DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 4

Topic :- UNITS AND MEASUREMENTS

1 **(b)**

Force = mass $\times$ acceleration

Or $F = ma$

$\therefore$ $[F] = [m][a]$

$= [\mathrm{M}][\mathrm{LT}^{2}]$

$= [\mathrm{MLT}^{-2}]$

2 **(d)**

$[\mathrm{ML}^{-2}\mathrm{T}^{-2}] = \frac{[\mathrm{MLT}^{-2}]}{[\mathrm{L}][\mathrm{L}^{2}]}$

$= \frac{\text{Force}}{\text{distance} \times \text{area}} = \frac{\text{pressure}}{\text{distance}}$

= pressure gradient.

3 **(c)**

Let $v^x = kg^y \lambda^z \rho^\delta$. Now by submitting the dimensions of each quantities and equating the powers of M, L and T

we get $\delta = 0$ and $x = 2, y = 1, z = 1$

4 **(a)**

Time period

$T \propto p^a \rho^b E^c$

Or, $T = kp^a \rho^b E^c$

k, is a dimensionless constant.

According to homogeneity of dimensions,

LHS=RHS

$\therefore$ $[\mathrm{T}] = [\mathrm{ML}^{-1}\mathrm{T}^{-2}]^a [\mathrm{ML}^{-3}]^b [\mathrm{ML}^{2}\mathrm{T}^{-2}]^c$

$[\mathrm{T}] = [\mathrm{M}^{a+b+c}][\mathrm{L}^{-a-3b+2c}][\mathrm{T}^{-2a-2c}]$

Comparing the powers, we obtain

$a + b + c = 0$

$-a - 3b + 2c = 0$

$-2a - 2c = 1$

On solving, we get

$a = -\frac{5}{6}, b = \frac{1}{2}, c = \frac{1}{3}$

5 **(b)**

Average value $= \frac{2.63 + 2.56 + 2.42 + 2.71 + 2.80}{5}$

$= 2.62$ sec

Now $|\Delta T_1| = 2.63 - 2.62 = 0.01$

$|\Delta T_2| = 2.62 - 2.56 = 0.06$

$|\Delta T_3| = 2.62 - 2.42 = 0.20$

$|\Delta T_4| = 2.71 - 2.62 = 0.09$

$|\Delta T_5| = 2.80 - 2.62 = 0.18$

Mean absolute error

$\Delta T = \frac{|\Delta T_1| + |\Delta T_2| + |\Delta T_3| + |\Delta T_4| + |\Delta T_5|}{5}$

$= \frac{0.54}{5} = 0.108 = 0.11\ sec$

6 **(c)**

$Y = \frac{4MgL}{\pi D^2 l}$ so maximum permissible error in Y

$= \frac{\Delta Y}{Y} \times 100 = \left(\frac{\Delta M}{M} + \frac{\Delta g}{g} + \frac{\Delta L}{L} + \frac{2\Delta D}{D} + \frac{\Delta l}{l}\right) \times 100$

$= \left(\frac{1}{300} + \frac{1}{981} + \frac{1}{2820} + 2 \times \frac{1}{41} + \frac{1}{87}\right) \times 100$

$= 0.065 \times 100 = 6.5\%$

7 **(d)**

$\tau = \frac{dL}{dt} \Rightarrow dL = \tau \times dt = r \times F \times dt$

i.e., the unit of angular momentum is *joule-second*

8 **(b)**

$f = \frac{1}{2\pi\sqrt{LC}} \Rightarrow LC = \frac{1}{f^2} = [M^0L^0T^2]$

9 **(a)**

$\frac{\text{angular momentum}}{\text{linear momentum}} = \frac{[\mathrm{ML^2T^{-1}}]}{[\mathrm{MLT^{-1}}]} = [\mathrm{M^0LT^0}]$

10 **(a)**

$[e] = [AT]$, $\in_0 = [M^{-1}L^{-3}T^4A^2]$, $[\mathrm{h}] = [ML^2T^{-1}]$

And $[c] = [LT^{-1}]$

$\therefore \left[\frac{e^2}{4\pi\epsilon_0 \mathrm{h} c}\right] = \left[\frac{A^2T^2}{M^{-1}L^{-3}T^4A^2 \times ML^2T^{-1} \times LT^{-1}}\right]$

$= [M^0L^0T^0]$

12 **(a)**

The result has to be in one significant umber only.

13 **(b)**

$v \propto g^p h^q$ (given)

By submitting the dimension of each quantity and comparing the powers on both sides we get $[LT^{-1}] = [LT^{-2}]^p [L]^q$

$\Rightarrow p + q = 1,\ -2p = -1,\ \therefore p = \frac{1}{2}, q = \frac{1}{2}$

14 **(b)**

Force = Mass $\times$ acceleration

$= [M][LT^{-2}] = [MLT^{-2}]$

Torque = Force $\times$ distance $= [MLT^{-2}][L] = [ML^2T^{-2}]$

Work = Force $\times$ distance $= [MLT^{-2}][L] = [ML^2T^{-2}]$

Energy $= [ML^2T^{-2}]$

$Power = \frac{\text{Work}}{\text{Time}} = \frac{[ML^2T^{-2}]}{[T]} = [ML^2T^{-3}]$

16 **(b)**

Positions $x = ka^m t^n$

$$[\mathrm{M^0LT^0}] = [\mathrm{LT^{-2}}]^m [\mathrm{T}]^n$$

$$= [\mathrm{M^0L^mT^{-2m+n}}]$$

On comparing both sides

$$m = 1$$

$$-2m + n = 0$$

$$n = 2m$$

$$n = 2 \times 1 = 2$$

17 **(a)**

$$\because R = \frac{PV}{T} = \left[\frac{ML^{-1}T^{-2} \times L^3}{\theta}\right] = [ML^2T^{-2}\theta^{-1}]$$

18 **(b)**

We know that

Specific heat $= \frac{Q}{m\,\Delta t}$

Unit of specific heat $= \frac{\text{unit of heat}}{\text{unit of mass } \times \text{ unit of temperature}}$

$\therefore$ Unit of specific heat $= \dfrac{\text{J}}{\text{kg°C}} = \text{Jkg}^{-1}\text{°C}^{-1}$

19 **(a)**

$K = Y \times r_0 = [ML^{-1}T^{-2}] \times [L] = [MT^{-2}]$

Y=Young's modulus and $r_0 =$ Interatomic distance

20 **(a)**

Couple of force = $|\vec{r} \times \vec{F}| = [ML^2T^{-2}]$

Work $= [\vec{F}.\vec{d}] = [ML^2T^{-2}]$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	D	C	A	B	C	D	B	A	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	B	B	D	B	A	B	A	A