

PART - I - SCIENCE

PHYSICS

MEASURING INSTRUMENTS

Important Points :

In the modern times in which we live, accuracy is needed in every phase of life. In olden days barter system was more prevalent and people exchanged commodities and accurate measurements were not essential.

Now money is used and people expect correct returns for the money they pay. Hence the need for accurate measurements has come.

Uses of Instruments :

- Measuring very small length [Vernier Calipers]
- Measuring instruments for mass and weight
- Measuring time – devices used in ancient times as well as modern clocks
- About IST and GST

Points to Remember :

- The smallest measurement that can be measured using a device or instrument is called **Least Count** of that instrument.
- Vernier Calipers is an instrument that works under the principle of Vernier.
- Least Count of Vernier Calipers is 0.01cm.
- Error is defined as the deviation from the actual value.
- If the value is greater than that of actual value, it is called positive error and if the value is less than that of actual value it is called negative error.
- Mass of a body is the measure of the quantity of matter contained in the body.
- Weight is a measure of gravitational force on a body.

- An imaginary line drawn between the north and south poles of the globe is called Meridian.
- The earth is divided into 24 time zones spacing 15° of longitudes, one for each hour of the day.
- Screw gauge is an instrument to **measure the dimensions of very small objects** upto 0.001cm.
- Screw gauge works under the **principle of the screw**.
- The pitch of the screw gauge** is defined as the ratio of distance travelled on the pitch scale to the number of rotations.
- The least count of a screw gauge** is the ratio of the pitch to the number of divisions on the head scale.
- If the zero of the head scale coincides with the pitch scale axis, then there is **no zero error**.
- If the zero of the head scale lies below the pitch scale axis, then the **zero error is positive**.
- If the zero of the head scale lies above the pitch scale axis, then the **zero error is negative**.
- To measure long distances **Radio echo method, Laser pulse method and Parallax method** are used.
- Astronomical distance** is the mean distance of the centre of the Sun from the centre of the Earth
 $1 \text{ AU} = 1.496 \times 10^{11} \text{ m}$.
- Light year** is the distance travelled by light in one year in vacuum.
 $1 \text{ Light year} = 9.467 \times 10^{15} \text{ m}$

MOTION

Important Points :

What is Motion? A body is said to be in the state of Motion, when it continuously changes its position with respect to time.

Motion depends on the distance travelled [displacement] and the time taken to cover the distance.

Points to Remember :

- A body is said to be in the state of rest when it remains in the same position with respect to time.
- A body is said to be in the state of motion when it continuously changes its position with respect to time.
- The distance between the two places is not the same, it depends upon the path chosen.
- The shortest distance between the initial and final position of the body is called displacement.
- If an object covers equal distances in equal interval of time, it is said to be in uniform motion.
- If an object covers unequal distance in equal intervals of time, it is said to be in non-uniform motion.
- Speed is the rate of distance travelled.
- Velocity is the rate of change of displacement.
- Equal displacement covered by a body in equal intervals of time is known as uniform velocity.

- Rate of change of velocity is acceleration.
- If the velocity increases or decreases by equal amount in equal intervals of time it is called uniform acceleration.
- The variation in velocity with time for an object moving in a straight line can be represented by a velocity-time graph.
- $v = u + at$, $v^2 = u^2 + 2as$, $s = ut + \frac{1}{2}at^2$ are three equations of motion.
- The deceleration and acceleration due to the gravitational force of earth is known as acceleration due to gravity (g)
- When an object moves in a circular path with a constant speed its motion is called uniform circular motion. The velocity in a circular path considering the angle covered by the body is called angular velocity.
- One radian is the angle subtended by an arc of a circle of length equal to its radius at the centre of the circle.
- Linear Velocity = Radius of the circle \times Angular velocity.
- The constant force that acts on the body along the radius towards the centre and perpendicular to the velocity of the body is known as centripetal force and the force equal in magnitude and opposite in direction to the centripetal force is known as centrifugal force.

SOUND

Important Points :

How sounds are produced, why a medium is required for transmission of sound, what is meant by audible range of sound, ultra and infra sonic sounds?

It is not surprising that all animals including man do not hear the same range of sound. Some animals can hear very low sounds or very high pitched sounds.

In this chapter, you will learn about SONAR and the Doppler Effect.

Among the uses of sound, Ultra sound scan plays a very important role in the field of medicine.

Points to Remember :

- Sound is a form of energy.
- Sound makes it possible for us to communicate with one another through speech.
- Vibrations are small to and fro motion of objects.
- Vibrations produce sound.
- The matter or substance through which sound is transmitted is called medium. It can be a solid, liquid or gas.
- A wave is a series of disturbances, that move through a medium.
- Waves are of two types. They are electromagnetic waves and mechanical waves.
- If the particles of a medium vibrate in a direction, parallel to or along the direction of propagation of wave, it is called a **longitudinal wave**.
- Sound waves in air or gases travel in the form of longitudinal waves.
- Longitudinal waves propagate in the form of compression and rarefaction.

- If the particles of the medium vibrate in a direction, perpendicular to the direction of propagation, the wave is called a **Transverse wave**.
- Transverse waves propagate in a medium in the form of crests and troughs.
- **Crest** : Maximum displacement along upward direction
Trough : The maximum displacement along downward direction.
- **Amplitude** : The maximum displacement of a particle from the mean position.
- **Time period** : Time taken by a particle of the medium to complete one vibration.
- **Frequency** : The number of vibration completed by a particle in one second.
- **Wave length**: Distance moved by a wave during the time a particle completes one vibration.
- $\text{Velocity} = \text{Frequency} \times \text{Wavelength}$
- The sound waves produced by us, when reflected back are heard as echo.
- The repeated reflection of sound that results in persistence of sound is called **reverberation**.
- We can hear sound of frequencies ranging from 20 Hz to 20,000 Hz. It is called audible range of sound for human beings.
- Sound of frequencies above 20,000 Hz are known as **Ultrasonic**.
- Sound of frequencies below 20 Hz are called **Infrasonic**.
- **SONAR** : SOUND NAVIGATION AND RANGING.
- Sonar is a device used to measure the distance, direction and speed of underwater objects and depth of the sea.
- The phenomenon of the apparent change in the frequency of source due to relative motion between the source and the observer is called Doppler's effect.

LIQUIDS

Important Point :

What are liquids? It is a state of matter which flow from one place to another.

Points to Remember :

- Liquids flow from one place to another.
- They have a definite volume and they take the shape of the container.
- The pressure at any point inside a liquid is $P = h\rho g$ and it increases with depth.
- The buoyant force that acts through the centre of gravity of the displaced liquid is called the centre of buoyancy.

- Archimedes discovered the principle of Lever and principle of Floatation.
- Density = $\frac{\text{Mass}}{\text{Volume}}$ and its unit is Kg m^{-3} .
- Relative density is defined as the ratio of density of the body to the density of water. It has no unit.
- An iron piece floats in mercury but sinks in water.
- Hydrometers are used for the determination of the specific gravities of solids and liquids.
- A common hydrometer used to test the purity of milk is called lactometer.

LAWS OF MOTION AND GRAVITATION

Important Points :

- If the resultant of all the forces acting on a body is zero, the forces are called **balanced forces**.
- If the resultant of all forces acting on a body is not zero, the forces are called **unbalanced forces**.
- **Force** is one which changes or tends to change the state of rest or of uniform motion of a body.
- **The first law of motion** states that a body continues to be in a state of rest or in a state of uniform motion along a straight line, unless an external force is applied on the body to change the state.
- **Inertia** is the inability of the body to change by itself its state of rest or of uniform motion

along a straight line. **The mass** of a body is a measure of inertia.

- According to Newton's second law of motion, the rate of change of linear momentum of a body is directly proportional to the external force applied on the body and this change takes place always in the direction of applied force.
- **Force acting on a body** is the product of mass and acceleration of the body.
- **Linear momentum of a body** is defined as the product of mass and velocity of the body.
- **Newton III law states** that for every action, there is always an equal and opposite reaction. These forces act on two different objects and never cancel each other.