosed by uneven lines are called **irregular surface area**.
  - Regular surface area can be measured using the formula.
  - Irregular surface area can be measured using a graph paper.
    Multiples: - Km^2, hectare, acre
    Sub multiples: - dm^2, cm^2, mm^2
- **Measurement of volume: -**
  - The space occupied by an object is called **volume**.
  - The SI unit of volume is cubic metre (m^3).
  - Volume of regular solid can be measured using formula.
- **Measuring the volume of a liquid: -**
  - Liquid do not have definite shape or size. Take the shape of the container.
  - Measured in millilitres or litres.
    1 L = 1000 ml (or) 1000 cm^3
    1 m^3 = 1,000,000 cm^3 or 1000 litres
- **Measurement of capacity: -**
  - The volume or shape inside a container is known as **capacity**.
  - **Common Measuring Vessels: -**
    Measuring cylinder, Measuring flasks, Pipette, Burettes
- **Measuring volume of an irregular solid: -**
  - Irregular solids are those that have no definite geometrical dimensions.
  - Measuring cylinder or overflow jar is used.
  - Whenever a solid is immersed in a liquid, an equal volume of the liquid is displaced by the solid.
- **Measuring the volume of a solid using measuring cylinder or overflow jar: -**
  - ✓ Initial volume = 60 ml
    Volume of the liquid when the solid is completely immersed = 80 ml
    So, volume of displaced liquid = 80 ml - 60 ml = 20 ml
    So, volume of solid = 20 ml.

- ✓ If the size of solid is large, we use overflow jar.
    - Fill the can completely with the liquid.
    - Immersed the solid completely.
    - Certain amount of liquid will overflow, which is collected in a cylinder.
    - The volume of the collected liquid is equal to the volume of the solid.

- **Density: -**
    - The mass of the substance per unit volume.

$$Density = \frac{Mass}{Volume}$$

    - Equal volumes of different substance have different masses.
    - Equal masses of different substance have different volumes.
    - SI unit of Density is Kg/m^3
      $1\ g/cm^3 = 1000\ Kg/m^3$
    - **Density: A characteristic property of a substance:-**
        - ❖ It is the product of the no. of molecules per unit volume of that substance.
    - **Application of density in real life: -**
        i) Flotation of an iceberg.
        ii) Flotation of a ship made of iron.
        iii) Swimming in sea water.

- **Hydrometer: -**
    - Device use to measure the density of liquids.
    - Lower bulb is made heavy by filling it with mercury or lead shots to keep it upright.
    - The thin narrow stem is graduated in such a manner that the mark up to which it sinks gives the value of relative density.
    - Special hydrometer are designed to test the purity of milk (lactometer) or whether a battery is fully charged (acid battery hydrometer).

- ❖ **Speed: -**
    - Distance covered by the body in unit Time.

$$Speed = \frac{Distance}{Time}$$

    - It is a scalar quantity.
    - SI unit of speed is **m/s**.
    - CGS unit of speed is **cm/s**.
    - Other unit is km/hr.

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Chapter 2: Force and Pressure: Motion (GRADE-7)

- A body is said to be at rest when its position does not change with time with respect to its surrounding.
- When the position of a body changes with time with respect to its immediate surroundings it is said to be in **Motion**.
- Whenever we speak of a body at rest or in motion, we always say this in comparison to a second body, which is known as the reference body.

❖ **Scalar and vector quantity: -**

- A physical quantity that can be described only by its magnitude is called a **scalar quantity**.
- A physical quantity that needs both magnitude and direction for its complete description is called a **vector quantity**.

❖ **Distance and displacement: -**

- The actual length of the path covered by a moving body in a certain interval of time is called the distance travelled by the body.
- The shortest distance covered in a particular direction by a body while moving from one point to another is called its **displacement**.
- **Distance** is scalar quantity.
- **Displacement** is vector quantity.
  SI unit is **meter (m).**
- Distance is always positive.
  Displacement can be both Positive and Negative.
- Distance can never be zero.
  Displacement can be zero.

❖ **Speed and Velocity: -**

- Distance travelled by a body per unit time is called **speed**.
  - ✓ It is a scalar quantity.
  - ✓ Can never be negative.
- Distance travelled by a body per unit time in a given direction is called **velocity**.
  - ✓ It is a vector quantity.
  - ✓ Velocity can be negative.
- **SI** unit of speed is **m/s**.
- $\boldsymbol{Speed} = \frac{Distance}{Time}$
- $\boldsymbol{Velocity} = \frac{Displacement}{Time}$

- **Average speed** of a body is defined as the ratio of the total distance travelled to the total time taken by the body.

$$\boldsymbol{Average\ Speed} = \frac{Total\ Distance}{Total\ Time}$$

❖ **Motion along a straight line: -**

i) **Uniform motion: -** When a body covers equal distance in equal interval of time along a straight line.

ii) **Non-uniform motion: -** When a body covers unequal distance in equal interval of time along a straight line.

❖ **Type of motions: -**

i) **Translator motion: -** The motion in which every point on the moving body moves through the same distance in the same interval of time.

a) **Rectilinear motion: -** If the motion of a body is along a straight line.

b) **Curvilinear motion: -** If the motion of a body is along a curved path.

ii) **Rotatory motion or Circular motion: -** When a body moves about a fixed axis without changing its position, the body is said to have a rotatory motion.

iii) **Oscillatory motion: -** A motion in which a body moves 'to and fro' or 'back and forth' about its mean position.

iv) **Vibratory motion: -** A motion in which a part of a body moves to and fro in a definite style while the rest of the body always remains fixed.

v) **Periodic motion: -** Any motion that repeats itself at regular intervals of time is known as periodic motion.

***All periodic motions need not be oscillatory but all oscillatory motions are periodic.**

vi) **Non-Periodic motion: -** A motion which does not repeat itself after a fixed interval of time.

vii) **Complex or Multiple motion: -** A motion which is a combination of two or more types of motion. The motion in which there is simultaneous occurrence of both rotational and translational motion is called **rolling motion**.

viii) **Random motion or Zigzag or Irregular motion: -** A motion in which a object frequently changes its direction of motion.

❖ **The motion of a simple pendulum as periodic: -**

- If a heavy point mass is suspended by weightless, inextensible and perfectly flexible string from a rigid support, then this arrangement is called a **simple pendulum**.
- The metallic sphere is called **a bob**.

➢ **Point of suspension: -** It is fixed point in a rigid support from which the pendulum is suspended.

➢ **Point of oscillation:** - The centre of gravity of the pendulum.

➢ **Length of the pendulum:** - This is the distance between the point of suspension and the point of oscillation of the pendulum.

- **Mean position (or) rest position:** - It is the position of the bob when the freely suspended pendulum is at rest.
- **Extreme position or turning point:** - The positions of the bob at the maximum distance on both sides of the mean position up to which the pendulum can oscillate are called **extreme positions**.
- **One Oscillation: -** One complete to and fro movement of a pendulum about its mean position.
- **Amplitude: -** Maximum displacement of the pendulum from its mean position.
- **Time period: -** Time taken to complete one oscillation.
- **Frequency:** - No. of vibrations in one second.
  Its unit is hertz (Hz).

$$So, \quad \boldsymbol{F = \frac{1}{T}}$$

- **Force: -** A physical cause which changes either the size or shape, or sets a body into motion or brings a body at rest.
  - **SI** unit: Newton (N)
  - **CGS** unit: dyne (dyn)
    1 N = 10^5 dyn
  - Force can be contact or non-contact.
  - It is a vector quantity.
- **Weight: -** The force with which the earth surface attract the body.
  SI unit is Newton (N). Also, measured in kilogram-force (kgf)
  1 kgf = 10 N
  W = mg
  - The weight of a body is not the same at all places on the earth.
  - Maximum at the poles and minimum at the equator.
  - It is because acceleration due to gravity is maximum at the poles and minimum at the equator.
  - Force of gravity decreases with altitude.
  - Spring balance is used to measure weight.
  - **Electronic balance**: It is very sensitive and accurate balance. Used in laboratory and in a jeweller's shop.
  - SI unit is Newton (N).

Mass	**Weight**
✓ Amount of matter in a substance.	✓ The force of gravity acting on a body.
✓ SI unit is Kilogram (Kg).	✓ SI unit is Newton (N).
✓ Mass remains constant.	✓ Weight varies.
✓ Measured by physical or beam balance.	✓ Measured by a spring balance.

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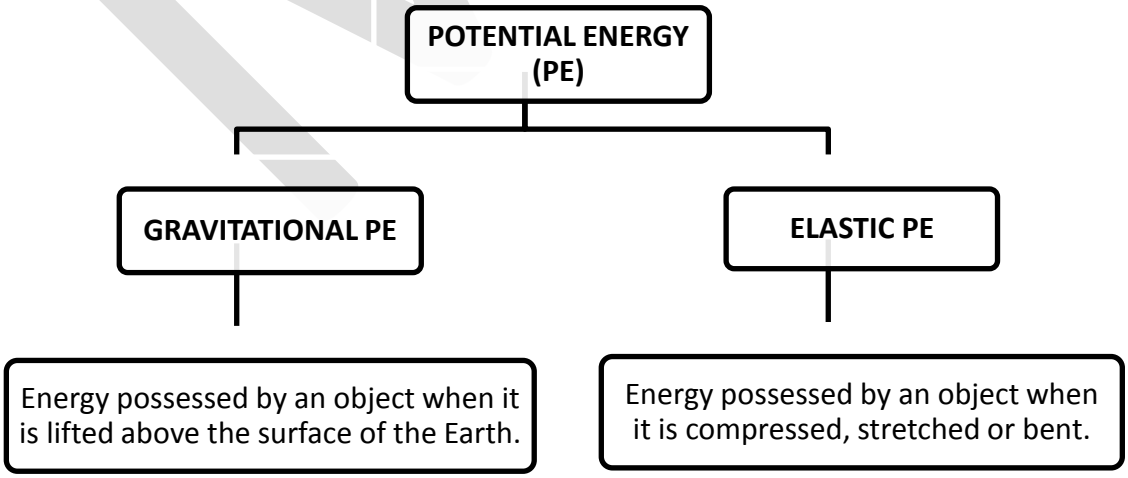
Chapter 3: Energy (GRADE-7)

- **Energy** is the capacity to do work.
- It is due to its state of motion, position or its configuration.
- SI unit of energy is joule (J).
- CGS unit of energy is erg.
  1 J = 10^7 erg
- Heat energy is usually measured in calories.
  1 cal = 4.2 J.
- 1 Calorie is the energy required to raise the temperature of 1g of water by 1 ^{0}C.
- Other units are watt hour, kilowatt hour and electron volt.

❖ **Forms of energy: -**

1. **Mechanical Energy: -** It is the energy possessed by a body due to its position, configuration or state of motion.
   a. **Kinetic Energy:** The energy possessed by virtue of its motion.
   $$K = \frac{1}{2}mv^2$$
   b. **Potential Energy (PE):** The energy stored in a body as a result of its position, shape or change in configuration
   $$\mathbf{PE = mgh}$$
   Potential energy depends on mass and height.



2. **Heat Energy: -**
   - Invisible form of energy gives sensation of hotness and coldness.

- Get by burning of coal, wood, oil etc.
- Petrol are used to run vehicles.

3. **Light Energy: -**
    - Light energy is used by green plants for the process of photosynthesis.
    - Enables us to see the object around us.
4. **Electrical energy: -**
    - One of the most useful forms of energy.
    - Used to produce heat and light.
    - Also, used to produce motion and sound.
5. **Magnetic Energy: -**
    - Every possessed by a substance that has the property of attracting iron.
    - Used in factories scrap iron is separated from other waste material.
6. **Chemical Energy: -** It is energy stored in an object or material and is released during chemical reactions.
7. **Sound Energy: -** It is form of energy produced due to vibration of a body.
8. **Nuclear Energy: -**
    - When the nucleus of an element like uranium is split apart, tremendous amount of energy is released in the form of heat. This energy is called nuclear energy.
    - Nuclear energy can be used for constructive as well as destructive purposes.
    - In an atom bomb, nuclear energy is released which can be very destructive in nature.
    - It is also used in treatment of diseases like cancer.

❖ **Law of conservation of energy: -** The principle of conservation of energy states that energy can neither be created nor destroyed. The total energy of the universe remains constant. Energy can only be transferred from one form to another.

❖ **Transformation of energy: -**

1. **Electrical into sound energy: -** Loudspeaker, Electrical bell and stereo system.
2. **Heat into electrical energy: -** thermocouple, thermoelectric power station etc.
3. **Solar into heat energy: -** Solar cooker and solar furnaces.
4. **Electrical into heat energy: -** electrical heater, electric iron, room heater, geyser, toaster etc.
5. **Electrical into mechanical energy: -** Table fan, Washing machine etc.
6. **Electrical into light energy: -** tubes, bulbs etc.
7. **Light energy into electrical energy: -** Photocell
8. **Electrical into chemical energy: -** While charging battery.
9. **Chemical into electrical: -** in a dry cell.
10. **Mechanical into electrical energy: -** Dynamo
11. **Chemical into heat energy: -** Burning of fossil fuel.
12. **Chemical into mechanical energy: -** Automobiles

13. **Light into chemical energy: -** Photosynthesis
14. **Sound into electrical energy: -** microphone
15. **Heat into mechanical energy: -** Steam engine

❖ **Energy chain: -**

- The sun is the main source of energy on the Earth.
- Green plants converts solar energy into chemical energy by the process of photosynthesis.
- This chemical energy is stored in the plants in the form of sugar.
- Chemical energy stored is transferred to living being in the form of their food and it remains stored in their body.
- When dead plants and animals remain buried under the earth for millions of years, they get converted into fossil fuels like coal and petroleum.
- When these fuels are burnt in a thermal power plant, electricity is produced, which is supplied to our houses.
- This process of transfer of solar energy into electrical energy makes an energy chain in nature.

❖ **Source of energy: -**

1. **Energy from sun:**
   - Sun is the ultimate source of energy.
     Application:
     - ✓ Solar cooker, solar cell, furnance etc.
     - ✓ Causes water cycle in nature.
2. **Energy from flowing water: -** Electricity produced by water is called **hydroelectricity**.
3. **Energy from wind: -**
   - Wind energy can turns the blades of wind mill. Which is used to pump water from ground.
   - Sailing of boat.
4. **Energy from biomass: -**
   - Garbage, industrial waste, crop residue, sewage, wood bushes, cow dung etc form biomass.
   - It decomposed in the absence of oxygen to produce methane gas.
   - The residues are used as manure.
   - Biogas is a cheaper and cleaner fuel.
   - Gobar gas plants are becoming popular in our villages.
5. **Energy from fuels: -**
   - Substances like wood, coal, petrol etc. burnt to produce large amount of heat.
   - They are used as a fuel.
   - Coal and petroleum are **fossil fuels**.

6. **Energy from sea wave: -** Sea tides are used in a turbine to produce electrical energy.
7. **Energy from the nucleus of an atom: -** Nuclear energy is obtaining by splitting the nucleus of an element. This called **nuclear fission**.

❖ **Why does an object move when a force applied on it?**

It is because the force increases the level of energy of the object. It gives the object the ability to move in the direction of the force.

So, Work = Energy

❖ **Conservation of sources of energy: -**

- The energy which cannot be renewed are called as non-renewable source of energy.
- Source of energy which are abundant in nature are called renewable source of energy.
- They are also termed as alternate source of energy.

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Chapter 4: Light Energy (GRADE-7)

- Light is a invisible form of energy which causes the sensation of vision.
- The speed of light in air or vaccum is **3×10^8 m/s.**

❖ **Reflection of light:**

- The bouncing back of the light rays from the surface of an object.
- When a ray of light, traveling from a source, strikes the surface of an object, following situations can arise:
  i) Transmission of light
  ii) Absorption of light
  iii) Reflection of light

❖ **Types of reflection:**

1. **Regular reflection:**
   - Occurs when a parallel beam of light falls on a smooth and polished surface.
   - The reflected rays are also parallel to each other and they reflect in a fixed direction.
2. **Diffuse or irregular reflection:**
   - Occurs when a parallel beam of light, traveling through any medium, strikes a rough surface and gets reflected in various directions.
   - It is this diffused light which enables us to see the object around us.

❖ **General terms related to reflection of light:**

- **Mirror:** Any smooth polished surface which can reflect back the rays of light into the same medium.
- **Incident ray:** A light ray travelling from an optical medium which strike a reflecting surface.
- **Point of Incidence:** The point at which the incident ray strikes the reflecting surface.
- **Reflected ray:** The light ray that bounce off a reflecting surface into the same medium in which the incident ray is travelling.
- **Normal:** The perpendicular drawn to the reflecting surface at the point of incidence.
- **Angle of incidence** is the angle which the incident ray makes with the normal at the point of incidence.
- **Angle of reflection:** The angle which the reflected ray makes with the normal.
- **Plane of incidence:** The plane containing the reflected ray and the normal

- **Plane of reflection:** The plane containing the reflected ray and the normal.
- **Difference between Real Image and Virtual image:**

Real image	Virtual image
➢ Image that can be taken on screen.	➢ Image that cannot be taken on screen.
➢ After reflection/refraction actually intersect each other.	➢ Do not actually intersect but appears to diverge from it.
➢ It is always inverted.	➢ Always react but laterally inverted.

❖ **Laws of reflection:**

i) The incident ray, the reflected ray and the normal to the reflecting surface at the point of cadence lie on the same plane.

ii) The angle of incidence is always equal to the angle of reflection i.e. $\angle i = \angle r$.

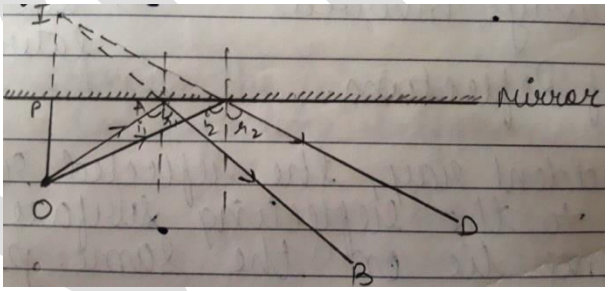
- The laws of reflection are equally valid for both regular and irregular reflections.

❖ **Lateral Inversion:** The phenomenon of right appearing left and left appearing right on reflection in a plane mirror.

- Letters A, I, O, H, V, T, M, W remains unchanged.
- The front of an ambulance the word is written as **ECNALUBMA**. Because the driver of the vehicle ahead looking at it in the rear view mirror, will read as **AMBULANCE**.

❖ **Formation of image in a plane mirror:**

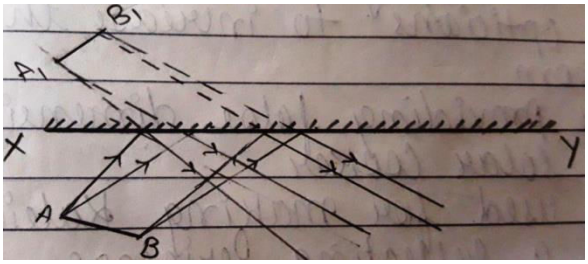
➢ **Image of a point object:**



- Take a white sheet of paper and place a mirror parallel to it.
- Place appoint object O in front of the mirror.
- From point O, rays of light will travel in all directions.
- The diagram shows only two rays, marked OA and OC, which enter the eye after reflection from the mirror.
- The reflected rays AB and CD appear to come from the point I behind the mirror.
- The eye sees the reflection of the point object O at I in the mirror.
- The image appears to be inside the mirror and cannot be obtained on a screen.
- So, all plane mirrors form virtual images.
- The position of the image 'I' can be located by producing the rays BA and DC. They meet at the point I.

- It is found that OP=IP.
  i.e. the image is as far behind the mirror as the object is in front of it.

➢ **Image of an extended object:**



- Consider AB, a small pencil as an extended object in front of a plane mirror XY.
- Two rays starting from A, incident on the mirror, get reflected following the laws of reflection.
- To an observer these reflected rays appear to come from A_1.
- Similarly, two rays starting from B, after reflection from plane mirror, will appear to diverge from the point B_1.
- Thus, $A_1B_1$is the virtual image, laterally inverted, erect, equal in size and is formed as far behind the plane mirror as the object is in front of it.

➢ **Characteristic of image formed by a plane mirror:**

i) Image is virtual.
ii) Image is upright/erect.
iii) Image is of the size as the object.
iv) The image is laterally inverted.
v) Image is formed as far behind the mirror

➢ **Uses of plane mirrors:**

i) Used as looking glass.
ii) Used by opticians to increase the effective length of the room.
iii) Used for providing false dimension in show case.
iv) Used in solar cooker.
v) They are used for making Kaleidoscope.
vi) Used in a reflecting Periscope.

❖ **Colours:**

- The sunlight [white light] constitutes seven colours of light.
- Light is a basically composed of three chief colours Red, Blue and Green called as primary colours.

➢ **Colours Addition:** Colours that are formed by combination of any two primary colours are called secondary colours.

✓ Red + Blue = Purple/Magenta
✓ Red + Green = Yellow
✓ Blue + Green = Cyan
✓ Red + Blue + Green = White

* **The secondary colours obtained by mixing primary colours are different because paints contain pigments which are not colours of light.**

✓ Cyan + Magenta = (B + G) + (B + R) = Blue

✓ Yellow + Cyan = (R + G) + (B + G) = Green

✓ Yellow + Magenta = (R + G) + (B + R) = Red

- Absorption of all colours gives black appearance.
- Reflection of all colours gives white appearance.

Examples:

A yellow marigold flower when viewed in sunlight appears yellow because it absorbs blue and reflects both red and green.

➢ **Colours Subtraction:**

- Pigment reflects when what is does not absorb.
  - When paints are mixed together the result is the sum of their absorption characteristic. That is the why this is known as colour subtraction.

    ✓ Cyan + Yellow = (Blue + Green) + (Red + Green)
    Cyan absorbs Red.
    Yellow absorbs Blue.
    Hence Green colour is obtained.

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Chapter 5: Heat (GRADE-7)

- Heat is a form of energy which causes the sensation of hotness or coldness.
- The degree of hotness or coldness of a body is called its **temperature**.
- The energy transferred from one body to another due to a temperature difference between them is called heat.
- The flow of this energy is always from a body at a higher temperature to a body at a lower temperature.
- Heat is commonly measure in Calorie.

  1 Calorie: The amount of heat energy required to raise the temperature of 1 g of water through 1^0C.

  1Kilocalorie = 1000 Calorie

  The SI unit of heat is Joule (J).

  1 Cal = 4.86 J

❖ **Effects of heat:**

i) Change in temperature
ii) Change in dimension
iii) Change in state
iv) Chemical change
v) Biological change

❖ **Fire:**

- Fire is a rapid, sustained chemical reaction that produces heat and light.
- Accompanied by a flame.
- Flame is the visible manifestation of fire.
- Material can be:
  (i) Combustible/Inflammable
  (ii) Incombustible/Non-inflammable
- Those substances which catch fire very easily are called combustible substance.
- Those substances which do not catch fire easily are called incombustible substances.

❖ **Temperature:**

- The human body is quite sensitive to the changes in temperature.
- But our sense of touch is neither accurate nor perfect.
- Measurement of temperature by our sense organs cannot done correctly.
- Hence, the instrument is used for measuring temperature called thermometer.

- Liquid thermometer is most commonly used thermometer which is based on volume expansion of liquid.
- The two commonly used liquid are mercury and alcohol.

➢ **Mercury Thermometer:**

- Consist of a thick walled capillary tube of uniform bore having a cylindrical bulb of suitable size at one end.
- The bulb and tube are completely filled with mercury by alternate heating and cooling.
- A thermometer has two fixed point
  - i) A lower fixed pint: - Ice point
  - ii) A upper fixed point:- Steam point

✓ **Setting the lower fixed point:**

- A bulb containing thermometer is placed inside a funnel containing ice in surrounding.
- This arrangement helps to maintain constant temperature of 0^0C.
- The mercury inside the bulb contract due to cooling and its level falls till it reaches 0^0C.
- It is kept about 10-15 minute
- As the mercury stop contracting, this level is marked 0^0C.

✓ **Setting the lower fixed point:**

- A bulb containing thermometer is kept inside a flask of boiling water such that bulb does not touch the surface of boiling water.
- It is kept for 10-15 minute till mercury stops expanding and its level becomes fixed.
- Now the intervals between two mark points are divided into 100 equal divisions.

➢ **Reasons for using mercury as thermometric liquid:**

i) Mercury absorbs less heat from a body in order to attain its temperature.
ii) It has uniform contraction and expansion.
iii) It has high boiling point (357^0C) and low freezing point (-39^0C). So, it can be used to measure a fairly wide range.
iv) Volume expansion is fairly large.
v) Can easily seen through glass.
vi) Does not stick on wall.
vii) Easily obtained in pure form.
viii) It is non-volatile.

➢ **Reason for using alcohol as a thermometric liquid:**

i) Its freezing point is -114^0C and hence can record very low temperature.
ii) The expansion is much more and hence more sensitive (6 times of mercury)
Range of mercury thermometer: - -38^0C to 356^0C
Range of alcohol thermometer: - -114^0C to 78^0C

➢ **The parameters of temperature scale:**

Scale	Celsius	Fahrenheit	Kelvin
Symbol	^{0}C	^{0}F	K
Measure of each equal part	1^{0}C	1^{0}F	1K
Lower fixed point	0	32	273
Upper fixed point	100	212	373
No. of division	100	180	100

So, $\frac{C}{5} = \frac{F-32}{9}$ **or** $\frac{C}{100} = \frac{F-32}{18}$

Temperature in Kelvin = temp in ^{0}C + 273.

❖ **Difference between Heat and Temperature:**

Heat	Temperature
• Form of energy.	• Degree of hotness/coldness.
• Not a measurable quantity.	• Measured with thermometer.
• SI unit is joule.	• Kelvin.

❖ **Transferred of heat:**

- Heat is always transferred from a hot body to a cold one.
- The flow of heat continues till both the bodies acquired the same temperature.
- The Two bodies are then in a state of thermal equilibrium.
- **There are three distinct ways of transmission of heat:**
  1. Conduction
  2. Convection
  3. Radiation

➢ **Conduction** is the process of transfer of heat from the hot end to the cold end of a body without any actual visible movement of the material of the body.

- It mainly occurs in solid.
- When one end of a solid is heated molecules at this in gains energy and start vibrating rapidly.
- The vibrating molecules collide against the neighbouring molecules and make them vibrate with greater speed.
- These in turn, make the molecules next to them vibrate faster.
- This process continues until the vibrations have been transmitted to all molecules and the entire body has become hot.
- Material which Allow heat to pass through them easily are called wood conductors of heat. Examples silver, copper, gold, graphite etc.
- Materials which do not allow heat energy to pass through them easily are called Poor or bad Conductors or insulators. E.g. glass, clay, plastic, etc.

➢ **Application of Good Conductors:**

i) Cooking utensils

ii) Boilers

iii) Mercury used in thermometer

iv) Cooling coils in refrigerators and air Conditioners are made up of copper as they easily conduct away the heat.

v) Copper tubing used in automobile radiators.

- **Application of Bad Conductors:**
  - i) Cooking vessels are provided with ebonite / wooden handle.
  - ii) Woolen Clothes are Comfortable in winters.
  - iii) Sawdust used to cover ice blocks.
  - iv) New quilt is warmer than older one.
  - v) Ice boxes & refrigerators have inner linings of glass wool.
  - vi) Birds puff up their feathers in winter.
- **Convection:** The process of transmission of heat from one place to the other by actual movement of the heated particles.

- In the case of water, heat is transmitted through water by convection.
- Motion of water itself is responsible for the transmission of heat.
- Convection is responsible for transmission of heat through fluids.
- In the process of Convection, Molecules of the fluids come in contact with the source of heat.
- They take some heat and move away.
- But in Solid, molecules are firmly, bound together and cannot move freely.
- **Heat Cannot be transferred by convection in vacuum**, as it needs a medium.
- The transfer of heat is always vertically upwards.
- Because heated molecules become lighter and rise up while the colder move down.
- Thus, a circulatory movement is set- up in the fluid which is Called Convection Current.
- The Current continues till the entire liquid acquires the same temperature.

- Convection in liquid is explained by heating some crystal of Potassium permanganate by Convection.
- Convection in air can be demonstrated by burning incense stick.
- **Applications of Convection Currents:**

(i) Land and sea Breeze:

- Land becomes hotter or colder more rapidly than water.
- During day time, the land gets heated more quickly than sea water, Hot air, above the land being lighter rises up and cold air from the sea move towards the land. Thus convection current is set up which gives sure to Sea breeze.
- During the night, the land cools more quickly than sea water, so hot air above the sea rises up and cold air moves from the land towards the sea, this gives rise to a Convection current which result in land breeze.

(ii) Winds:

- Winds are convection Currents of air.
- Due to the heat from the sun, some parts of the earth's surface become hotter than others.

- The warm air in this region being lighter rises up and cooler denser air takes its place. This causes wind.

(iii) **Ocean Currents:**

- The ocean water near the equator is heated by the sum to a much higher temperature than the water near the poles of the earth.
- This is because sun rays falls directly on equatorial region & slantingly In the polar region.
- The ocean water in equatorial region expands and becomes lighter, but the walls in the polar region remains cold & heavy.
- Therefore current flows from equator to poles.
- These currents control the temperature of the ocean & are called Oceanic current.

(iv) **Ventilation:**

- The air we breathe out is hotter and lighter.
- Ventilators on the top of the room provides outlet for the stale & warm air.
- While fresh air enters through doors & windows.

(v) **Chimney:**

- This are fitted over the furnance in factories to remove undesirable gases and smoke.
- The smoke or hot gases being lighter rise up and escape through the Chimneys.

(vi) **Central Heating of Buildings:**

- In winter, the buildings are heated centrally on the principle of convection current.
- Hot water system includes a furnance, boiler and radiators.
- Radiators in room are connected by pipes to a boiler which is heated by the furnance.
- The furnance & boiler are in the basement.
- The furnance heats the water to about 82^0C.
- Convection carries the hot water up through the pipes to the room radiators.
- Heat is released into the rooms from the radiators as the hot water cools.
- Cooler water in the radiator sinks back down and replaces the rising water in the boiler.

(vii) **Installation Of Air Conditioners:**

- AC is installed near ceiling above the window level for effective cooling.
- The cooled air being denser descends down & warm air rises up & convection Current is set.

➢ **Radiation:**

- The process of heat transfer from a hot body to a cold one without the help of any material medium or without heating the intervening medium.
- It can travel a long distance in vacuum.
- The heat energy, which is transferred by the process of radiation is called radiant heat or thermal radiation.

✓ **Emission of radiant heat:**

- All hot objects emit radiant energy.
- The rate at which a body radiates heat depends on:

i) Its temperature.
ii) Its colour & nature (dull or Shiny).

✓ **Absorption of radiant heat:**

- When radiant heat falls on a body, the body absorbs part of it & reflects the rest.
- The body becomes warm because of the absorbed radiations.
- If a body absorbs more radiation and reflects less, then it is a good absorber.
- If a body absorbs less radiation and reflects more, then it is a poor absorber & good reflector.

Good absorbers are also good radiators & vice - versa.

➢ **Application of Radiations:**

i) For rapid heating, cooking utensils are blackened at the bottom. Outer surface of teapots are brightly polished to minimize heat loss.
ii) White & light Coloured shirts are preferred during summer. During winter we prefer black and dark clothes.
iii) Radiators in car & AC are painted black.
iv) A cloudy night is found to be warmer.
v) The inner planets are warmer than outer planets.

❖ **Thermos flask:**

- It is a special kind of flask or bottle that keeps liquid hot or cold for a long time.
- It was invented by Sir James Dewar in 1890.
- So it is also called Dewar flask.

➢ **Construction:**

- It is a double walled glass vessel.
- The outer surface of the inner wall & inner surface of its outer wall are silvered.
- The air between the two walls is removed and is sealed to make the Space between the two walls almost vaccum.
- The mouth of the bottle is fitted with a stopper, made of Cork, Plastic or some other good insulator of heat.

➢ **Working:**

- It minimize heat transfer by conduction, convection and radiation –

i) The vaccum in between the walls of the bottle prevents heat transfer by conduction & convection.
ii) The silvered surface minimizes the heat transfer by radiation.
iii) The stopper being a very poor Conductor of heat minimizes the heat transfer through the neck.
iv) As glass itself is a bad conductor of heat, the glass walls conduct very little heat.

Thus sum total of the heat transfer being very small, cold liquid remains Cold & hot liquid remain hot for several hours.

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Chapter 6: Sound (GRADE-7)

- Sound is a form of energy that produces a sensation of hearing in our ears.
- Sound is produced by the vibrations of a body.
- Vibrations is a rapid back and forth movement of a body.
- Sounds travels in the form of waves.
- Even though we do not see them, the vibrations travel to our ears.
- Not all sounds are audible to human ears. The audibility depends on the no. of vibrations per second (frequency).
- Frequency less than 20 Hz i.e. infrasonic sound & greater than 20,000 Hz i.e. ultrasonic sound is not audible to human ears.

❖ **Sources of sound:**

(i) By Human beings:

- Human beings have a voice box called larynx.
- Two ligaments, commonly known as vocal cords are stretched across the larynx.
- Such that it leaves a narrow slit between them for passage of air.
- When our lungs force air through them, they vibrate and produce sound.
- The frequency is changed as the muscles attached to the vocal cords increase or decrease their pull.
- When the vocal cords are tight and thin, the voice is of high frequency.
- If it is loose and thick, the voice is of low frequency.
- Women have shorter vocal chords than men whereas children have very short vocal cords. That is why voices of women and Children are shrill (high frequency).

(ii) By Animals:

- Animals like dogs, Cats, frogs & cow make sound with the help of their voice boxes.
- Birds produce sound by means of ring of cartilage, called syrinx.
- Some birds have two parts in their voice box, so they can produce two notes at the same time.
- Mosiquitoes, bees and some other insects make buzzing sound by rapidly vibrating their wings.

(iii) **By different musical Instruments:**

- Depending on their shape and size, produce different type of sound which is regular and pleasant.
- Some musical instruments are violin, guitar, harmonium, tabla, etc.

❖ **A Propagation of sound waves:**

- When a body vibrates, these vibrations then pass through a Medium in the form of waves.

- In a wave the particles of the medium vibrate about their mean position.
- The energy of the sound is transferred by the vibrating particles from the source of sound.
- The regions in which vibrating particles are pushed close to each other are called compression.
- Those in which they are away from each other are called rarefraction.
- One complete to and fro motion of strip produces one compression and one rarefraction which together is called one wave.
- The particles which vibrate in the direction of propagation of sound is called longitudinal wave.
- Material medium is necessary for the propagation of sound i.e. cannot travel in vacuum.
- We can hear the sound of the train through rails much before the sound reaches through the air. This is because the speed of sound in steel is very fast as Compared to air.
- Light travels faster than sound.
- Sound travel slowest in gases, faster in liquid and fastest in solid.
- Any Object travelling with a speed greater than the speed of sound is said to be having supersonic speed.

❖ **Reflection of sound:**

- The phenomenon of returning back of sound on striking a surface is called reflection of sound.
- The laws of reflection are obeyed by sound but the surfaces which reflect sound need not be smooth and polished.
- The reflection of sound is used in megaphone, sound bands and ear trumpet.
- Metallic sheets are good reflector, whereas plywood, solid wall, carpets, spongy articles are bad reflector i.e. they absorb most of the sound.

➢ **Application:**

(i) Echo:

- The reflected sound that can be distinguished as the repetition of the original sound is called an echo.
- It is due to reflection of sound.
- Ordinarily, it is not heard because it gets merged with the original sound.
- The sensation of any sound persists in our ear for about 0.1 second, after the original sound heard dies off. This is known as the Persistence of hearing.
- If an echo is heard within this time interval the original sound, and its echo is not distinguished.
- So, an echo is only heard, if sound reaches the ear after 0.1 second after only original sound dies.
- If sound takes 332 m/s, the distance travelled by sound in 0.1 second is 33.2 m.
- So, if the obstacle is at distance of at least 16.6 m and Size of the reflector should be large.
- Also, Sound produced must have enough intensity or loudness.

$$\textbf{Speed of sound} = \frac{\textbf{total distance travelled by Sound}}{\textbf{time taken}}$$

or

$$V = \frac{2S}{t}$$

- Bats interpret the echo to determine the size and shape and the direction of motion of the objects.
- Dolphins also emit high - frequency sound wave to detect fish at night or in muddy water and also to avoid fishing nets.

➢ **Reverberation:**

- Reverberation is the Persistence of sound after the original source has stopped producing sound.
- It often occurs in a small room with height, width and length of approximately 17m or less.

(ii) SONAR:

- Sonar is the short form of Sound Navigation and Ranging.
- It is a technique used for determining the depth of water and locating underwater objects like reefs, Submarines shoal of fish, etc.
- It consists of an ultrasonic transmitter and receiver mounted on the bottom of a ship.
- A short signal of ultrasonic sound is sent towards the bottom of the ocean.
- After reflection from the ocean floor, the signal returns and is reflected by the receiver.

❖ **Absorption of sound**:

- It is the process by which material or an object takes in sound energy when sound waves strike it.
- Part of energy is transformed into heat energy and part of it transmitted through the absorbing bodies.

Question: Why is sound not heard outside a theatre hall?

Answer: Because sound is absorbed by material that covers the Ceiling, walls, floor, heavy thick curtains and furniture. Which take in sound energy and no reflection of sound; we hear one main sound.

❖ **Common terms related to sound:**

i) **Oscillation:** One complete to and fro motion of a vibrating body about its mean position that constitutes one full wave.

ii) **Wavelength**: The length of the wave along the x-axis.

iii) **Amplitude:** The maximum displacement of a vibrating body on either side of the mean position.

- ✓ Larger the amplitude, greater the sound produced.

iv) **Time period:** The time taken by a vibrating body to complete one vibration.

v) **Frequency:** The number of complete vibrations made in one second.

- ✓ Denoted by ‘F’ or 'n'.

- ✓ Measured in hertz (Hz).

❖ **Uses of ultrasonic Sound:**

i) A special whistle called Galton's Whistle produce frequencies greater than 20,000 Hz, used to train dogs.
ii) Bat produces ultrasonic sound to detect any prey or obstacles in their path.
iii) Bats & Dolphin use to locate any obstacles.
iv) Used by fisherman to locate shoal of fish in the sea.
v) Used in SONAR.
vi) Used in dish washing machines.
vii) In homogenizing milk.
viii) For scanning and imaging internal organ of the human body.
ix) Used in treatment of muscular pain & 'arthritis'.
x) Used to detect faults in metal sheet.

❖ **Characteristics of sound:**

- One Sound differs from the other in three fundamental properties called Characteristic. These are:
  - **i) Loudness**
  - **ii) Pitch**
  - iii) **Quality**

➢ **Loudness:**

- Loudness of a sound is the degree of sensation of a sound produced in the ear.
- Loudness depends upon the following factors:
  - **i) Response or Sensitivity of the Ear for sound of that frequency.**
  - ii) **Amplitude of vibrations:**
    - Greater the amplitude louder is the sound.
    - A man and Child, both may shout the same note, having the same frequency, but the amplitude and the loudness of the sound wave produced by the man are greater than that of the child.
  - **iii) Area of a vibrating Body**:
    - Larger the area, louder is the sound produced. E.g. bell, drum.
  - **iv) Distance from the source:**
    - Loudness decreases with the increase in distance of the listener from the source.

➢ **Pitch:**

- It is that characteristic which determines the Shrillness of a sound.
- The pitch of a sound depends on the following two factors.
  - i) **Frequency of a vibrating Body:**
    - With increase in frequency, the pitch of sound increases
      Higher frequency -> shrill effect
      Lower frequency -> Bass effect
  - ii) **Relative motion between the source and the listener:**

- Closer the source, higher the frequency (pitch & vice – versa).
- Pitch is a subjective property & cannot be measured.
- Frequency is measurable quantity.
- Same frequency may have different pitch for different listeners.

➢ **Difference between loudness and pitch:**

Loudness	Pitch
1. It is the property of a sound virtue of which a loud sound can be distinguished from a faint one	1. It is that Characteristic of a sound by which a shrill sound can be distinguished from a flat sound.
2. It depends on the amount of sound energy received by the ears per unit time.	2. It does not depend upon it.
3. It does not depend on frequency of a sound.	3. It changes with change in frequency.

➢ **Quality Or Timber:**

- The quality of sound depends on the source of sound.
- Two sounds can have the same frequency, same amplitude but they will sound different if their sources are different.
- The sound of single frequency is called Mono tone.
- Collection of tones is called Note.
- In a note, the minimum frequency is called the fundamental tone and the rest of the frequencies are called overtones.
- The multiples of fundamental frequency are called harmonics. For example, in a note of 5 Hz, 7 Hz, 10 Hz, 15 Hz & 18 Hz. 5 Hz is Called fundamental tone rest are termed as overtones.
- Among these overtones, the whole number multiplies of the fundamental tone like 10 Hz & 15 Hz are called harmonics.
- The quality of sound is determined by the presence of harmonic and overtone in it.
- Greater the no. of overtones, more musical is the sound.

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Chapter 7: Electricity and Magnetism (GRADE-7)

- Electricity is a physical phenomena associated with the flow of electric Charge.
- A Greek philosopher, Thales, in 6OO BC noticed this effect for the first time.
- He found that the amber could pull small bits of paper towards it.

❖ **Current Electricity**:

- Atoms of a metal contain very loosely bound electrons drift in all direction.
- When these free elections are forced to flow in one direction, they constitute electric current.
- Current electricity is controlled flow of elections along a fixed path.
- The amount of work done in moving unit Charge from one point to the other is known as potential difference.
- The directed flow of elections in a conductor is called electric current.
- This continues till the potential difference between the two ends becomes zero.
- Conventionally, current flows from +ve to –ve.
- Current is the amount of charge flowing in one second across the Cross - section of conductor.

$$\textbf{Current}\ (\mathbf{I}) = \frac{\textbf{Charge}\ (\mathbf{Q})}{\textbf{time}\ (\mathbf{t})}$$

$$\text{So,}\quad \textbf{1 ampere} = \frac{\textbf{1 coulomb}}{\textbf{1 second}}$$

- One ampere of current is the current produced when one coulomb of electric charge is passed through the conductor in one second.
- Electricity can be obtained from electro chemical cells.
- Electrochemical cell is an arrangement in which chemical energy is converted into electric energy.
- When a cell is used, chemical reactions take place in it and electricity is produced.
- They are of two kinds: Primary cell & Secondary cell (or) accumulators.
- Primary cell provides current as a result of chemical reaction. They cannot be charged.
- Secondary cell can be charged.
- Besides there , we have button cells, lithium cell, Alkaline cell etc.

❖ **Simple Dry Cell**:

- It is a convenient Source of electricity available in a compact form and is portable.
- It is consist of Zinc cylinder and a carbon rod.
- Zinc cylinder is surrounded by thick layer of insulating paper serve as a cathode.

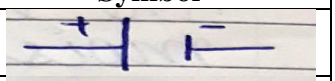
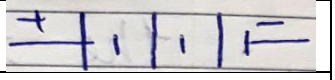
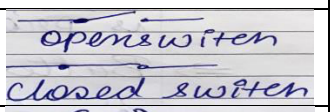
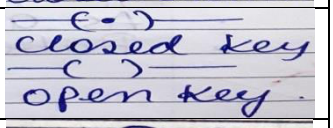
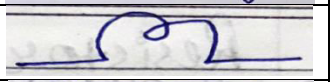
- The carbon rod, with a brass cap is enclosed by a mixture of manganese dioxide and charcoal in a muslin bag, acting as a anode.
- The electrolyte surrounding the carbon rod is a moist paste of ammonium Chloride & P.O.P.
- The top of the cell is sealed with an insulating substance like pitch to prevent drying up of the paste.
- A small hole is pierced through the top of the seal so that gases may come out from within the cell.
- When the terminals are connected through a copper wire, Chemical reactions take place & electric current is produced.

➢ **Batteries:**

- The Combination of two or more Cells.
- As a cell processes, very small amount of electricity.
- Batteries provide large amount of electricity.

❖ **Electric Circuit:**

- The path along which an electric current flows.
- A Circuit has mainly four components.
  - (i) A cell or battery
  - (ii) A Conducting wire
  - (iii) A switch
  - (iv) An appliance

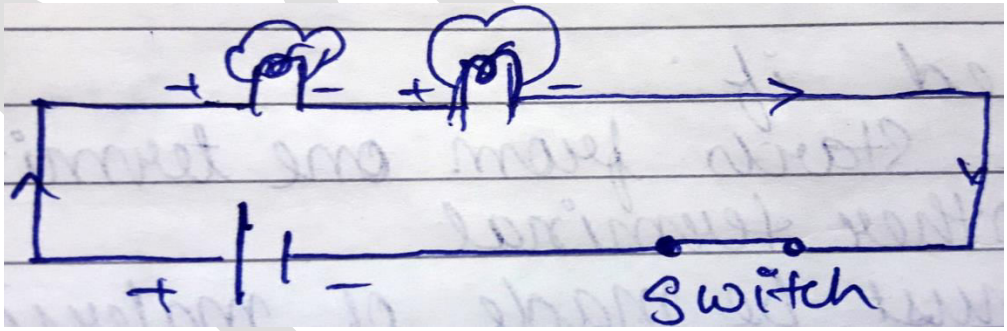
Name of element		Function	Symbol
I.	Cell	Act as a source of electric current.	
II.	Battery	Acts as a source of electric current.	
III.	Connecting wire	Being a good conductor of electricity connects two points so that current flows through circuit.	_____
IV.	Switch	To make or break an electric circuit for a short time.	
V.	Plug key	To make or break an electric circuit for a long time.	
VI.	Electric bulb	An electric appliance that produce light.	
VII.	Fuse	To limit the current flow in an electric circuit.	
VIII.	Resistor	To control the flow of current.	

- A circuit is said to be open if no current passes through it.

- A Circuit is said to be close / complete if current passes through it.
- If the circuit is broken or incomplete current does not flow.
- Circuit will be closed if:
  - (i) The Circuit which stores from one terminal of the cell, must end at the other terminal.
  - (ii) Parts of circuit must be made of materials that allows current to flow through them.
- The substances which allow electric current to flow through them easily are called conductors.
- The Substance which do not allow electric current to flow through them are called insulators.
- When an appliance is connected in electric circuit it opposes the flow of current through it. This obstruction by a material of the wire is called electrical resistance.
- Resistor is an electrical component that limits or regulates the flow of current is an electrical circuit.
- A diagram which shows how different components of a circuit have been connected using conventional symbol is called circuit diagram.
- This components are connected in two ways:
  - (i) In Series
  - (ii) In parallel

➢ **In series:**

- In a circuit when positive end of one bulb is connected to negative end of the other bulb. We say that the two bulbs are connected in series

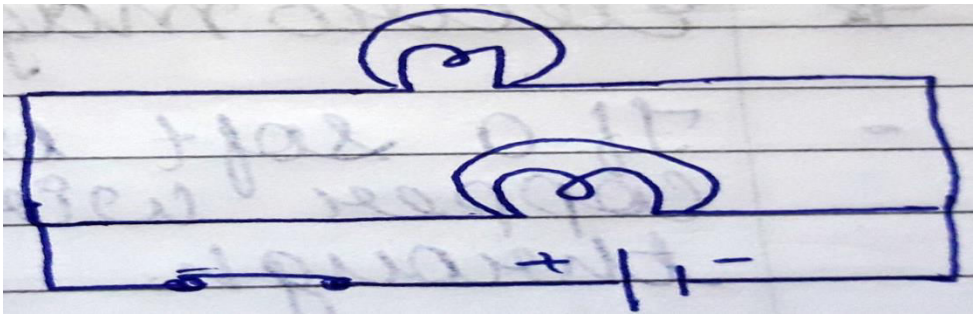


✓ **Conclusion:**

- i) Sum total of resistance increases with increase in number of bulbs.
- ii) Current flowing through each bulb decreases & each bulb glow dimly.
- iii) The bulbs work simultaneously, if the circuit is broken anywhere, none of the bulbs glow.

➢ **In Parallel:**

- In a circuit when each bulbs is connected to the positive end and other to the negative end of cell or battery. This arrangement is said to be in parallel.



- ✓ **Conclusion**:
  - i) The sum total of resistance decreases with increase in number of bulb.
  - ii) Current through each bulb remains the same.
  - iii) It works independently.

❖ **Magnetism:**

- A piece of Substance that has the property of attracting iron is called magnet.
- The property of magnet by virtue of which it attracts some substance like iron is called magnetism.

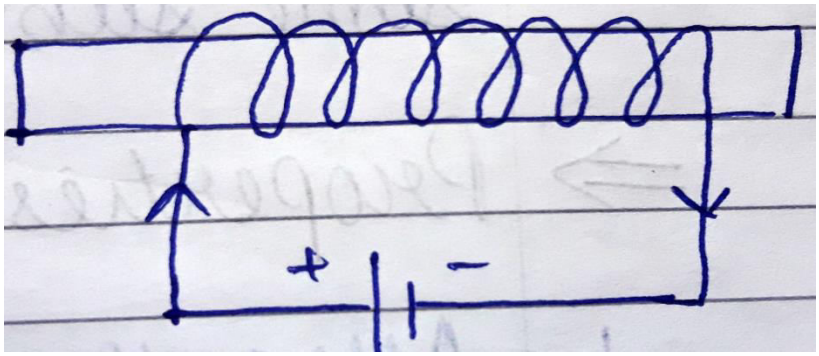
➢ **Properties of Magnet:**

1. **Attractive Property:**
   - Always attracts magnetic substances like iron.
   - Force is Maximum at poles.
2. **Directive property:**
   - Always points in the N - S direction.
3. **Like poles repel and unlike poles attracts:**
   - Repulsion is the surest test for magnet.
4. **Magnetic poles always occur in pairs:**
   - Magnetic field is the space around a magnet where its effect can be detected.

❖ **Electro magnets:**

- If a soft iron bar is wound over with a insulated copper wire in several turns, on passing current through wire it act as a magnet.
- The temporary magnet thus produced by electricity is called electromagnet.
- Strength of magnetic field depends on:
  - (i) Directly proportional to current.
  - (ii) Directly proportional to no. of turns per unit length.

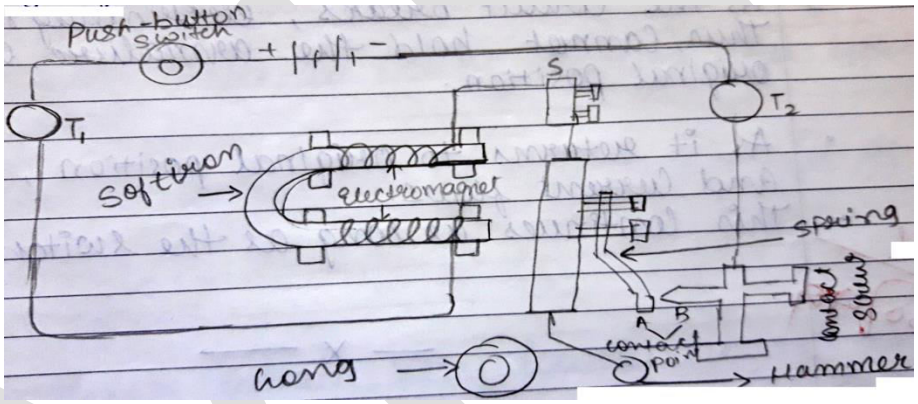
➢ **Uses of Electromagnets:**



i) Used in telephones, electric motors, electric bells etc.
ii) Powerful electromagnets are used in Cranes.
iii) Bullet trains.
iv) Audio & Video tapes.
v) Used in hospitals by surgeons to remove steel splinter from eyes or wound.
vi) Used to lift heavy loads of iron and steel.
vii) Electric motors.

❖ **Electric bell:**

- It is the direct application of electromagnets.
- It consists of following parts which are fitted on a flat wooden/plastic board :
  (i) U - Shaped electromagnet
  (ii) Armature of soft iron
  (iii) Contact spring
  (iv) Contact screw adjustment
  (v) Hammer & gong



➢ **Working:**

- The terminals T_1 and T_2 of the bell are connected to a through a push - button switch.
- When push - button is pressed, Current flows from cell to electromagnet & then to the contact screw and finally T_2 and again the cell.
- Thus, the electric circuit is completed.

➢ **When the electric current flows through the bell:**

1. The U - shaped soft iron turns into electromagnet & pull the armature towards itself.
2. The spring connecting the armature & the Stud comes under tension.
3. The hammer strikes the gong and produces sound.
4. The current flowing in the circuit break at the contact point but hammer continues moving towards the electromagnet due to inertia of motion.
5. As the circuit breaks, electromagnet gets demagnetized. Thus, cannot hold the armature and comes back to original position.
   - As it returns to original position, contact is re –established and current flows.
   - This continues as long as the switch remains pressed.