Unit# 01

Physical Quantities and measurements

Q#1 Define physics.

Ans: In Physics, we study matter, energy and their interaction. The laws and principles of Physics help us to understand nature.

Q#2 Define the term Natural philosophy.

Ans: Not until eighteenth century, various aspect of material objects were studied under a single subject called natural philosophy. But as the knowledge increased, it was divided into two main streams:

Physical sciences : Which deal with the study of non-living things.

Biological sciences: Which are concerned with the study of living things.

Q# 3 Why we study physics ?

Ans: The laws of physics help us to answer questions like those given below:

1) How does a mobile phone function without wires?
2) How do fireworks work?
   Also it helps us to understand nature that's why we study physics.

Q# 4 What is the role of physics in science ?

Ans: Physics is the most fundamental of all the sciences.

- ⇨ Biology uses the physics principles of fluid movement to understand how the blood flows through the heart, arteries, and veins.
- ⇨ Chemistry relies on the physics Of subatomic particles to understand why chemical reactions take place.

So we say that physics play very important role in science.

Q# 5 What is the role of physics in Technology.

Ans: Physics is behind every technology and plays a key role in further development of these technologies, such as airplanes, computers, PET scans and nuclear weapons.

Q# 6 Write some advantages of physics?

Ans: In our daily life, we hardly find a device where Physics is not involved.

- ⇨ Consider pulleys that make it easy to lift heavy loads.
- ⇨ Consider the means of transportation such as car and aeroplane etc. are applications of physics.

- ⇨ Domestic appliances such as air conditioners, refrigerators, vacuum-cleaners, washing machines, and microwave ovens etc. are applications of physics.
- ⇨ Similarly the means of communication such as radio, TV, telephone and computer are the result of applications of Physics.

Q# 7 Write some draw backs of physics.

Ans: The scientific inventions have also caused harms and destruction of serious nature. Such as

- ⇨ environmental pollution
- ⇨ deadly weapons.

Q# 8 Write Branches of physics.

Ans:

- ⇨ **Mechanics**:
  It is the study of motion of objects, its causes and effects. It is divided into two groups

1) Kinematics 2) Dynamics

- ⇨ **Optics**:
  It is the study of physical aspects of light, its properties, working and use of optical instruments.
- ⇨ **Thermodynamics**:
  This branch explores heat and temperature and their effects on matter. We learn about the principles of heat transfer and the ways we can harness thermal energy in everyday life.
- ⇨ **Electromagnetism**:
  It is the study of the charges at rest and in motion, their effects and their relationship with magnetism.
- ⇨ **Quantum Mechanics:**
  It is a field which delves into the physics of the very small, such as atoms and subatomic particles. It introduces students to a world where traditional rules may not apply, revealing the peculiar behaviour of matter at the smallest scales.
- ⇨ **Relativity**:
  The study of the effects of gravity and the relationship between space and time, primarily through the theories of special and general relativity.
- ⇨ **Atomic and Nuclear physics:**
  It is the study of the structure and properties of atoms. And It deals with the properties and behaviour of nuclei and the particles within the nuclei.
- ⇨ **Oscillations and Waves:**
  This branch of physics focuses on the phenomena of periodic motion (oscillations) and the propagation of disturbances (waves). It explores the

behaviour of systems that exhibit repetitive back-and-forth movements around a central point (oscillations) and the transmission of energy through disturbances that travel through a medium or space (waves).

Q# 9 What do you know about physical Quantities?

Ans: All measurable quantities are called physical quantities such as length, mass, time and temperature. A physical quantity possesses at least two characteristics in common. 1) Numerical magnitude 2) SI unit

Q# 10 What do you know about non-physical Quantities?

Ans: Those Quantities which cannot be measured are called non- physical quantities such as taste, feelings, colour etc.

Q # 11 Difference between base and Derived quantities?

Ans: <u>Base Quantities:</u>

- ⇨ Base quantities are the quantities on the basis of which other quantities are expressed.
- ⇨ Example: length, mass, time etc.
- ⇨ They are independent.
- ⇨ There are only seven base quantities are there.

<u>Derived Quantities:</u>

- ⇨ The quantities that are expressed in terms of base quantities are called derived quantities.
- ⇨ Example: speed, velocity, acceleration etc.
- ⇨ They are dependent.
- ⇨ Derived quantities are multiple.

Q# 12 What is meant by international system of units?

Ans: A complete set of units for all physical quantities is called system of units.

The international system of units is termed as System International (abbreviated as SI), a short form of the French name 'System: International d' Units' which means International System of Units'.

Q# 13 Why do we need SI units?

Ans: With the developments in the field of science and technology, the need for a commonly acceptable system of units was seriously felt all over the world particularly to exchange scientific and technical information.

Q# 14 What role Si units have played in development of science?

Ans: Si units have played very important role in development of science such as:

- ⇨ Manipulation is easy.(multiply, divide etc.)
- ⇨ It uses all over the world
- ⇨ Scientists are able to exchange information.

Q# 15 What is meant by Base units?

Ans: In System International (SI) seven (07) physical quantities are chosen as base and their units are defined and standardized. These units are called base units.

Quantity		Units	
Name	Symbol	Name	Symbol
Length	l	meter	m
Mass	m	kilograms	kg
Time	t	second	s
Electric Current	I	ampere	A
Intensity of Light	L	candela	Cd
Temperature	T	Kelvin	K
Amount of Substance	n	mole	mol

Q# 16 What is meant by Derived units?

Ans: Units of derived quantities are obtained by multiplying and/or dividing base quantities. In Sl units all other physical quantities can be derived from the seven base units.

Example:

Unit of area is m^2. Speed is m/s.

Q# 17 Define the term scientific Notation.

Ans: Scientific notation is an easy method of writing very large or small numbers in power of ten.

Standard form or scientific notation represents a number as the product of a number greater than 1 and less than 10 (called the mantissa) and a power of 10 (termed as exponent):

number = mantissa x10exponent

Q# 18 Why we write numbers using scientific notations?

Ans: Some of the quantities are very large. e.g. mass of Earth 6000,000,000,000,000,000,000,000 Kg Some of the quantities are very small. e.g. Atomic radius 0.000000000000001 m so it is difficult to write these number and also to understand that's why we use scientific notation.

Q# 19 What are Prefixes?

Ans: A mechanism through which numbers are expressed in power of ten that are given a proper name is called prefix.

For example.

In 5km: kilo is prefix.

In 5MW mega is prefix.

Note: Double prefixes are not allowed.

Q# 20 Why we use prefixes?

Ans: Prefixes makes standard form or scientific notation further easier. Large numbers are simply written in more convenient prefix with units.

For example 2900000 W is simple written as 2.9 MW

Q#21 Difference between scalars and vectors.

Ans: Scalars:

- ⇨ Physical quantities that can be completely described by numerical magnitude and SI unit.
- ⇨ Example are: mass, time, length etc
- ⇨ It follows algebraic rules.

Vectors:

- ⇨ Physical quantities that can be completely described by numerical magnitude and SI unit as well as direction.
- ⇨ Example are: force, acceleration, torque etc.
- ⇨ It can not follow algebraic laws.

Q # 22 How we represent Vector Quantities?

Ans: Symbolically:

A vector can be represented by a letter either capital or small. (e.g. F and for A and B) with an arrow over it.

Graphically a vector is represented by an arrow, the length of the arrow gives the magnitude with proper unit (under certain scale) and the arrow head points the direction of the vector.

Q# 23 What is meant by co-ordinate system?

Ans: A coordinate system is used to locate the position of any point and that point can be plotted as an ordered pair (x, y) known as Coordinates.

The horizontal number line is called X-axis' and the vertical number line is called Y-axis' and the point of intersection of these two axes is known as the origin and it is denoted as '0'.

Q#24 Write steps how to represent a vector in coordinator system?

Ans: Following steps are needed:

1. Choose and draw a coordinate system.

2. Select a suitable scale.

3. Draw a line in the fixed direction. Cut the line equal to the magnitude of the vector according to the chosen scale. Put an arrow along the direction of the vector.

Q# 25 Why vector Quantities can't be added and subtracted like scalar quantities?

Ans: Scalars quantities are added or subtracted only by simple arithmetic methods because scalar quantities have no direction. Since vectors quantity have magnitude as well as direction, therefore they cannot be added or subtracted like scalar quantities.

Q# 26 How we add vectors?

Ans: we can add vectors using head to tail rule. According to head-to-tail rule:

- Draw vectors according to given scale.
- Take any vector as a first vector then second vector so on.
- Join the head of first vector with tail of second vector then join third rector if any.
- Draw a resultant vector whose tail coincide with 1st vector and head coincide with head of last vector.

Q # 27 Can we add zero to a vector?

Ans: It is not possible because zero is a scalar Quantity and we cannot add scalar with a vector.

Q# 28 Does vector addition depends on the order?

Ans: No vector addition does not depend upon order because vector addition is commutative.

Q# 29 What do you know about measuring instruments?

Ans: For measurements of physical quantities we need devices termed as measuring instruments. These range from simple objects such as rulers and stopwatches to Atomic Force Microscope (AFM) and Scanning Tunnelling Electron Microscope (STEM). All measuring instruments have some measuring limitations

Q# 30 Define Least Count?

Ans: least count is the minimum value that can be measured on the scale of measuring instrument The measurement of every instrument is therefore limited to its least count

Q# 31 Write a detail note on meter rule?

Ans: A meter rule is a physics laboratory tool, used to measure the length of objects. Metre rules are one metre long (as compared to the standard metre). Metre Rulers usually have 1000 small divisions on them called millimetres. Metre rulers have least count of 1 mm.

Q#32 Can you measure distances smaller than 1 mm on metre rule? Why?

Ans: No it us not possible because least count of meter rule is 1mm. We can't find smaller reading than 1mm.

Q# 33 Write a note on measuring tape?

Ans: A measuring tape is a flexible ruler used to measure larger distance or length. It consists of a ribbon of cloth, plastic, metal, or fiberglass with linear measurement markings on it. The tape is usually housed in a compact case, and it can be pulled out and locked in place to measure distances. The most common units of measurement on a measuring tape are inches and centimetres.

Q# 34 What do you know about Vernier callipers?

Ans: 'Vernier calliper is a device used to measure a fraction of a smallest division on scale by sliding another scale over it' It can be used to measure the thickness, diameter or width of an object and the internal, external diameter of hollow cylinder.

Q # 35 How we find least count of Vernier calliper?

Ans: Least count can be obtained from dividing the value of smallest division on main scale by total number of divisions or Vernier scale.

$$\text{Least count of Vernier Callipers} = \frac{\text{smallest reading on main scale}}{\text{no. of divisions on vernier scale}}$$

$$= \frac{1\,\text{mm}}{10\ \text{divisions}} = 0.1\ \text{mm}$$

Hence $\quad L\,C = 0.1\ \text{mm} = 0.01\ \text{cm}$

Q# 36 How we find zero error of Vernier callipers ?

Ans: To find the zero error, close the jaws of Vernier Callipers gently. If zero line of the Vernier scale coincides with the zero of the main scale then the zero error is zero . Zero error will exist if zero line of the Vernier scale is not coinciding with the zero of main scale.

- Zero error will be positive if zero line of Vernier scale is on the right side of the zero of the main scale.
- Zero error will be negative if zero line of Vernier scale is on the left side of zero of the main scale.

Q# 37 How we take measurement using Vernier calliper ?

Ans: If we want to measure the diameter/length etc. of an object (e.g. a small sphere) with Vernier calliper, the following steps can be followed:

- Note the least count of the Vernier, (it is usually written on Vernier calliper).
- Determine and correct zero error if any.
- Fix the small sphere in the jaws and note the complete divisions of main scale past by the zero of Vernier scale.
- Look for the division of Vernier scale that is coinciding with any division on main scale. This is Vernier scale reading.
- Multiply the Vernier scale reading with least count which is the fraction to be added with main scale reading.

Q# 38 What do you know about screw gauge?

Ans: Screw gauge is also length measuring device and is used for measurements even smaller than Vernier callipers. ‘ Screw Gauge is a device used to measure a fraction of a smallest division on scale by rotating circular scale over it’

Q# 39 How we find least count of screw gauge?

Ans: The least count of screw gauge is found by dividing its pitch by the number of circular scale divisions.

$$\text{Least count} = \frac{\text{pitch of the screw gauge}}{\text{no. of divisions on circular scale}}$$

$$= \frac{1\,\text{mm}}{100}$$

$$= 0.01\ \text{mm} = 0.001\ \text{cm}$$

Q# 40 How we find zero error of Screw gauge?

Ans: To find the zero error, close the gap between the spindle and the stud of the screw gauge by rotating the ratchet in the clockwise direction. If zero of circular scale coincides with the index line, then the zero error will be zero.

- Zero error will be positive if zero of circular scale is behind the index line.
- Zero error will be negative if zero of circular scale has crossed the index line.

Q# 41 How we take measurement using Screw gauge?

Ans: If we want to measure the diameter of an object (e.g a wire piece) with screw gauge, the following steps can be followed.

- Note the pitch and least count of the screw gauge and determine the zero error
- Place the object (e.g. a wire piece) between with spindle and anvil.
- Read the main scale reading, which is the reading shown (or unblocked) by circular scale
- Identify the line of circular scale aligned with datum line, now multiply the least count of screw gauge by this number. This is circular scale reading.
- Add linear (or main) scale reading and circular scale reading, which gives the total reading.

Q# 42 Write a note on physical balance?

Ans: A physical balance is used in the laboratory to measure the mass of various objects by comparison. It consists of a beam resting at the centre on a fulcrum.

The beam carries scale pans over the hooks on either side. Unknown mass is placed on the left pan. Find some suitable standard masses that cause the pointer to remain at zero on raising the beam.

Its least count is 0.01g

Q# 43 Write a note in Electronic balance?

Ans: Electronic balances come in various ranges; milligram ranges, gram ranges and kilogramme ranges. Before measuring the mass of a body, it is switched ON and its reading is set to zero. Next place the object to be weighed. The reading on the balance gives you the mass of the body placed over it.

Its least count is 0.001g.

Q# 44 Which balance is more precise and why?

Ans: Least count of an electronic balance is 0.001 g or 1 mg. Therefore, its measurement would be more precise than a sensitive physical balance.

Q # 45 Write a note on physical balance?

Ans: A measuring cylinder is a tool used in laboratories to measure the volume of liquids, chemicals, or solutions. It is also known as a graduated cylinder. Measuring cylinders are typically made of transparent plastic or glass and have a vertical scale in millilitres (ml) or cubic centimetres (cm^3). The volume of a liquid can be determined by measuring the height of the liquid in the cylinder. The least count of a measuring cylinder is usually 1 cm^3.

Q# 46 How we find volume of irregular stone using Measuring cylinder?

Ans: Measuring cylinder can be used for measuring the volume of an irregular solid body such as metallic bob as shown in figure. When the object is completely immersed the volume of the water is read again. The volume of the object is found by subtracting the first reading from the second.

Q# 47 What is stop watch?

Ans: The duration of specific interval of time is measured by a stop watch. Stop watch types i.e. mechanical stop watch and digital stop watch.

Q# 48 Difference between mechanical and digital stop watch?

Ans: <u>Mechanical stopwatch:</u>

- It has two circular dials, a large circular dial in which a second hand of watch rotates and a small minute hand in which minute hand of watch rotates.
- The watch starts and stops by pressing the knob at top it, pressing it for some time will reset the watch back to zero.
- Its least count is 0.1s

Digital stopwatch:

- Digital stop watch are usually controlled by two buttons on the case. Pressing the left button starts the timer and by pressing it again the time stops. Pressing the right button resets the stopwatch to zero.
- The right button is also used to record split times or lap times.
- Its least count is 0.01s.

Q# 49 what do you know about Errors?

Ans: Every measurement, no matter how careful, has a certain amount of doubt known as error. Error is simply the uncertainty that arises during measurement. This means that all measurements are only approximate due to the presence of errors.

There are two main types of errors in measurement:

Systematic errors.

Random errors.

Q# 50 Difference between Systematic and Random error.

Ans: Systematic Error:

- Systematic errors tend to occur consistently in one direction, either positive or negative.
- It can be caused by instrument error or personal error.
- Systematic errors can be reduced by improving experimental techniques, choosing better instruments etc.

Random error:

- Random errors are unpredictable and uncontrollable errors that can happen irregularly.
- These errors can be caused by fluctuations in experimental conditions or imperfections in measuring instruments.
- It can be reduced by taking Average of several reading reputation.

Q#51 Difference between precision and Accuracy?

Ans: Accuracy :

- Degree of closeness to the measurement to the target.
- It does not depend upon Significant figure.
- It can be determined by single measurement.
- Degree of Conformity.

Precision:

- Degree of closeness to the measurement to each other.
- It depend upon Significant figures.
- It can not be determined by single measurement
- Degree of Reproducibility.

Q # 52 Write a detail note on Significant figures?

Ans: 'All the accurately known figures and the first doubtful figure are termed ass significant figures'

There are a few simple rules that help us determine how many significant figures are contained in a reported measurement:

1) All digits reported as a direct result of a measurement are significant.
2) The reported NONZERO digits (all digits from 1 to 9) are always significant. For example the number of Significant figures in 23.457 is 5
3) Zeros between significant digits are also significant. For example 2705 has 4 significant digits.
4) In whole numbers that end in one or more zeros without a decimal point. These zeros may or may not be significant.
    - If counted one by one than zero are significant figures
    - If does not counted one by one than they are not significant figure
5) Zeros used for spacing the decimal point are not significant. Here zeros are placeholders only. For example 0.03 has 1 significant digit.

Q# 53 How is the precision related to significant figures?

Ans: Precision depend upon significant figures such as:

- More significant figure greater is the precision.
- Each significant figure increases the If precision by factor of ten.

Q# 54 Write Rounding rules for decimal numbers?

Ans: The rules for rounding decimal numbers are as follows:

1. Find the digit you want to round and look at the digit to its right.

2. If the digits to the right are less than 5, treat them as zero.

3. If the digits to the right are 5 or greater, add 1 to that digit and treat all other digits as zero.

Q# 55 Write Rounding rules for whole numbers?

Ans: When rounding to a specific whole number of significant figures, we follow these steps:

1. Always choose the smaller place value for an accurate final result. Find the next smaller place to the right of the number being rounded off.

2. If the digit in the smallest place is less than 5, leave it as it is. Any digits after that become zero, which is called rounding down.

3.If the digit in the smallest place is greater than or equal to 5, add +1 to that digit. Any digits after that become zero, which is called rounding up.

Conceptual Questions

Q# 1 How physics plays an important role in our life?

Ans: Physics plays a vital role in our everyday lives, often in ways we may not immediately recognize. The laws & principles of physics helps in understanding the nature.

- Physics is the most fundamental of all the sciences. Biology uses physics principles of fluid movement to understand how blood flows through heart.
- Physics is behind every technology. It is present in the alarm clock that wakes US, the electricity that powers our appliances, and the vehicles that transport us to work or school etc.

Q# 2 Estimate your age in minutes and seconds.

Ans:

Suppose age = 15 years

Age in days= 15 x 365 days =5465 days

Age in hours= 5465 x24 hours = 131400 hours

Age in minutes = 131400 x 60 minutes = 7884000 minutes

Age in seconds = 7884000 x 60 seconds = 473040000 seconds

Q# 3 What base quantities are involved in these derived physical quantities; force, pressure, power and charge

Ans:

⇨ Force:

Unit: Kgm/s^2

mass , length , and second is involved.

⇨ Pressure

Unit: Kg/ms^2

Length, Mass and Time is involved.

⇨ Power:

Unit: kgm^2/s^3

Length, Mass and Time is involved.

⇨ Charge:

Unit: C/s

Current and time involved.

Q# 4. Show that prefix micro is thousand times smaller than prefix milli.

As we have, **micro** $= 10^{-6}$

$= 10^{-3} \times 10^{-3}$

$= 10^{-3}$ milli (As, milli $= 10^{-3}$)

1 micro $= 10^{-3}$ milli

$= \frac{1}{10^3}$ milli

$= \frac{1}{1000}$ milli

So, prefix micro is thousand times smaller than prefix milli.

Q # 5 . Justify that displacement is a vector quantity while energy is a scalar quantity.

Ans: Displacement:

Displacement refers to the shortest Path between two points. It describes how far and in what direction an object has moved Displacment Since it includes both magnitude (distance) and direction, displacement is vector quantity.

Energy:

Energy is the ability of a system to do work. It comes in various forms like kinetic, potential, thermal, etc. Energy has a magnitude (amount) but no direction. Therefore, energy is a scalar quantity,

Q# 6 Screw gauge can give more precise length than vernier calipers. Briefly explain why

Ans: The least count of an instrument is the smallest measurement that can be taken accurately with it.

Least count of screw gauge=0.01 mm

Least count of Vernier calliper =0.1 mm

As the least count of screw gauge is smaller than Vernier calliper, it can measure the length more precisely.

Q# 7 Difference between mechanical and digital stop watch?

Ans: Mechanical stopwatch:

- It has two circular dials, a large circular dial in which a second hand of watch rotates and a small minute hand in which minute hand of watch rotates.
- The watch starts and stops by pressing the knob at top it, pressing it for some time will reset the watch back to zero.
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Digital stopwatch:

- Digital stop watch are usually controlled by two buttons on the case. Pressing the left button starts the timer and by pressing it again the time stops. Pressing the right button resets the stopwatch to zero.
- The right button is also used to record split times or lap times.
- Its least count is 0.01s.

Q# 8 How measuring cylinder is used to measure volume of an irregular shaped stone?

Ans: To measure the volume of an irregular-shaped stone using a measuring cylinder, we can use the method of water displacement.

1. Fill the measuring cylinder with a known volume of water. Note the initial water level reading

2. Lower the irregular-shaped stone into the water-filled measuring cylinder using a wire or tweezers.

3. Once the stone is fully submerged and the water level stabilizes, take a new reading of the water level in the measuring cylinder.

4. The difference between the initial and final water level readings represents the volume of water displaced by the irregular-shaped stone.

Volume of Stone = Final Water Level Reading -Initial Water Level Reading

Q# 9 What precaution should be kept in mind while taking measurement using measuring cylinder?

Ans: Following are the precautions to be taken while measuring the volume of the liquid with a measuring cylinder

- Make sure the measuring cylinder is placed on a flat surface.
- Take care of the meniscus and take the reading accurately. Read the bottom of the meniscus (the curved surface of the liquid) to determine the volume.
- Avoid parallax error while taking the measurement. Always read the volume markings at eye level to avoid parallax errors.

- Parallax errors occur when the observer's line of sight is not perpendicular to the scale, leading to inaccurate readings.

Q#10 Why do we need to consider significant digits in measurements?

Ans: Significant figures play a vital role in determining which digits in a number are reliable and meaningful.

- They indicate the precision of a measurement or calculation by identifying the digits that are known with certainty.
- If We go beyond significant digits, we add the level of uncertainty associated with a particular value.
- It is important to consider the significant digits in measurements.

Q# 11 How random error can be reduced?

Ans: following methods are used to reduce Random error

- One cannot eradicate random error completely, but it can be reduced by repeatedly taking the measurements, As taking multiple measurements of the same quantity and then calculating the average will reduce the chances of getting higher error because averaging helps to minimize the impact of random fluctuations.
- One other way can be increasing the sample size. Large samples have less random error than small samples. That's because the errors in different directions cancel each other out more efficiently when you have more data points.

Q# 12 Difference between precision and Accuracy?

Ans: **Accuracy** :

- Degree of closeness to the measurement to the target.
- It does not depend upon Significant figure.
- It can be determined by single measurement.
- Degree of Conformity.

Precision:

- Degree of closeness to the measurement to each other.
- It depend upon Significant figures.
- It can not be determined by single measurement
- Degree of Reproducibility.

Numerical problems

1. Write the following numbers in scientific notations

a. $1234m$ **b.** $0.000023s$ **c.** $469.3 \times 10^5 m$ **d.** $0.00985 \times 10^7 s$

a. 1234m	b. 0.000023s	c. $469.3 \times 10^5 m$	d. $0.00985 \times 10^7 s$
$1234m$ $1.234 \times 10^3 m$	$0.000023s$ $2.3 \times 10^{-5} s$	$469.3 \times 10^5 m$ $4.693 \times 10^{5+2} m$ $4.693 \times 10^7 m$	$0.00985 \times 10^7 s$ $9.85 \times 10^{7-3} s$ $9.85 \times 10^4 s$

2. Express the following measurements using prefixes

a. $27.5 \times 10^{-10} m$ **b.** $0.00023 \times 10^{-2} m$

a. $27.5 \times 10^{-10} m$	b. $0.00023 \times 10^{-2} m$
$27.5 \times 10^{-10} m$ $2.75 \times 10^{-10+1} m$ $2.75 \times 10^{-9} m$ $2.75nm$	$0.00023 \times 10^{-2} m$ $2.3 \times 10^{-2-4} m$ $2.3 \times 10^{-6} m$ $2.3\mu m$

3. If a boy has age of 15 years 2 months and 10 days, convert his age in

a. seconds **b. milli seconds** **c. mega seconds**

15 Years into Seconds	2 Months into seconds	10 days into Seconds
$15\ years$ $= 15 \times 12\ Months$ $= 15 \times 12 \times 30\ days$ $= 15 \times 12 \times 30 \times 24\ hours$ $= 15 \times 12 \times 30 \times 24 \times 60\ minuts$ $= 15 \times 12 \times 30 \times 24 \times 60 \times 60s$ $= 466{,}560{,}000s$	$2\ months$ $= 2 \times 30\ days$ $= 2 \times 30 \times 24\ hours$ $= 2 \times 30 \times 24 \times 60\ minuts$ $= 2 \times 30 \times 24 \times 60 \times 60s$ $= 5{,}184{,}000s$	$10\ days$ $= 10 \times 24\ hours$ $= 10 \times 24 \times 60\ minuts$ $= 10 \times 24 \times 60 \times 60s$ $= 864{,}000s$

a. Seconds

$= 466{,}560{,}000 + 5{,}184{,}000 + 864{,}000$

$= 472{,}608{,}000s = 4.72608 \times 10^8 s$

b. milli seconds

$= 472{,}608{,}000 \times 10^3 \times 10^{-3} s$

$= 472{,}608{,}000{,}000ms$

c. Mega seconds

$= 472{,}608{,}000 \times 10^{-6} \times 10^6$

$= 472.608000Ms$

4. How many kilo meters are there in 25 micrometers?

$25\mu m$

$= 25 \times 10^{-6} m$

$= 25 \times 10^{-6} \times 10^{-3} \times 10^3 m$

$= 25 \times 10^{-9} km$

5. What is pitch and least count of
a. Vernier calipers if the smallest division on main scale is 1mm and total divisions on vernier scale are 20.
b. Screw gauge if the smallest division on its main scale is 0.5mm and its movable scale has 50 divisions.

Smallest division on main scale is called pitch. Which is given as 1mm.

$$Least\ Count = \frac{smallest\ division\ on\ main\ scale}{Total\ divisions\ on\ vernier\ scale}$$

$$Least\ count = \frac{1mm}{20}$$

$$Least\ count = 0.05mm = 0.05cm$$

Smallest division on main scale is called pitch. Which is given as 0.5mm

$$Least\ Count = \frac{Pitch}{number\ of\ divisions}$$

$$Least\ count = \frac{0.5mm}{50}$$

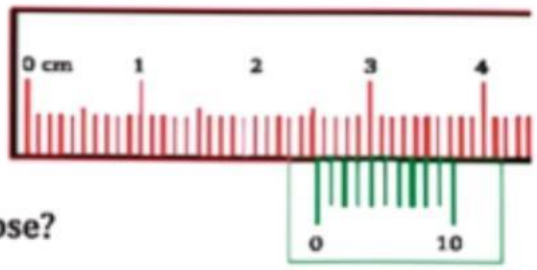
$$Least\ count = 0.01mm$$

6. Look at the measurement of vernier caliper (as shown):
a. What is its main scale reading? b. What is its coinciding division on vernier scale? c. Calculate total reading on the vernier caliper suppose?

a.
$Main\ Scale\ Reading = 2.5cm$

b.
$Vernier\ Scale\ Reading = 8$

c.
$Total\ Reading = M.S\ Reading + V.S\ Reading \times L.C$
$Total\ Reading = 2.5cm + 8 \times 0.01cm$
$Total\ Reading = 2.5cm + 0.08cm$
$Total\ Reading = 2.58cm$



ose?

7. Look at the figure of screw gauge, let's suppose a small steel ball is placed between its spindle and anvil then: a. What is its main scale reading? b. What is coinciding division of circular scale? c. Calculate the total diameter of the ball?

a.
$Main\ Scale\ Reading = 6.5mm$

b.
$Circular\ Scale\ Reading = 46$

c.
$Total\ Reading = M.S\ Reading + C.S\ Reading \times L.C$
$Total\ Reading = 6.5mm + 46 \times 0.01mm$
$Total\ Reading = 6.5mm + 0.46mm$
$Total\ Reading = 6.96mm$