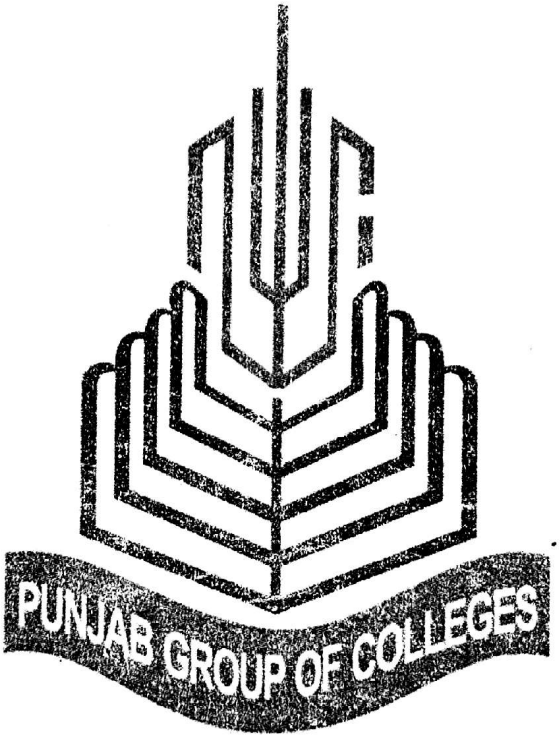
PUNJAB GROUP OF COLLEGES
HAROONABAD

Chapte # 01

Chapter Name ,, Measurements

(Short Answers and Numericals)



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CH # 01

ZiA. CH. Physics

Short Answer's

(i)

Ans:- The Natural Phenomenon that Repeat itself after equal time Interval can be used as a time Standard.

(i) Rotation of Earth about its axis.

(ii) Human Pulse Rate. (iii) Motion of Moon.

(iv) Rotation of Earth around the Sun.

(ii) Ans:- As we Know; $T = 2\pi\sqrt{\frac{l}{g}}$ ——— (i).

It Means that time period depends upon length "l" and value of "g" which are variable quantities.

(i) "g" changes from Place to place.

(ii) "l" is affected by change in temperature.

So, by eq. (i) time period changes.

(1.3) Ans:- Both units are used for amount of substance.

Kilogram:- we use the term Kilogram at Macro-level. One Kilogram of different substances have different number of molecules.

Mole:- It is used at Micro-Level. One mole of different substances contains same No. of molecules.

(1.4):-

Ans:- 0.214 is correct record.

Because the least count of the Scale is 0.001m. So, length Precisely measured upto three decimal.

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(1.5) Ans:- Its Analogous Statement is,

"A Result of experimental data is only as much accurate as its least accurate reading in experimental data".

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(1.6) Ans:- There are two types of Possible errors:-

(i). Systematic error:- It may occur due to Zero error of the instrument, or Poor Calibration.

(ii) Random error:- This error occur due to the negligence and inexperience of a Person.

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(1.7) Ans:- As constant have No Dimension. So a dimensional Analysis does not give any information on constant of Proportionality that may appear in an algebraic expression.

:-:-

(1.8) Ans:-

(i) Pressure:-

As, $P = F/A$.

Taking Dimension.

$$[P] = \frac{[F]}{[A]} = \frac{[MLT^{-2}]}{[L^2]}$$

$$[P] = [ML^{-1}T^{-2}]$$ Ans.

(ii) Density:-

As, $S = \frac{\text{mass}}{\text{volume}} = \frac{m}{V}$

Taking Dimension,

$$[S] = \frac{[M]}{[L^3]}$$

$$[S] = [ML^{-3}]$$ Ans

(1.9):- Ans:-

consider, $f = \frac{V}{\lambda}$

$$\frac{1}{T} = \frac{V}{\lambda}$$

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

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

$$[T^{-1}] = [T^{-1}]$$

Hence, the Relation $f = \frac{V}{\lambda}$ is correct.

consider, $f = V\lambda$.

$$\frac{1}{T} = V\lambda.$$

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

$$[T^{-1}] \neq [L^2T^{-1}]$$

Hence, the Relation $f = V\lambda$ is incorrect.

Numerical Problem's

1.1 :- Given data;

$v = c = 3 \times 10^8 \, m s^{-1}$, $S = ??$

$t = 1$ year.

$t = 1 \times 365 \times 24 \times 60 \times 60 \, s$

$t = 3.15 \times 10^7 \, s$

As we Know;

$S = v \times t$

$S = 3 \times 10^8 \, m s^{-1} \times 3.15 \times 10^7 \, s$

$S = 9.5 \times 10^{15} \, m$ Ans

(1.2) (a) :- $1 \text{ Year} = 365 \times 24 \times 60 \times 60 \, s$

$1 \text{ Year} = 3.15 \times 10^7 \, s$

(b) $1 \text{ Year} = 3.15 \times 10^7 \, s$

$1 \text{ Year} = 3.15 \times 10^7 \, s \times \frac{10^{-9}}{10^{-9}}$

$1 \text{ Year} = 3.15 \times 10^7 \times 10^9 \, s \times 10^{-9}$

$1 \text{ Year} = 3.15 \times 10^{7+9} \, s \times 10^{-9}$

$\because \text{neno} = n = 10^9$

$1 \text{ Year} = 3.15 \times 10^{16} \, ns$

(c) $1 \text{ Year} = 3.15 \times 10^7 \, s$

$1 \text{ Sec} = \frac{1}{3.15 \times 10^7} \text{ Year}$

$1 \text{ Sec.} = 3.17 \times 10^{-8} \text{ Years}$

(1.3) :- Given data;

$l = 15.3 \, cm$, $w = 12.80 \, cm$.

$A = ?$

As, $A = l \times w$

$A = (15.3 \times 12.80) \, cm^2$.

$A = 195.84 \, cm^2$.

As, in Given values the Least Significant figure is three So the answer is;

$A = 196 \, cm^2$

(1.4) :- Given data;

$m_1 = 2.189 \, kg$, $m_2 = 0.089 \, kg$

$m_3 = 11.8 \, kg$, $m_4 = 5.32 \, kg$.

$M = ?$

As,

$M = m_1 + m_2 + m_3 + m_4$.

$M = (2.189 + 0.089 + 11.8 + 5.32) \, kg$

$M = 19.398 \, kg$

As, 11.8 is least Precision, So the answer is;

$M = 19.4 \, kg$.

(1.6):- $F = G\frac{m_1 m_2}{r^2}$.

$$G = \frac{Fr^2}{m_1 m_2} \Rightarrow \boxed{Nm^2/kg^2}$$

Taking Dimension.

$$[G] = \frac{[MLT^{-2}][L^2]}{[M][M]}$$

$$[G] = [M^{-1}L^3T^{-2}]$$

(1.7):- As,

$$v_f = v_i + at.$$

L.H.S $\quad v_f = ms^{-1}$

Taking Dimension;

$$[v_f] = [LT^{-1}] \text{ —— (1)}.$$

R.H.S:- $v_i + at$

Taking Dimension:-

$$= [LT^{-1}] + [LT^{-2}][T].$$

$$= [LT^{-1}] + [LT^{-1}]$$

$$= 2[LT^{-1}] \text{ —— (2)}$$

where 2 is constant and having no Dimension So, By Eq. (1) & (2) the Eq. $v_f = v_i + at$ is Dimensionly correct.

(1.8):- According to Statement;

$V \propto \rho E$

$V = \text{constant} \cdot \rho^a E^b$ —— (1)

Taking Dimension o.b.s:-,

$[V] = \text{constant}[\rho]^a[E]^b$ —— (2).

$\because [\rho] = [ML^{-3}]$

$\because E = \frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta l/l}$

$\because$ Strain is Dimensionless.

$$\therefore [E] = \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$$

Put in eq. (2).

$$[LT^{-1}] = \text{const.}[ML^{-3}]^a[ML^{-1}T^{-2}]^b$$

comparing the Co-efficients.

$$[L] = [L]^{-3a-b}$$

$$1 = -3a - b \text{ —— (A)}.$$

$$[T]^{-1} = [T]^{-2b}$$

$$+1 = +2b$$

$$\boxed{b = \frac{1}{2}} \text{ put in (A)}.$$

$$1 = -3a - \frac{1}{2}$$

$$1 + \frac{1}{2} = -3a \Rightarrow \frac{3}{2} = -3a$$

$$\boxed{a = -\frac{1}{2}} \text{ putting in (1)}.$$

$$V = \text{constant} \cdot \rho^{-1/2} E^{1/2}.$$

$$\boxed{V = \text{constant} \cdot \sqrt{\frac{E}{\rho}}}$$

(1.9) $E = mc^2$.

L.H.S.

$E = W = Fd$

Taking Dimension:

$[E] = [MLT^{-2}][L]$

$[E] = [ML^2T^{-2}]$ — (i).

R.H.S mc^2.

Taking Dimension:

$\Rightarrow [M][LT^{-1}]^2 \quad \because c = v.$

$\Rightarrow [ML^2T^{-2}]$ — (ii)

By eq. (i) & (ii) the eq. $E = mc^2$ is Dimensionally correct.

(1.10) According to Statement :-

$a \propto \gamma^n v^m$

$a = \text{constant } \gamma^n v^m$

Taking Dimension o.b.s:

$[LT^{-2}] = \text{constant}.[L]^n[LT^{-1}]^m$

Comparing the co-efficients.

$[L]^1 = [L]^{n+m}$

$1 = n + m$ — (A).

$[T]^{-2} = [T]^{-m}$

$-2 = -m$

$\boxed{m = 2}$

Put in eq. (A).

$1 = n + 2$

$1 - 2 = n$

$\boxed{-1 = n}$

-: ——— :-