displacement can is tool used to perform this method.

50. What is meant by human error?

They occur due to personal performance. The limitation of the human perception such as the inability to perfectly estimate the position of the pointer on a scale.

51. How human errors can reduced?

Human error can be reduced by ensuring proper training, techniques and procedure to handle the instruments and avoiding environmental distraction or disturbance for proper focusing. The best way is to use automated or digital instruments to reduce the impact of human errors.

52. What is meant by systematic error?

They refer to an effect that influence all measurements of particular measurements equally. It produces a consistence difference in reading. It occurs to some definite rules.

53. How systematic error occur? And how it can be reduced?

It may occur due to zero error of instrument, poor calibration of instrument or incorrect marking. The effect of this kind of error can be reduced by comparing the instrument with another which is known to be more accurate. Thus a correction factor can be applied.

54. What is meant by Random error?

These errors occur when repeated measurements of a quantity give different values under the same conditions. For Example: changes in temperature, pressure, humidity, voltage, etc.

55. How random errors can be reduced?

The effect of random errors can be reduced using several or multiple readings. then taking their average or mean value. Similarly, for the measuring time period oscillating pendulum, the time of several oscillation, say 30 oscillations is not and then mean or average value of one oscillation is determined.

56. Explain uncertainty in a measurement

There is no such thing as a perfect measurement. Whenever a physical quantity is measured except counting, there is inevitably some uncertainty about its determined value due to some instrument.

57. Define significant figures?

In any measurement, the accurately known digits and the first doubtful digit are known-as significant figures

58. What is meant by rounding off?

In this process if last digit more then 5 the retained digit increased by one, if less than 5 it retained as such.

59. Name some repetitive processes occuring in nature which could serve as reasonable time standard.

1. Earth's Rotation 2. Earth's Revolution around the Sun 3. Lunar Phases 4. Tidal Cycles 5. Seasonal Cycles

60. Differentiate between Precision and Accuracy?

Precision: Precision of a measurement refers to how close together a group of measurements actually are to each other.

Accuracy: Accuracy of a measurement refers how close the measured value is to some accepted or true value

Exercise short questions

1.1. Can a non-physical quantity be measured? If yes, then how? (1.1)

No, a non-physical quantity can be measurement but can described by other ways. Explanation: A non-physical quantity cannot be measured using tools

and instruments. They often pertain to the perception or interpretation of the observer. They can be described or qualitatively or compared using some predetermined criteria, indices or through survey techniques.

1.2. What is measurement? Name its two parts. (1.2)

Ans: Measurement: A measurement is a physical quantity having number and a unit. Parts of a measurement: A measurement consists of two parts, a number and a unit. A measurement without unit is meaningless.

1.3. Why do we need a standard unit for measurements? (1.3)

Ans: We need a standard unit for measurements because: i) In the early days, people used to measure length using hand or arm, foot or steps. This measurement may result in confusion as the measurement of different people may differ from each other because of different sizes of their hands, arms or steps. ii) For scientist, problems were faced when people of different countries exchanged scientific information or traded with other countries using different units. Not very far in the past, every country in the world had its own units of measurements.

1.4. Write the name of 3 base quantities and 3 derived quantities. (1.2)

Ans: Base Quantities: i) Length ii) Mass iii) Time iv) Temperature Derived Quantities: i) Area ii) Volume iii) Speed iv) Force

1.5. Which SI unit will you use to express the height of your desk? (1.3)

In SI unit, we will use to express the height of our desk is metre (m).

1.6. Write the name and symbols of all SI base units.

Sr no	Name of physical quantity	Unit	Symbol
1	Length	Meter	M
2	Mass	Kilogram	Kg
3	Time	Second	S
4	Temperature	Kelvin	K
5	Electric current	Ampere	A
6	Intensity of light	Candela	Cd
7	Amount of substance	mole	Mol

1.7. Why prefix is used? Name three sub-multiples and three multiple prefixes with their symbols.

Prefixes are used to simplify the representation of very large or very small quantities

Submultiple of length		
1 milli metre	1mm	10^{-3}
1centi metre	1cm	10^{-2}
1micrometre	1μm	10^{2}

Submultiple of Mass		
1 kilogram	1kg	10^{3} m
1mega gram	1mg	10^{6} m
1giga gram	1Gg	10^{9} m

1.8. In SI unit, we will use to express the height of our desk is metre (m1.8. What is meant by? (a) 5 pm (b) 15 ns (c) 6 μm (d) 5 fs (1.3) Ans: (a) 5 pm: 5 pm means 5 pico metre, it is length i.e., 5×10–12 m. (b) 15 ns: 15 ns means 15 nano seconds,

it is time i.e., 15×10–9 s. (c) 6 μm: 6 μm means 6 micro metre, it is length i.e., 6×10–6 m. (d) 5 fs: 5 fs means 5 femto seconds, it is time i.e., 5×10–15 s.).

1.9. For what purpose a Vernier Callipers is used? (1.5)

Ans: Vernier Callipers is an instrument used to measure small lengths down to 1/10th of a millimetre. It can be used to measure the thickness, diameter, width or depth of an object.

(b) Name its two main parts. Ans: Vernier Callipers has two parts: (i) Main scale (ii) Vernier scale

(c) How is least count found? Ans: The least count is found by dividing the length of one small division on main scale by the total number of divisions on the Vernier scale. Mathematically, Least Count of Verniers Callipers

$$= \frac{\text{smallest reding on main scale}}{\text{no of divisions on vernier scale}} = \frac{1mm}{10\ divisions} = 0.1\text{mm} = 0.01\text{cm}$$

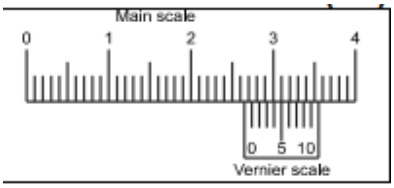
(M.S) and one Vernier scale (V.S) division. Least count = 1 M.S div - 1 V.S div = 1 mm - 0.9 mm = 0.1 mm So, the least count of vernier callipers is 0.1 mm or 0.01 cm

(d) What is meant by zero error?

Ans: **Zero Error:** Zero error is a type of error in which an instrument gives a reading when the true reading at that time is zero.

Definition: Any error in the measuring instrument that can affect the reading is called zero error. **Explanation:** If on joining the jaws A and B, the zeros of the main scale and Vernier scale do not exactly coincide with each other then there is an error in the instrument called zero error.

1.10. State least count and Vernier scale reading as shown in the figure and hence, find the length. (1.5)



Ans: Least Count of Vernier Callipers: Least count of a Vernier Callipers is the difference between one main scale division (M.S) and one Vernier scale (V.S) division. Hence,

Least count = 1 M.S div -1 V.S div = 1 mm- 0.9 mm = 0.1 mm

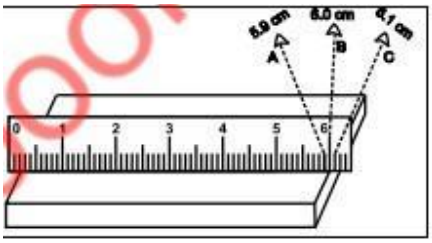
Length=MSR+LC×VSR

2.6cm+0.01×5

2.6cm+0.05m

=2.65cm

1.11. Which reading out of A, B and C shows the correct length and why? (1.5)



Ans: In the figure, three readings are taken which of them, reading B (6.0 cm) is correct length because eye shall be kept in level vernier scale and zero error is zero.

CRQs

1.1. In what unit will you express each of the following?

Ans:

(a) Thickness of a five-rupee coin: **millimetre (mm)**

(b) Length of a book: **inches (inch)**

(c) Length of football field: **metre (m)**

(d) The distance between two cities: **kilometre (km)**

(e) Mass of five-rupee coin: **gram (g)**

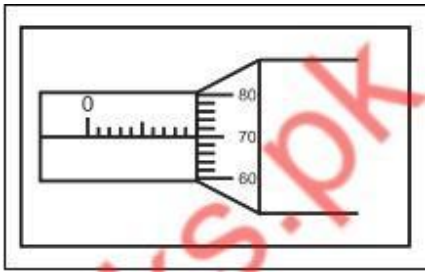
(f) Mass of your school bag: **kilogram (kg)** (g) Duration of your class period: **minutes (min)**

(h) Volume of petrol filled in the tank of a car: **litre (L)**

(i) Time to boil one litre milk: **minutes (min)**

1.2. Why might a standard system of measurement be helpful to a tailor? (1.3) Ans: A standard system of measurement can be helpful to a tailor because it can improve efficiency and reduce errors in garment sizes. Explanation: Tailoring requires precise measurements to ensure a good fit. A standard system allows tailors to accurately measure body dimensions, reducing errors and the need for extensive alteration.

1.3. The minimum main scale reading of a micrometer screw gauge is 1 mm and there are 100 divisions on the circular scale. When thimble is rotated once, 1 mm is its measurement on the main scale. What is the least count of the instrument? The reading for thickness of a steel rod as shown in the figure. What is the thickness of the rod?



a) The least count of given micrometer screw gauge is 1 mm.

b) Reading on main scale is 9 mm. Reading on circular scale is 70. Therefore, the thickness of the rod given in figure is: Thickness of the rod

$=9\text{mm}+\frac{70}{100}\text{mm}$

$=9+0.70\text{mm}=9.70\text{mm}$

1.4. You are provided a metre scale and a bundle of pencils; how can the diameter of a pencil be measured using the metre scale with the same precision as that of Vernier Callipers? Describe briefly. (1.5)

Ans: To measure the diameter of a pencil using a metre scale with the same precision as Vernier Callipers.

(i) Arrange Multiple Pencils: Line up several identical pencils tightly in a row.

(ii) Measure Total Length: Use the metre scale to measure the total length L of all pencils.

(iii) Count the Pencils: Note the total number of pencils

(iv) Calculate Diameter: Divide the total length L by the number of pencils n . Distance = L/n This method averages out errors, improving precision.

1.5. The end of a metre scale is worn out. Where will you place a pencil to find the length? (1.5)

Ans: If the end of a metre scale is worn out, you should avoid using it as a reference point. Instead:

(i) Place the Pencil at a Mark: Align one end of the pencil with a clear marking, such as the 1 cm or 10 cm mark on the scale.

(ii) Measure the Other End: Note the reading at the other end of the pencil.

(iii) Subtract: Subtract the starting mark from the final reading to find the length of the pencil.

Length of the pencil = Final reading − Starting reading

1.6. Why is it better to place the object close to the metre scale? (1.5)

Ans: It is better to place the object close to the metre scale for the following reasons:

(i) Minimizing Parallax Error

(ii) More Accurate Measurement

(iii) Using the Unworn Sections

(iv) Improved Precision

1.7. Why a standard unit is needed to measure a quantity correctly? (1.3)

Ans: A standard unit is needed to measure quantities accurately because it ensures consistency, avoids ambiguity, allows for comparability, and enables clear communication. It provides a reliable reference for precise measurements, essential for science, technology, and everyday use.

1.8. Suggests some natural phenomena that could serve as a reasonably accurate time standard. (1.11)

Ans: Natural phenomena that can serve as accurate time standards include:

i) Earth's Rotation (Day): The 24-hour cycle of Earth's rotation.

ii) Earth's Orbit (Year): The 365.25-day orbit around the Sun.

iii) Pendulum Oscillation: The consistent swinging of a pendulum.

iv) Atomic Transitions: The vibrations of atoms like cesium for precise time keeping.

v) Moon's Phases: The 29.5 day lunar cycle. These provide reliable and repeatable time intervals.

1.9. It is difficult to locate the meniscus in a wider vessel. Why? (1.8)

Ans: In wider vessels, the meniscus is harder to locate due to the reduced curvature of the liquid's surface, making it flatter. This reduces the noticeable effect of surface tension, and the wider surface increases the risk of parallax errors.

1.10. Which instrument can be used to measure: (1.5) (i) Internal diameter of a test tube. (ii) Depth of a beaker.

Ans:

(i) A Vernier Callipers can be used to measure the internal diameter of a test tube because it has a vernier scale.

(ii) Vernier Callipers can be used to measure the depth of a beaker because it has a vernier scale. D C