SHORT QUESTIONS

1.1 Name several repetitive phenomenon occurring in nature which could serve as reasonable time standard.

Ans. Any natural phenomenon that repeats itself after exactly same time interval can be used as a measure of time. The repetitive phenomenon could serve as reasonable time standard, occurring in nature are as follows:

1. **Sun:** Sun served as reasonable time standard because sunset and sunrises gives the information of time.
2. **Moon:** Moon is also reasonable time standard because it gives the information of time.
3. **Weather:** Changing of weather can also give information about time.
4. Rotation of Earth on its axis.
5. Rotation of Earth around the sun.
6. Oscillation of a simple pendulum.

1.2 Give draw backs to use the period of a pendulum as a time standard.

Ans. As we know that the time period of a simple pendulum depends upon the length and value of g at any place. Since

$$T = 2\pi\sqrt{\frac{l}{g}}$$

(i) It is clear that time period of a simple pendulum depends upon the value of g which is different at different places. So a pendulum of same length may have different time period at difference places. So period of pendulum cannot be taken as standard for measuring time.

(ii) Friction: Time period of a simple pendulum changes due to air resistance.

(iii) Temperature: In summer due to increase in temperature, length of simple pendulum changes so time period changes.

1.3 Why do we find it useful to have two units for the amount of substance, the kilogram and the mole?

Ans. It is very useful to have two units for the amount of substance i.e., kilogram and mole. If we want to consider a specific amounts of mass without considering number of microscopic atoms present in it, it is useful to use **kilogram**. Because one kilogram of different substances contains different number of molecules. While if we want to consider a fixed number of atoms present in it then it is useful to use **mole**. Because one mole of any substance contains the same number of atoms or molecules.

1.4 Three student's measured the length of a needle with a scale on which minimum division is 1 mm and recorded as (i) 0.2145m (ii) 0.21m (iii) 0.214m. Which record is correct and why?

Ans. In these records (iii) 0.214 m is more correct than the other records because the least count of a scale is 1 mm which can be written as 0.001 m. So according to this figure, the student measure that type of record is correct.

1.5 An old saying is that "A chain is only as strong as its weakest link". What analogue statement can you make regarding experimental data used in computation?

Ans. The analogous statement regarding experimental data used in computation is "A result obtained from an experimental data used in computation is only as accurate as its least accurate reading".

1.6 The period of simple pendulum is measured by a stopwatch. What type of errors are possible in the time period?

Ans. When the period of a simple pendulum is measured by a stopwatch, the following types of errors are possible:

1. **Systematic Error:** The error due to the fault in the measuring instrument is called systematic error i.e., zero error.
2. **Personal Error:** The error due to the faulty procedure of an observer is called personal error.

1.7 Does dimensional analysis give any information on constant of proportionality that may appear in an algebraic expression? Explain.

Ans. Dimensional analysis does not give any information about the constant of proportionality or dimensionless constant. For example

$$v = \text{Constant} \times \sqrt{\frac{E}{\rho}}$$

The numerical value of this constant cannot determined by dimensional analysis.

1.8 Write the dimension of:

(i) Pressure (ii) Density

Ans. (i) Dimensions of Pressure:

$$\text{As} \quad P = \frac{F}{A} = \frac{ma}{A}$$

$$\text{Unit of P} = \frac{\text{kg ms}^{-2}}{\text{m}^2} = \text{kg m}^{-1}\text{s}^{-2}$$

$$\Rightarrow \quad [P] = [ML^{-1}T^{-2}]$$

(ii) Dimensions of Density:

$$\text{As} \quad \text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Unit of density} = \frac{\text{kg}}{\text{m}^3} = \text{kg m}^{-3}$$

$$[\text{Density}] = [ML^{-3}]$$

1.9 The wavelength λ of a wave depends on the speed v of the wave and its frequency f. Knowing that:

$$[\lambda] = [L], [v] = [LT^{-1}] \text{ and } [f] = [T^{-1}]$$

Decide which of the following is correct, $f = v\lambda$ or $f = \frac{v}{\lambda}$.

Ans. In 1st case if $f = v\lambda$ where f is frequency. Its dimension is $[T^{-1}]$, v is speed, its dimensions are $[LT^{-1}]$.

λ is the wavelength, its dimension is [L].

So,
$$[T^{-1}] = [LT^{-1}][L]$$
$$[T^{-1}] = [L^2T^{-1}]$$

Hence the equation $f = v\lambda$ is not dimensionally correct because left hand side dimension is not equal to right hand side dimension.

In second case

$$f = \frac{v}{\lambda}$$

So
$$[T^{-1}] = \frac{[LT^{-1}]}{[L]}$$
$$[T^{-1}] = [T^{-1}]$$

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