MADHAV INTERNATIONAL SCHOOL
Affiliated to the Council for Indian School Certificate Examinations (CISCE) - GU031/2014
Pranaminagar, Vastral, Ahmedabad-382418, Gujarat
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Chapter: 1 Matter (GRADE-6)

- Any substance that occupies space and has mass is called **matter**.
- **Properties of matter:**
  1. It has mass or weight.
  2. It occupies space.
- The quantity of matter contained in a body is called its **mass**.
- Mass of a body remains the same at any place in the earth.
- Matter is made up of tiny invisible particle called **atoms**.
- It do not have independent existence.
- It combine with one another to form molecules.
- A **molecule** is the smallest particle of a substance that can exist independently and has all the properties of that matter.

❖ **States of matter:**

i) Solid: -

- The molecules in solids are closely & tightly packed.
- The molecules are not free to move from one place to another.
- Solids have a definite shape and volume.
- Most of solids when heated change into their liquid form.
  E.g. Ice, Iron, Wax, Lead etc.

ii) Liquid: -

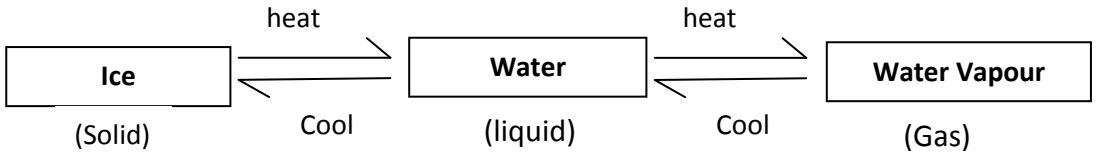
- The molecules in a liquid are loosely packed & less tightly packed.
- The molecules are free to move within the liquid.
- They flow from a higher level to a lower level.
- Do not have definite shape. They take the shape of the container.
- Liquids have definite volume.
- Liquids when heated change into their gaseous form.
  E.g. Water, Oil, Petrol, Milk etc.

iii) Gas: -

- The molecules in a gas are very loosely packed & far away from each other.
- They neither have a definite shape nor a volume.
- They occupy space available.
- They can be compressed into a small space.
  E.g. Water Vapour, The air around us, Smoke etc.

❖ **Change of state of matter: -**

- The change of state takes place by a change in temperature.



Worksheet

Chapter: 1 Matter

- **Answer the following questions: -**

Q1. What are the properties of matter?
Q2. Draw neat diagram to show interconversion of state of matter.
Q3. What is an atom?
Q4. What are molecules?
Q5. State characteristics properties of solid.
Q6. State characteristics properties of liquid.
Q7. Difference between solid, liquid and gas.
Q8. When does the change of state takes place?
Q9. What is matter comprised of? Explain briefly.

- **Define: -**

1- Matter 2- Solid 3- Liquid 4- Gas

- **Fill in the blanks: -**

1. Solids can have …….. of free surfaces.
2. Gases have neither definite …… nor definite shape.
3. Inter molecular …….. in case of gas molecules are very large as compared to solid and liquids.
4. A gas can have …….. number of free surfaces.
5. Solids can …….. Whereas liquids can be ……. .
6. In case of solids intermolecular space are in …….. .

- **Match the following: -**

Column A	Column B
1. Space in between the molecules of matter	a) Matter
2. Force of attraction between the molecules of matter	b) Solids
3. Any material which occupies space and has mass	c) Gases
4. A state of matter which can flow in all direction	d) Intermolecular force
5. A state of matter which can have any number of free surface	e) Intermolecular spaces

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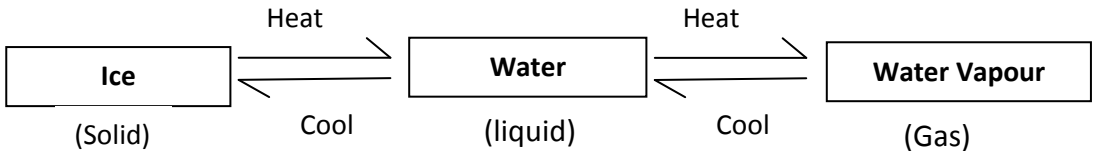

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Chapter 2: Physical Quantities and Measurement (GRADE-6)

- Measurement is the comparison of an unknown quantity with a known constant quantity or unit.
- Part of every measurement consists a number and the unit.
- Any quantity that can be measured is called a physical quantity.

  Physical quantity = Numerical value × unit
- To measure a physical quantity:
  i) The unit in which the quantity is to be measured.
  ii) The numerical value contained in the given quantity.
- **Need for standard units of measurement: -**
- Measuring a physical quantity was a problem.
- All the units were unreliable because parts of the human body differ in length for different people.
- Scientists have introduced some standard units to maintain uniformity in measurement.
- **Characteristics: -**
  i) It is of moderate size that can be conveniently used.
  ii) Space and time do not affect its value.
  iii) It is always possible to define it without any ambiguity or doubt.
  iv) It is not perishable.
  v) It is easily reproduce.
- **Rules for writing correct units: -**
  i) Lower case is used to write the names of unit.
  ii) Unit named after scientist too are written in lower case; except Celsius and Fahrenheit.
  iii) Symbols of units that bear the name of the scientist are written in upper case.
  iv) Other symbols are written in lower case.
  v) Symbols are never followed by full stop.
  vi) Units are written in plural only when used in words, but symbols remain unaltered.
- **Measurement of length: -**
- Length is distance between two point.
- SI unit of length is metre (m).
- Metre is defined as distance between two fine marks engraved on a platinum-iridium bar kept at the International Bureau of weight and measure in Paris International Prototype of a metre.

- A copy of the standard metre is kept at the National Physical Laboratory, Delhi.
- The CGS unit of length is centimeter (cm).
- Instrument used to measure length are:
  - Rulers, metre scale and measuring tape.
  - Vernier calipers, screw gauge, spherometer, microscope etc are used for measuring small length.
- **Multiples: -** Kilometre, hectometer, decameter.
- **Submultiples: -** decimeter, centimeter, millimeter.
- **Hight Year: -** it is a distance travelled by light with speed of 3×10^{8} m/s in one year.
- This unit is generally used to measure the distance of a star from the Earth.
- The size of tiny objects like electrons, protons, atoms and molecules are expressed in still smaller unit of length i.e. 1 micron (μ) = 10^{-6} m, 1 angstrom (A^{0}) = 10^{-10} m.
- **Measuring length accurately by using a metre scale: -**
  i) The scale should be placed exactly along the length to be measured.
  ii) Place the eye vertically above the point where the measurement is to be taken.
     - Error produced due to wrong positioning of the eye is called Parallax error.
  iii) The ruler should have sharp ends.
- **Measuring the diameter of a spherical object: -**
- Place two solid wooden blocks on either side of the spherical object.
- Adjust so that the edges touching the spherical object become parallel to each other.
- Measure the inner distance by metre scale.
- This distance is equal to the diameter of the spherical object.
- **Measuring the length of curved object or line: -**
- It can be measured by using a thread.
- A thread is spread along the length of the curved line between the two end points.
- This length of the thread is now measured by a ruler.
- It gives the length of the curved line.
- **Measuring the diameter of a wire : -**
- Wind a wire tightly around a pencil with the turns touching each other.
- If the thickness of 20 turns = 2 cm.
  Diameter of the wire = 2/20 = 0.1 cm.
- **Measuring the thickness of a rupee coin: -**
- Take one-rupee coins.
- Place them one by one on top of the other.
- Measure the thickness of the stack.
- If the thickness of 10 coins = 1 cm.
  Thickness of one coin = 1/10 cm = 0.1 cm or 1 mm.
- **Measuring length using measuring tape: -**
  1 inch = 2.54 centimeters.

12 inch = 1 foot.

- **Measuring of Area: -**
- The area of a plane figure is the measure of the surface enclosed by its boundary. This is also 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 area 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: - Kilometer^2, hectare, acre
  Submultiples: - dm^2**,** cm^2**,** mm^2

- **Mass: -**
- Mass represents the amount of matter contained in a body.
- Weight is the force of gravity activity on an object.
- Weight changes from place to place but mass remains constant.
- SI unit of Mass is Kilogram (Kg)
  CGS unit of Mass is gram (g).
  Multiples: - quintal, ton
  Submultiples: - gram, milligram

- **Instruments used to measure Mass: -**

  i) **Grocer's Balance: -**
     - The standard weight is kept on one pan and the substances are kept on the other pan.

  ii) **Beam Balance: -**
  Construction: -
     - Used to measure beam balance.
     - Consist of a horizontal beam of iron of length about 50 cm supported at its centre by an iron loop.
     - Two similar pans are suspended at equal distance from the centre by means of strings.
     - A vertical pointer is fixed at the centre of the iron loop.
     - A beam balance is said to be true if its beam remains horizontal and the pointer vertical when its pans are empty or equal weight are placed on them.

A beam balance is true only if: -

i) Two pans of equal mass.
ii) The length of arm on either side of the support is equal.
iii) The string used are of equal length.

iii) Physical Balance: -

Construction: -

- It can measure mass up to 1 milligram or less.
- Generally used in a science laboratory or in a jewellery shop to measure mass of gold or other precious things accurately.
- It is consist of mainly of beam and two scale pans.
- Beam is made of brass or aluminium.
- It has one pointer and three knife edges made of some hard material like steel or agate.
- Central knife edge serves as fulcrum.
- Fulcrum rests on an agate plate on top of a pillar.
- The pillar is kept vertical using a plumb line and the leveling screw (S1 & S2).
- Two pans of equal mass are suspended at the two ends of the beam from the other two knife edges.
- The pointer moves over the scale fixed at the base of the pillar.
- The balance in kept in a glass case to protect it from dust and save the balance from being disturbed by air currents during its use.

Weight Box: -

- It is a wooden box containing standard weights ranging usually from 1 mg to 100 mg.

Procedure: -

- The balance is leveled by the screw at the base.
- The beam is raised gently by turning the knob to ensure that the pointer swings equally on both sides of the zero mark on the scale.
- The substance to be weighed is placed at the centre of the left hand scale.
- Suitable weight is placed at centre of the right hand scale pan with the help of forceps.
- Weight in the right hand scale pan increased or decreased systematically till the beam rise fully.
- Weights on the two pans are now balanced.
- The total mass of the weights on the right hand pan gives the mass of the object.
- Record the result immediately.

*** A physical balance should not be used to measure the mass of a hot object.**

iv) Electronic Balance: -

- It is a device used to find accurate measurement of weight.
- Commonly used in laboratories for weighing chemical for various experiment.
- Also used to weigh food and other grocery items.

Working: -

- The device is switched on.
- The object to be weighed is placed on pan.
- The pan moves downward due to mass of sample and gravitational force.
- This force is converted into electrical signal and displayed on digital display board.
- Noted balance is mass and not weight.
- It is calibrated in such a way that force is divide by the value of (g) to display mass.
- It is balance to measure of two decimal places.

Precautions: -

- Keep the device dry and never put a jar around it.
- Never place a weight directly on a pan.
- Make sure that there is no air currents or vibrations as these device are very sensitive.
- It must be placed on leveled surface.
- When the device is turned on, check to see that the digital display shows zero reading.

❖ **Measurement of time: -**

- The interval between two events is called Time.
- SI unit of time is second (s).
- One mean solar day is the time taken by the Earth to complete one rotation about its axis.

  1 sec = 1/86400 Part of a solar day.
- Earlier man estimated time by looking the sum and the moon.
- Sundials were built and designed.
- Now a day, time is measured by modern and advanced clock and watches.
- The most accurate time-keeping device in the world is atomic clock.
- A device to measure time in hours and minute is called a clock or a watch.
- A device use to display measured time in digital screen is called a digital watch.
- A stopwatch is a device which helps to measure the time taken for a particular event.

❖ **Measurement of temperature: -**

- Temperature is the measure of the degree of hotness or coldness of a body.
- Measured with thermometer.
- SI unit is Kelvin.
- Commonly used units are degree Celsius (^{0}C) and degree Fahrenheit (^{0}F).
- We need two fixed points of temperature: -
  - ✓ **The lower fixed point: -** temperature at which ice melts at sea level.
  - ✓ **The upper fixed point: -** temperature at which pure water boils at sea level.
- The relation used to convert temperature or ^{0}C scale to ^{0}F scale is:

  C/100 = F-32/180
- Kelvin scale is theoretical scale = t^{0}C+273.

➢ **Types of thermometer: -**

i) Laboratory Thermometer: -

- Used to measure temperature in the laboratory.
- It consists of a very fine capillary tube protected by thick glass tube called stem of the thermometer.
- One end of capillary tube is expanded into a glass bulb capillary tube containing mercury.
- The stem has marking called graduation or degrees.
- Ranges from -10^{0}C to 110^{0}C.
- When bulb of thermometer kept in: -

  Hot water: - Mercury expands and rises up.

  Cold water: - Contract and falls down.

ii) Clinical thermometer or Doctor's thermometer:-

- It is used for measuring a person's body temperature.
- Temperature ranges from 35^{0}C to 42^{0}C.
- The normal body temperature of the human body is 37 ^{0}C or 98.6 ^{0}F.
- Reading above this, denotes fever.
- It should not be washed with very hot water or placed in hot place as it may break.

❖ **Approximation in measurement: -**

- It is quick judgment of measurement. It is not exact representation but is still close enough to be useful.
- It is not a reliable form of measurement.
- The closeness with which a measurement gives result to match with the true value is called accuracy.
- Error can be reduced by taking the average of large no. of reading of the same quantity.

$$Average = \frac{sum\ of\ all\ observation}{No.of\ observation}$$

❖ **Standard weights and measure: -**

- Department of weights and measures, Govt. of India, maintains the correctness of weights and different measuring devices used all over the country.

➢ **Characteristics of correct metre scale: -**

i) It has arrow signs (← →) at both the ends.
ii) It contains the stamp of approval.

➢ **Characteristics of correct beam balance: -**

i) The handle should not manipulate the beam.
ii) The beam should be able to move freely on the central axis.
iii) It should have stamp of approval.

➢ **Characteristics of weights: -**

i) It is made of metal.
ii) It has a hole at the bottom in which lead is felled.
   ✓ Head gives the required heaviness to the weight.
iii) It should have stamp of approval.

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Chapter 3: Force (GRADE-6)

Force is the cause that changes or tends to change the state of rest or motion of a body or changes the shape of an object.

- **Effects of force: -**
  1. A force produces motion in an object.
  2. A force stops the motion of an object.
  3. A force can increase or decrease the speed of a moving object.
  4. A force can change the direction of motion of an object.
  5. A force can change the shape and size of an object.
  6. Force has no effect on the mass of a body. Mass remains constant.
- **Types of forces: -**

Contact Force	**Non-Contact Force**
✓ Muscular force	✓ Gravitational force
✓ Mechanical force	✓ Electrostatic force
✓ Frictional force	✓ Magnetic force

- The force that acts on the bodies in contact is called **contact force**.
- The force exerted by our muscles is called **muscular force**.
- The force exerted by a machine is called **mechanical force**.
- The force acting along the two surface in contact which opposes the motion of one body over the other is known as **the force of friction or frictional force**.
- The force that acts between objects that are not in contact is called **non-contact force**.
- Every object in the universe attracts every other object with a force that is called its **gravitational force**.
  - Depends on the **Mass** and the distance.
  - Greater the mass greater the gravitational force.
  - Greater the distance less gravitational force.
- Attraction or repulsion of particles or object because of their electric charge **is called as electrostatic force**.

  E.g.: -
  - ✓ Clinging of thermocol on palm, when cut with knife. [Attractive]
  - ✓ Rubbing of mustard seed in a polythene bag. [Repulsive]
- Force of attraction or repulsion exerted by a magnate is known as **magnetic force**.

- **Unit of force: -**
  - SI unit of force is Newton (N).
  - Another unit used is Kilogram force (Kgf).
    - The force required to lift a mass of 1 kg vertically up ward is called 1 kgf. 1kgf = 10 N
  - Force has both **magnitude** and **direction**.
  - **Resultant force** is defined as a single force that will produce the same effect on a body as is produced by the joint action of all the forces together.
  -

Two Forces	Resultant	Direction
Same direction	Sum of force	Remains same
Opposite direction	Difference	Along the greater force

- **Friction: -** The force acting along the two surface in contact which oppose the motion of one body over the other.
  - ✓ **Properties of frictional force: -**
    i) Opposes their relative motion.
    ii) Depends on the material and condition of the surface in contact.
    iii) Independent of the area of contact of the surface.
    iv) Weight of the body.
- **Types of friction: -**
  i) Static friction: - When a surface attempts to move over another surface in contact.
  ii) Sliding friction: - When a body slides over another body in contact.
  iii) Rolling friction: - When a body rolls over another body in contact.
  iv) Fluid friction: - When a body moves through fluid.

Fluid friction < Rolling friction < Sliding friction

- **Effects of friction: -**
  i) Friction opposes motion
  ii) Friction produces heat
  iii) Friction causes wear and tear
- **Advantages of friction: -**
  i) We can walk on a road.
  ii) Vehicles are able to move on road.
  iii) You can hold a book.
  iv) Enable us to write.
- **Disadvantages of friction: -**
  i) Always opposes the motion of a body.
  ii) Produce a lot of heat and noise at the cost of mechanical energy. Hence, loss of energy.

iii) Causes wear and tear.
iv) Fuel is consumed.

- **Method of reducing friction: -**
  i) Polishing
  ii) By using lubricants
  iii) Using ball bearing
  iv) Stream lining
- **Method increase friction: -**
  i) Tyres are corrugated
  ii) Sports shoes are provided with spikes
  iii) Shoe sole are provided with grooves
  iv) Sand and gravel are speared on slippery ground

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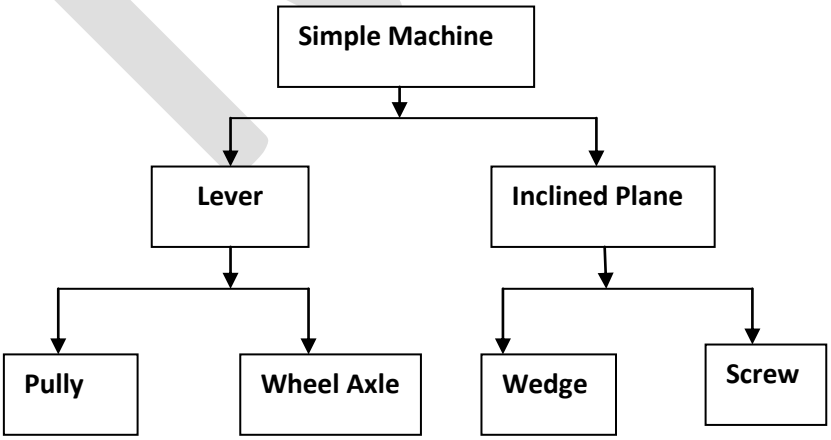
Chapter 4: Energy [Machine] (GRADE-6)

- **A simple machine** is a tool that makes our work easier and faster. E.g. screw driver, hammer, ramp etc.
- Some machines are made up of number of simple machines working together. They are called **complex machine**. E.g. bicycle, fan, clock etc.
- It is used to multiply the magnitude of a force.
- It is used to change the direction of the force.

❖ **General terms:**

1. **Effort (E):** The external force applied to a machine.
2. **Load (L):** The force against which a machine works.
3. **Fulcrum (F):** It is a fixed point about which a machine turns while doing mechanical work.
4. **Velocity Ratio (VR):** It is the ratio of the velocity of effort to the velocity of load.
5. **Mechanical advantage (MA):** It is ratio of a load to the effort.
6. **Input:** Work done on a machine.
7. **Output:** The useful work done by a machine.
8. **Efficiency:** The ratio of the output to the input.
   - No machine is 100% efficient.
   - Output < Input
   - Energy is lost to overcome friction.
   - Energy is lost to move parts of machine.

❖ **Types of simple machine:**



❖ **Lever:**

- A lever is a rigid body capable of rotating about a fixed or axis called the fulcrum.

- The shortcut distance of the effort from the fulcrum is called effort arm.
- The shortest distance of the load from the fulcrum is called load arm.
  - **Principle of lever:**

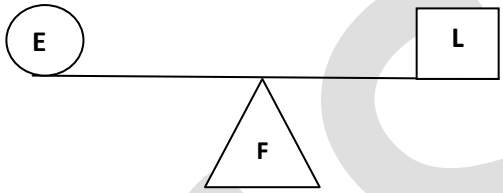
    Effort × Effort arm = Load × Load arm

    i.e. Turning effect of the effort = Turning effect of the Load

    Turning effect is the product of the magnitude of the force and its shortest distance from the fulcrum.

❖ Types of Lever:

1. **Lever of first order:** When the fulcrum acts in the middle, the load at end and effort at the other end.

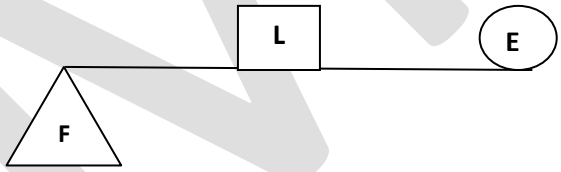


❖ **Characteristics:**

- Fulcrum is in between load and effort.
- $MA = \frac{EA\ (Effort\ Arm)}{LA\ (Load\ Arm)}$
- MA can be increased by moving the fulcrum towards the load.
- Effort can be decreased by moving fulcrum towards the load.

  Examples: See-saw; a pair of scirros; a crow bar; handle of a common water pump; the human forearm.

2. **Lever of second order:** When the load acts in between the effort and the fulcrum.

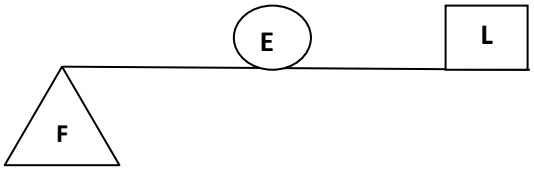


❖ **Characteristics:**

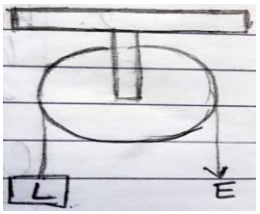
- Load is between effort and fulcrum.
- $MA = \frac{EA\ (Effort\ Arm)}{LA\ (Load\ Arm)}$
- MA is always more than one.
- By moving load towards the fulcrum, the load arm decreases and MA increases.

  Examples: a nut cracker, a wheel barrow, ore of a boat, bottle opener.

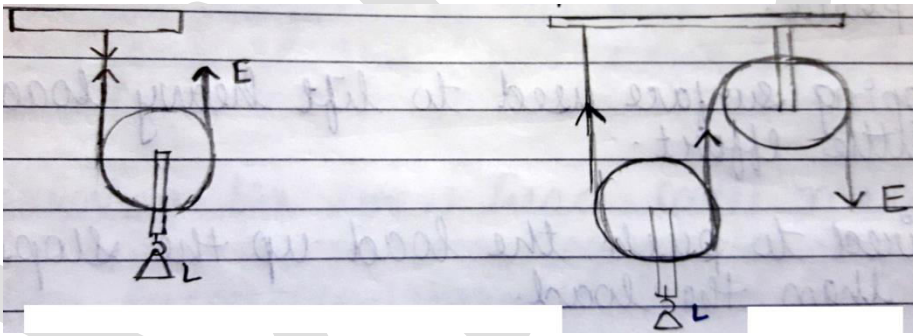
3. **Lever of third order:** When the efforts acts in between the load and the fulcrum.



- **Characteristics:**
  - Effort is in between the fulcrum and the load.
  - MA is always less than one.
  - As the load moves through a large distance, it is always a speed multiplier.
    Examples: fire tong, bread knife, football player.
- **Pulleys:** It is a flat circular disc having a groove in its edge and capable of rotating about a fixed point passing through its centre and is commonly called axle.
  - Generally made from some metal and wooden.
  - Pully rotates about the axle.
  - A string is passed around the groove.
  - The axle is fixed to a metallic frame.



- **Single fixed pulley:**
  - Effort is made by pulling the rope downwards in order to lift the load up.
  - Because it is always more convenient to pull a rope downward.
  - It helps to change the direction of our effort.
  - It helps in pulling water from the well.
- **Single movable pulley:**



  - One end of the rope if fixed and load is hung from the pulley block.
  - This pulley, effort is shared equally by two parts of the rope.
  - For every metre the rope is raised, the load raises only half the length.
  - Since the effort is shared by two parts of the rope, its MA=2.
  - Considering no friction force acting on the pulley and the pulley block is weightless, VR=MA.
- **Wheel and Axle:**
  - The wheel and axle is basically an arrangement of a wheel with a rod attached to it called the axle.
  - It consists of two cylinders of different diameter joined together.
  - It is a modified lever the centre of the axle serve as a fulcrum.
  - Effort is applied to a large wheel to turn the smaller axle.
    Examples: steering wheel, bicycle pedals, wagon etc.
- **Inclined Plane:**
  - It is a sloping surface used to lift heavy loads with relatively little effort.
  - Force required to push the load up the slope is much less than the load.

- If it is at a steep angle then the effort required to move the load up will be greater than a plane tilted slightly.
- However, total work done is same irrespectively of the angle of inclination of the plane.
- **MA** of an inclined plane is the ratio of the length of the inclined plane (l) to the vertical rise (h).

$$MA = \frac{\boldsymbol{l}}{\boldsymbol{h}}$$

❖ **Application:**

i) Hilly roads have gradual slope
ii) Staircase
iii) Use of ramp
iv) Flyovers

❖ **Screw:**

- It is a simple machine which looks like a nail.
- It has grooves made around a rod.
- The winding edge, wrapped around the circular curved surface of the rod called the thread.
- One end is flat and other is pointed.
- A slit is made on the screw head.
- Turning the screw head ones makes the screw advance a distance equal to the space between two successive threads called its pitch.
  - ✓ **Application:**
    - **Screw jack:** to lift truck or a car
    - **Fasten things:** Nuts and bolts
    - **A drill:** to make hole
    - **Propellers:** to produce motion

❖ **Wedge:**

- Consists of pair of inclined plane.
  Examples: hammer, chisel and axe.
  - ✓ **Application:**
    - Used to split, cut or fasten objects.
    - The working principle is to reduce the surface so that minimum force is required to generate maximum pressure.

❖ **Care of Machine:**

- Iron parts should painted to avoid rusting.
- Moving part should be lubricated to reduce friction.
- Should be cleaned regularly.
- When not in use, machines should be kept covered to protect them from dust and moister.

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Chapter 5: Light (GRADE-6)

- Light is a invisible form of energy which causes sensation of vision.
- Light can even travel in vaccum with a speed of **3×10^8 m/s**.
- The distance of the sun from the Earth is 149.6 million kilometers.
- It takes nearly $8\frac{1}{3}$ min (or) 500 sec to reach the Earth.
- Therefore, we see the sun rising $8\frac{1}{3}$ min after it actually rise.

❖ **Source of light:**

- An object which emits light is called a source of light.
- It can be classified into two categories.
  1) Natural source of light.
  2) Man-made or artificial source of light.

➢ **Natural source:**

- **Sun** is the main natural source of light.
- Stars
- Jugnu (glow-worm) and some fish also emit light. Sun bodies are termed as **Bioluminous object**.

➢ **Artificial source of light:**

- Glowing electric bulb.
- Lighted torch.
- Burning candle etc.

➢ **Luminous bodies:** Are those which themselves emit light.

➢ **Non-Luminous bodies:** The bodies which do not possess light of their own.

➢ **Bioluminescence:**

- The emission of light by some living organism.
- It is produced due to some chemical reaction which directly converts into light energy.
- As in this process, very little amount of heat is given off; the light is called **Cold light**.
  - Any non-luminous body can be made luminous by heating it to 525 ^{0}C or more.

➢ **How do we see object?**

- The light from a source spread in all direction.
- When it falls on non-luminous body, the body reflects the light.
- When this enters our eyes, we can see the body.
- It is the reflected light (called moonlight) that enables us to see the moon.

❖ **Generals term related to light:**

1. **Optical Medium:** Space through which light can pass wholly or partly.

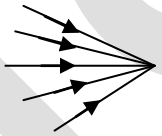
There are three kind of substance:

- **Transparent substance:** A substance through which light propagate easily.
- **Translucent substance:** A substance through which light propagates partially.
- **Opaque substance:** Substances which do not allow any light to pass through them.

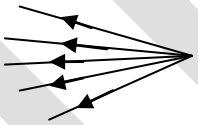
2. **A point source of light:**

- A source of light which has negligible dimension.
- It is a hypothetical concept.
- Any real source can be treated as a collection of large no. of point sources.

3. **An extended source of light:** Any source of light, which is bigger than a point source.
4. **A Ray of light:** The narrow path along which light energy travels in a given direction.
5. **A beam of light:** A collection of a no. of rays.
   - **Convergent Beam of light:** When a no. of rays coming from different direction, meet at a point.



   - **Divergent Beam of light:** When all the rays move away from a point in different directions.



   - **Parallel Beam of light:** When all the rays in a beam are parallel to each other.

❖ **Rectilinear Propagation of light:** In a medium, light travels in a straight line. It is the basic property of light. This property of light is called rectilinear propagation of light.

✓ **Application:**

- Formation of shadow and eclipses.
- Formation of day and night.
- Small laser torches are used as pointer.
- A beam of sunlight enters a dark room through a ventilator, the path of light appears straight.

❖ **A Pin hole Camera:** It is device which obtains the image of an object through a small hole.

Principle: It is based on the principle of rectilinear propagation of light.

Construction:

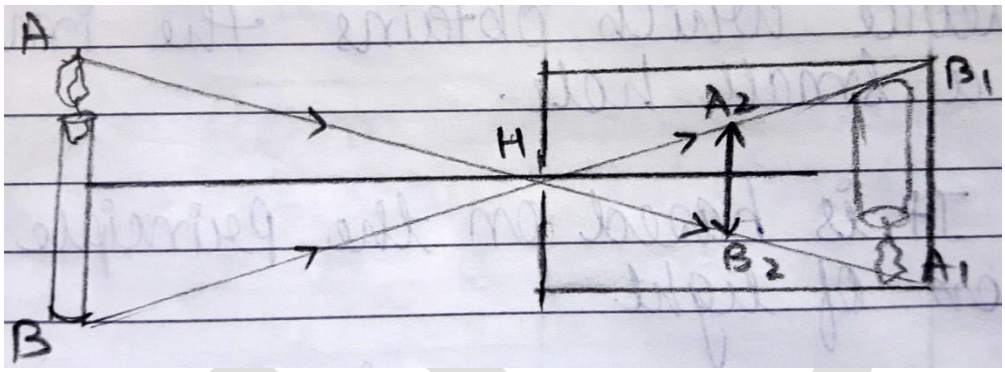
- It is consist of a rectangular box made of cardboard, wood or metal closed from all sides.

- A hole is made at the centre of one face of box.
- On opposite side ground glass is fitted.
- Box is properly sealed, so that no light enters it except pin hole.
- To avoid reflection, it is painted black from inside.

Working: When an object AB is placed in front of the pinhole, light from the point A travels along AH in straight light and passing through the pinhole reaches the point A_1 on the screen.

Thus, A_1 becomes the image of A. Similarly, the image of B formed B_1.

So, inverted image A_1B_1 is formed on the screen.



Characteristic of an image:

i) Image is real.
ii) Image is inverted.
iii) Smaller than the size of object.

➢ **Size of image depends upon:**

a) Distance between the screen and pin hole:

✓ Lesser the distance, smaller the image formed and brighter, vice-versa.

b) Distance of the object from pin hole:

✓ If the object is moved further away from the pin hole, the size of image decreases and vice-versa.

➢ **Effect of size and shape of the pin hole:**

i) The image is not affected by the shape of the pin hole.
ii) If the size of pin hole increases, the image will be blurred. Image overlap with each other giving overall image a blurring effect.

$$\boldsymbol{Magnification\ (m) = \frac{height\ of\ image}{height\ of\ object}}$$

or

$$\boldsymbol{Magnification\ (m) = \frac{Distance\ of\ image\ from\ pin\ hole}{Distance\ of\ object\ from\ pin\ hole}}$$

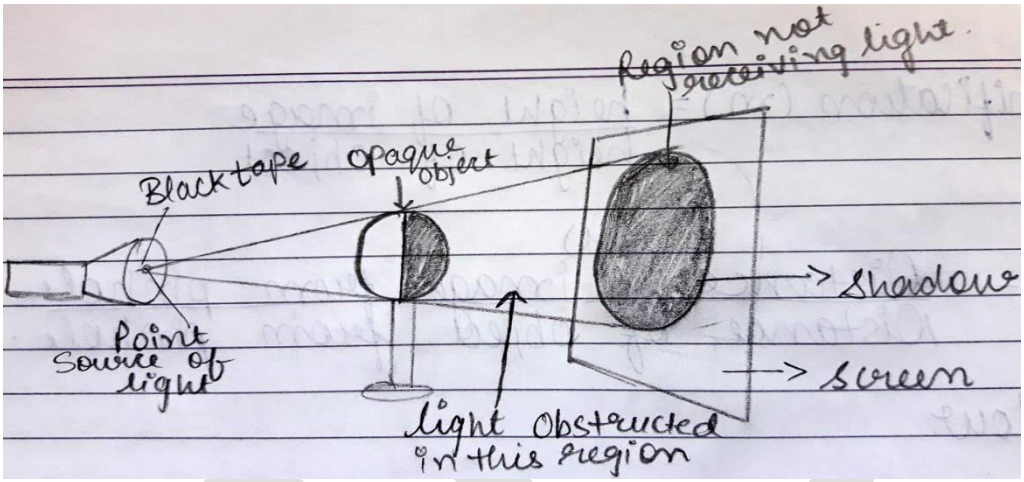
❖ **Shadow:**

- The dark patch formed behind an opaque body when it is placed in the path of light.
- **The nature and size depends on:**
  i) Size of the source
  ii) Size of the object

iii) Distance between the source and object

- Shadow consist of two region: Umbra and Penumbra
  - ✓ The inner patch of a shadow is completely dark as no light reaches this region. This region of total darkness is called the umbra.
  - ✓ A region of partial darkness which surrounds the umbra is called penumbra.

➢ **A shadow produced by a point source of light:** When an opaque object is placed between a point source of light and a screen, a shadow is formed on the screen.



Characteristics of a shadow:

i) Only umbra region is formed.
ii) Umbra is uniformly dark and sharp at the edge.
iii) Shape is same as that of the object.
iv) Size is always bigger than of the object.
v) Size of shadow increases with increase in distance of the screen from object and vice-versa.
vi) Also by decreasing distance between point source and the object vice-versa.

➢ **Shadow produced by an extended source of light:** An extended source is made up of a large number of point source, each casting its own sharp shadow.

(i) When the source of light is smaller than the opaque object:

- ✓ Both umbra and penumbra are formed.
- ✓ Umbra is larger than penumbra.
- ✓ If the screen is moved towards the opaque object, the size of both umbra and penumbra will decrease and vice-versa.
- ✓ If the source of light is moved towards the opaque object, the size of both umbra and penumbra will increase and vice-versa.

(ii) When the source of light is bigger than the opaque object:

- ✓ Both umbra and penumbra are formed.
- ✓ The size of umbra is smaller than penumbra.
- ✓ If the source is shifted towards the object, the size of the penumbra decreases while umbra increases.

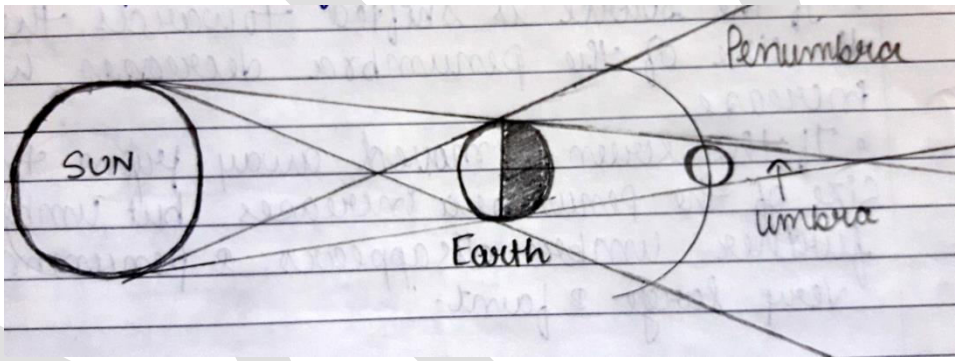
- ✓ If the screen is moved away from the object, the size of the penumbra increases but umbra decreases further umbra disappears and penumbra becomes very large and faint.
  For this reason we do not see the shadow of a kite or bird flying high in the sky.

❖ **Eclipse:**

- The shadow cast by the heavenly bodies on each other causes the eclipse.
- Formation of an eclipse is based on the principle of formation of a shadow.
- During the course of revolution whenever the earth, the moon and the sun are in straight line and in the same plane, then either the shadow of the Earth falls on the moon or shadow of the moon falls on the earth.

➢ **Lunar Eclipse:**

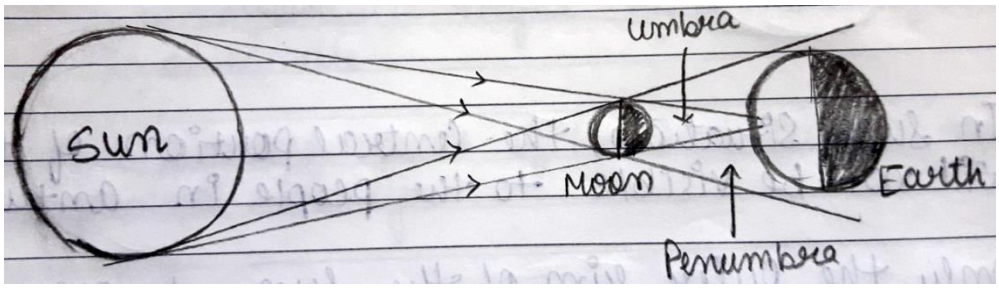
- During the course of revolution, when the sun, earth and the moon comes in straight line.
- With the Earth in the centre of the Sun and the moon.
- Shadow of the Earth falls on the moon and hence lunar eclipse is formed.



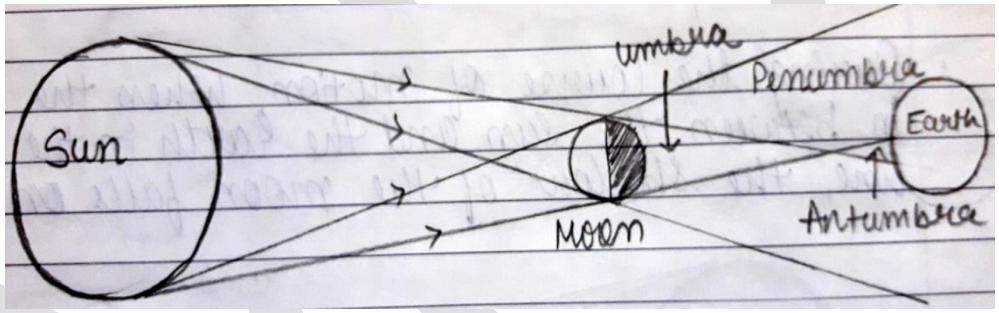
- Such that a part or whole of the moon is not visible to us for some time, from some part on the Earth.
- When the moon enters the penumbra, it looks pole and penumbral eclipse occurs.
- When the whole of the moon is in the umbra region total lunar eclipse occurs. The moon is completely invisible at this time.
- When moon is partly in the umbra and partly in penumbra region partial lunar eclipse occur.
- **Lunar eclipse always occurs on a full moon night,** but it does not occur on every full moon.
- Because orbits of the Earth and the moon are not in the same plane but inclined at angle of 5^0 with each other.
- During total lunar eclipse the moon appears as a duel red disc because some scattered light from the Earth's atmosphere reaches the moon.

❖ **Solar Eclipse:**

- During the course of motion when the moon comes in between the sun and the Earth in the same straight line, the shadow of the moon falls on the Earth.



- When a part or whole of the sun is not visible to us for some time, from some parts on the earth, solar eclipse has occurred.
- People in the region of the umbra will see total solar eclipse.
- Those in penumbra will see a partial solar eclipse.
- During a total solar eclipse the entire disc of the Sun is blocked by the moon.
- Observing in this region see a darkened sun with the glow of the outer rim of the sun.
- Sometimes, the distance between the moon and the Earth is very large because of the elliptical orbit.
- In that case, the open of the umbral cone may not touch the Earth's surface.



- In such situation, the central portion of the sun will not be visible to the people in ant umbra.
- Only the outer rim of the sun, known as Corona is visible as a very bright ring. Such eclipse is called an annular eclipse.
- Near the beginning and end of total solar eclipse, a thin slice of the visible sun appears broken up into beads of light.
- It is called the **diamond ring effect**.
- It is always formed on a new moon day.
- Because the orbits of the moon and the earth are not coplanar but inclined at an angle with each other.

➢ **Precautions to be taken while viewing solar eclipse:**

- Solar eclipse should not be watched directly. It is because the Sun's corona gives off harmful ultraviolet radiations during solar eclipse.
- These radiations can burn the retina of the eyes and cause permanent blindness.
- It should be observed through fairly thick plane glass, covered with a thick layer of soot from the flame of a candle.
- The soot cuts off most of the harmful radiations and protects the eyes.

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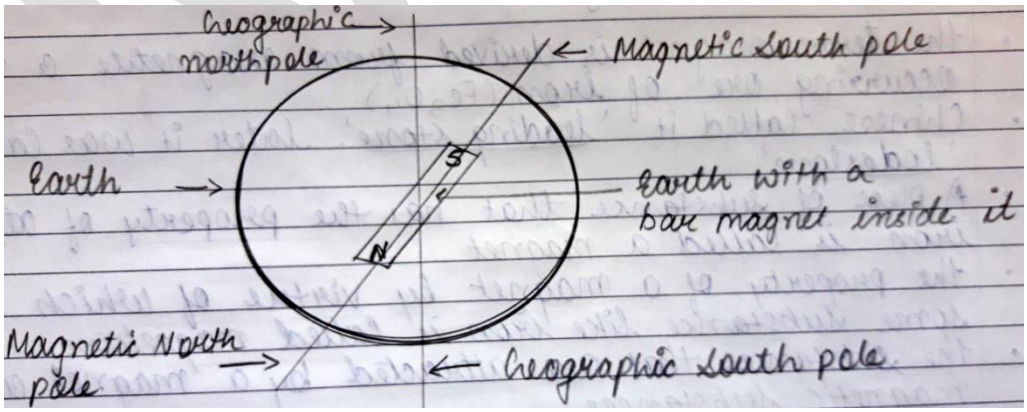
Chapter 6: Magnetism (GRADE-6)

- The term magnet is derived from magnetite a naturally occurring ore of iron (Fe_3O_4).
- Chinese called it 'leading stone' later it was called as 'lodestone'.
- A piece of substance that has the property of attracting iron is called a magnet.
- The property of a magnet by virtue of which it attracts some Substance like iron is called magnetism.
- The substances that are attracted by a magnet are called magnetic substances.
- The substances that are not attracted by a magnet are called non - magnetic substance.
- Substances that occur naturally and have the property of attracting magnetic substance are called natural magnets.
- Magnet made by using artificial methods are called artificial magnet.
- Artificial magnets can be of various shapes and sizes. Some of them are listed below:
    1. Bar magnet
    2. Horseshoe magnet
    3. U - Shaped magnet
    4. Cylindrical magnet

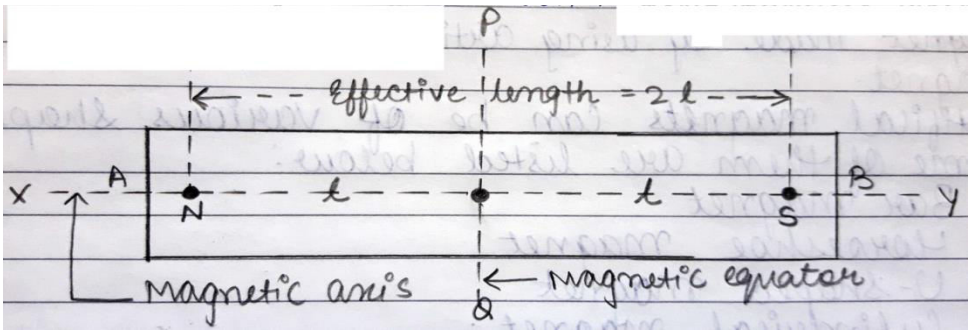
❖ **Earth as a Magnet:**

- When a bar magnet is suspended freely, its north pole always points towards the geographic north pole and south pole points towards the geographic south pole.
- It is because the Earth behaves like a magnet.



- The north pole of the bar magnet is actually attracted by the magnetic South & vice - versa.
- This Indicates that magnetic south pole of the Earth lies somewhere near the geographic North Pole & vice- versa.
- Earth's make angle of 17^0 with geographical axis of the Earth.

❖ **Parts of a Magnet**:



1. **Magnetic Poles:** The two ends of a magnet where the magnetic force is maximum.
    - The end of the magnet pointing toward the geographical north of the Earth is called north - seeking pole or North pole.
    - The opposite end pointing towards the geographical south of the Earth is called south - seeking pole on the South Pole.
2. **Magnetic Axis:** The imaginary line (XY) joining the two pole of a magnet.
3. **Length of a magnet:** The total distance between the north pole to the centre and south pole to the Centre of a magnet.
4. **Effective length of a magnet**: The distance between the magnetic north pole & the magnetic south pole.
5. **Magnetic Equator:** An imaginary line bisecting the effective length of a magnet.

❖ **Properties of a magnet:**

1. **Attractive property of a magnet:**
    - Always attracts a magnetic substance.
    - Force of attraction is maximum at the poles.
2. **Directive Property of a magnet:**
    - When, suspended always point in N - S direction.
3. **Like poles of two magnets repel, unlike pole attract:**
    - Repulsion is a surest test for a magnet.
4. **Magnetic poles always occur in pairs:**
    - The space around a magnet where its influence can be detected is called its magnetic field.
    - Lines of force are closed continuous curve in a magnetic field along which the north pole will move if free to do and its direction is given by the direction in which the free north pole will point.
    - Concept of representing magnetic field was introduced by Michael faraday.

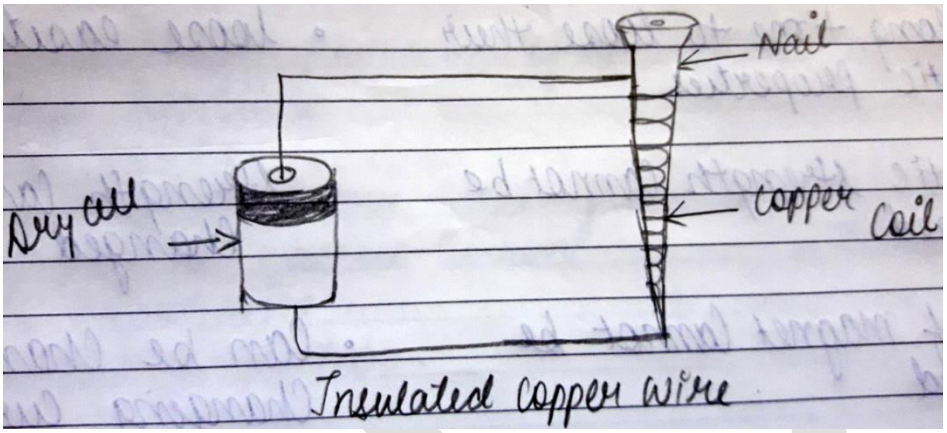
❖ **Making Magnets**:

- On removing the Cause, if a magnet loses its magnetism it is called temporary magnet.
- Magnet that do not lose their magnetism, when the cause producing it is removed, are called Permanent magnets.
- **Soft Iron** is temporary magnets.
  Steel is permanent magnets.

❖ **Methods:**

1. **Magnetic Induction Method:** The phenomenon by which temporary magnetism is produced in an ordinary piece of iron due to the presence of a magnet is called magnetic induction.
2. **Single touch Method**
3. **Double Touch method**
4. **Electric Method**

➢ **Making a magnet with the help of electric current:**



- Wind an insulated copper wire over an iron nail.
- Keep the ends of the Copper wire bare from insulation.
- Connect the two ends of the Copper wire to the end of a battery.
- Bring a few paper clips near this arrangement.
- Paper clips are attracted by the nail.
- The paper clips fall down.

Strength depends on:

i) Amount of Current passing
ii) The no. of turn of the coil.

Advantages:

i) Made stronger than permanent.
ii) Can easily be magnetised & demagnetized.

Permanent magnet	Temporary magnet
✓ Made of steel	✓ Made of soft iron
✓ Take long time to magnetize	✓ Magnetized easily
✓ Take long time to loose their magnetic properties	✓ Loose easily
✓ Magnetic strength cannot be increased	✓ Strength Can be changed
✓ Poles of magnet cannot be changed	✓ Can be changed by changing current direction

➢ **Uses of Permanent magnets:**

i) In a magnetic compass.
ii) Used in doors, cupboard doors, electric meters.
iii) Ceramic magnets are used in large computer.

iv) In bicycle dynamos.
v) In toys to give magical effects.

- **Uses of temporary magnet [electro magnets]:**

i) In fans, washing machines etc.
ii) Electric bells.
iii) Surgeons use to remove iron bits from wounds.
iv) In telephone, radio, television, loudspeaker, etc.
v) Electrical measuring equipments like ammeter, voltmeter, etc.
vi) Used to lift heavy iron and steel articles in factories.

- **Demagnetizing a magnet:** The magnetic property of a magnet gets destroyed by:

i) Rough handling
ii) By heating
iii) By dropping many times from a height
iv) By passing electric current
v) By hammering
vi) Earths Induction

- **Care and storage of magnets:**

- Tendency to lose their magnetism when their poles are left bare is called self - demagnetization.
- Bar magnets are kept in pairs with their pole in opposite direction and piece of wood between them. Two piece of soft iron called keepers.
- Horseshoe magnet need only one keeper.