DIMENSIONS

Subject: Physics DIMENSIONS

PHYSICS

1.	The dimensions of CV^2 mate (A) L^2I (C) LI^2	hes with the dimensions of (B) $L^2 I^2$ (D) $\frac{1}{LI}$	14.	g is acceleration due to gr ues of p and q are	ing body changes as $g^p h^q$ where avity and h is the height. The val-	
2		s allowed to fall under gravity		(A) $1, \frac{1}{2}$	(B) $\frac{1}{2}, \frac{1}{2}$	
Ζ.	through a column of a viscou	is liquid of coefficient of vis-		(C) $\frac{1}{2}, 1$	(D) 1, 1	
	cosity η . After some time the velocity of the ball attains a constant value known as terminal velocity v_T . The termi-		15.	. The dimensional formula f	or <i>r.m.s.</i> (root mean square) ve-	
	nal velocity depends on (i) th $(iii) r$ and (iv) acceleration d	The mass of the ball m , (ii) η ,		locity is (A) M^0LT^{-1}	(B) $M^0 L^0 T^{-2}$	
	following relations is dimensi	onally correct		(C) $M^0 L^0 T^{-1}$	(b) MLT^{-3}	
	(A) $v_T \propto \frac{mg}{mg}$	(B) $v_T \propto \frac{\eta r}{r}$	16		o of angular to linear momentum	
	(A) $v_T \propto \frac{mg}{\eta r}$ (C) $v_T \propto \eta r mg$	(D) $v_{\pi} \propto \frac{mg}{mgr}$	10.	is	of angular to intear momentum	
r	Dimensional formula of veloc			(A) $M^0 L^1 T^0$	(B) $M^1 L^1 T^{-1}$	
5.	(A) M^0LT^{-2}	(B) LT^0		(C) $M^1 L^2 T^{-1}$	(D) $M^{-1}L^{-1}T^{-1}$	
	(C) $M^0 L T^{-1}$	(D) $M^0 L^{-1} T^{-1}$	17.	The dimensions of surface	tension are	
Л	An athletic coach told his tea			(A) $ML^{-1}T^{-2}$	(B) MLT^{-2}	
4.	equals power. What dimension	ons does he view for muscle		(C) $ML^{-1}T^{-1}$	(D) MT^{-2}	
	(A) MLT^{-2}	(B) ML^2T^{-2}	18.		nductance, capacitance and re-	
	(C) MLT^2	(D) L		sistance respectively, the c	dimensional formula for $C^2 LR$ is	
5.	Dimensions of the following	three quantities are the same		(A) $[ML^{-2}T^{-1}I^0]$	(B) $[M^0 L^0 T^3 I^0]$	
	(A) Work, energy, force			(c) $[M^{-1}L^{-2}T^6I^2]$		
		impulse	19		sional analysis were laid down by	
	(C) Potential energy, kinetic energy, momentum		15.		5	
c		cient of elasticity		(A) Gallileo	(B) Newton	
0.	Dimensions of time in power (A) T^{-1}	(B) T^{-2}		(C) Fourier	(D) Joule	
	(C) T^{-3}	(D) T^{0}	20.	. Which of the following qua as that of energy	antities has the same dimensions	
7	If the velocity of light (<i>c</i>), gra			(A) Power	(B) Force	
<i>,</i> .	Planck's constant (h) are cho			(C) Momentum	(D) Work	
	then the dimensions of mass	in new system is	21			
	(A) $c^{1/2}G^{1/2}h^{1/2}$	(B) $c^{1/2}G^{1/2}h^{-1/2}$	21.	The expression $[ML^2T^{-2}]$ (A) Pressure	-	
	(C) $c^{1/2}G^{-1/2}h^{1/2}$	(D) $c^{-1/2}G^{1/2}h^{1/2}$				
8.	Dimension of R is		22	(C) Momentum		
	(A) ML^2T^{-1}	(B) $ML^2T^{-3}A^{-2}$	22.	P. In a system of units if force (F) , acceleration (A) and time (T) are taken as fundamental units then the dimensional		
_	(C) $ML^{-1}T^{-2}$	(D) None of these		formula of energy is		
9.	The dimensions of resistivity where Ω stands for the dime			(A) FA^2T	(B) FAT^2	
	where Q stands for the dime (A) $ML^3T^{-1}Q^{-2}$	(B) $ML^3T^{-2}Q^{-1}$		(C) F^2AT	(D) <i>FAT</i>	
	(C) $ML^2T^{-1}Q^{-1}$	(D) $MLT^{-1}Q^{-1}$	23.	Dimensions of kinetic ener	rgy are	
0	The dimensional formula for	•		(A) ML^2T^{-2}	(B) $M^2 L T^{-1}$	
0.	(A) MLT^{-2}	(B) MLT^{-1}		(C) ML^2T^{-1}	(D) ML^3T^{-1}	
	(C) ML^2T^{-1}	(D) $M^2 L T^{-1}$	24			
1.	The dimensions of power are		24.	. The dimension of $rac{1}{\sqrt{arepsilon_0 \mu_0}}$ is	s that of	
••	(A) $M^1 L^2 T^{-3}$	(B) $M^2 L^1 T^{-2}$		(A) Velocity	(B) Time	
	(C) $M^1 L^2 T^{-1}$	(D) $M^1 L^1 T^{-2}$		(C) Capacitance	(D) Distance	
2.	Dimensions of magnetic field	· · /	25. Which pair has the same dimensions			
	(A) $[M^0 L^{-1} T^0 A^1]$	(B) $[MLT^{-1}A^{-1}]$	20.	(A) Work and power	(B) Density and relative den-	
	(C) $[ML^0T^{-2}A^{-1}]$	(D) $[MLT^{-2}A]$, ,	sity	
3.	The pair having the same din			(C) Momentum and impul	se (D) Stress and strain	
	(A) Angular momentum,	work	٦ <i>६</i>			
	-	(B) Work, torque	20.	The dimensional formula of (A) ML^{-3}	(B) LT^{-1}	
	(C) Potential energy, linear	(D) Kinetic energy, velocity				
	momentum			(C) MLT^{-2}	(D) Dimensionless	

- (B) $\frac{1}{2}, \frac{1}{2}$ (D) 1, 1
- for *r.m.s.* (root mean square) ve-
 - (B) $M^0 L^0 T^{-2}$ (D) MLT^{-3}
- io of angular to linear momentum
 - (B) $M^1 L^1 T^{-1}$
 - (D) $M^{-1}L^{-1}T^{-1}$ e tension are
 - (B) MLT^{-2}
 - (D) MT^{-2}
- inductance, capacitance and redimensional formula for $C^2 LR$ is
 - (B) $[M^0 L^0 T^3 I^0]$
 - (D) $[M^0 L^0 T^2 I^0]$
- nsional analysis were laid down by
 - (B) Newton
 - (D) Joule
- uantities has the same dimensions
 - (B) Force
 - (D) Work
- ²] represents
 - (B) Kinetic energy
 - (D) Power
- ce (F), acceleration (A) and time ental units then the dimensional
 - (B) FAT^2
 - (D) *FAT*
- ergy are
 - (B) $M^2 L T^{-1}$
 - (D) ML^3T^{-1}
- is that of
 - (B) Time
 - (D) Distance
- dimensions (B) Density and relative density
 - ulse (D) Stress and strain
 - of relative density is
 - (B) LT^{-1}
 - (C) *MLT*
- (D) Dimensionless

27.	Of the following quantities, w ferent from the remaining thr		39.	Whose dimensions is ML^2T	
	-	(B) Force per unit area		(A) Torque (C) Power	(B) Angul (D) Work
	(C) Product of voltage and charge per unit volume	(D) Angular momentum per unit mass	40.	The dimensions of electric p (A) $[ML^2T^{-2}Q^{-1}]$	
28.	Out of the following which pa same dimensions	ir of quantities do not have		(C) $[ML^2T^{-1}Q]$	(D) $[ML^2]$
	(A) Planck's constant and angular momentum	(B) Work and energy	41.	Dimensions of <i>CR</i> are those (A) Frequency	e of (B) Energ
	(C) Pressure and Young's modulus	(D) Torque & moment of inertia	42	(C) Time period Let $[\varepsilon_0]$ denotes the dimensi	(D) Currei
20	The dimensions of permittivit		-τ ∠ ,	tivity of the vacuum and $[\mu_0]$	
29.	(A) $A^2 T^2 M^{-1} L^{-3}$	(B) $A^2 T^4 M^{-1} L^{-3}$		the vacuum. If $M = \text{mass}$, $I = \text{electriccurrent}$, then	
	(C) $A^{-2}T^{-4}ML^3$	(D) $A^2T^{-4}M^{-1}L^{-3}$		(A) $[\varepsilon_0] = M^{-1}L^{-3}T^2I$	(B) $[\varepsilon_0] =$
30.	Dimensional formula ML^2T^{-3}	•		(C) $[\mu_0] = ML^2T^{-1}I$	(D) None
	(A) Force	(B) Power	43.	If C and L denote capacitan	ice and induc
	(C) Energy	(D) Work		then the dimensions of LC	
31.	Inductance <i>L</i> can be dimension (A) $ML^2T^{-2}A^{-2}$	5 1		(A) $M^0 L^0 T^0$	(B) $M^0 L^0$
	(A) $ML^{-2}T^{-2}A^{-2}$ (C) $ML^{-2}T^{-2}A^{-2}$	(B) $ML^2T^{-4}A^{-3}$ (D) $ML^2T^4A^3$		(C) $M^2 L^0 T^2$	(D) MLT^2
32.	The physical quantity which h	· · /	44.	Frequency is the function of face tension (T) . Then its va	alue is
	$M^1 T^{-3}$ is			(A) $k \rho^{1/2} a^{3/2} / \sqrt{T}$	(B) $k \rho^{3/2} a$
	(A) Surface tension	(B) Solar constant		(C) $k\rho^{1/2}a^{3/2}/T^{3/4}$	(D) $k \rho^{1/2} a$
22	(C) DensityOut of following four dimensi	(D) Compressibility	45.	MLT^{-1} represents the dime	
55.	quantity is to be called a dime			(A) Power	(B) Mome
	(A) Acceleration due to	(B) Surface tension of water		(C) Force	(D) Couple
	gravity	(D) The velocity of light in	46.	Dimension of electric curren (A) $[M^0L^0T^{-1}Q]$	(B) $[ML^2]$
	(C) Weight of a standard kilogram mass	(D) The velocity of light in vacuum		(A) $[M^2LT^{-1}Q]$ (C) $[M^2LT^{-1}Q]$	(D) $[ML]^2$
34.	Dimensional formula for torq		47	The dimensions of pressure	
	(A) $L^2 M T^{-2}$	(B) $L^{-1}MT^{-2}$	<i>ч</i> /.	(A) MLT^{-2}	(B) ML^{-2}
	(C) $L^2 M T^{-3}$	(D) LMT^{-2}		(C) $ML^{-1}T^{-2}$	(D) MLT^2
35.	The period of a body under S $P^a D^b S^c$; where P is pressure,		48.	Planck's constant has the di	
	tension. The value of a, b and			(A) Energy	(B) Linear
	(A) $-\frac{3}{2}, \frac{1}{2}, 1$	(B) −1, −2, 3		(C) Work	(D) Angul
	(C) $\frac{1}{2}, -\frac{3}{2}, -\frac{1}{2}$	(D) 1, 2, $\frac{1}{3}$	49.	The equation of state of son	
36	The physical quantity that has	5		$\left(P+\frac{a}{V^2}\right)(V-b)=RT.$ He	ere P is the p
	(A) Angular Velocity	(B) Linear momentum		volume, T is the absolute te stants. The dimensions of 'a	mperature a
0.7	(C) Angular momentum	(D) Strain		(A) ML^5T^{-2}	(B) ML^{-1}
37.	The dimensional formula for (A) $ML^{-2}T^{-3}$	Planck's constant (h) is (B) ML^2T^{-2}		(C) $M^0 L^3 T^0$	(D) $M^0 L^6$
	(C) ML^2T^{-1}	(B) $ML^{-2}T^{-2}$	50.	Out of the following, the on tical dimensions is	ly pair that d
38.	If the time period (T) of vibra on surface tension (S) , radius	(r) of the drop and density		(A) Angular momentum and Planck's constant	d (B) Mome mom
	(ρ) of the liquid, then the exp (A) $T = k\sqrt{\rho r^3/S}$	(B) $T = k \sqrt{\rho^{1/2} r^3 / S}$		(C) Work and torque	(D) Impul

(C)
$$T = k \sqrt{\rho r^3 / S^{1/2}}$$

- (B) $T = k \sqrt{\rho^{1/2} r^3} / S$ (D) None of these
- Time period (D) Current ε_0 denotes the dimensional formula of the permitof the vacuum and $[\mu_0]$ that of the permeability of vacuum. If M = mass, L = length, T = Time andelectriccurrent, then (B) $[\varepsilon_0] = M^{-1}L^{-3}T^4I^2$ $[\varepsilon_0] = M^{-1} L^{-3} T^2 I$ $[\mu_0] = ML^2 T^{-1} I$ (D) None of these and L denote capacitance and inductance respectively, the dimensions of LC are (B) $M^0 L^0 T^2$ $M^{0}L^{0}T^{0}$ $M^2 L^0 T^2$ (D) MLT^2 uency is the function of density (ρ) , length (a) and surtension (T). Then its value is $k \rho^{1/2} a^{3/2} / \sqrt{T}$ (B) $k\rho^{3/2}a^{3/2}/\sqrt{T}$ $k \rho^{1/2} a^{3/2} / T^{3/4}$ (D) $k\rho^{1/2}a^{1/2}/T^{3/2}$ T^{-1} represents the dimensional formula of Power (B) Momentum orce (D) Couple ension of electric current is $[M^0 L^0 T^{-1} Q]$ (B) $[ML^2T^{-1}Q]$ $[M^2 L T^{-1} Q]$ (D) $[M^2 L^2 T^{-1} Q]$ dimensions of pressure are MLT^{-2} (B) $ML^{-2}T^2$ $ML^{-1}T^{-2}$ (D) MLT^2 ck's constant has the dimensions (unit) of Energy (B) Linear momentum Nork (D) Angular momentum equation of state of some gases can be expressed as $+ \frac{a}{V^2} (V - b) = RT$. Here P is the pressure, V is the me, T is the absolute temperature and a, b, R are conts. The dimensions of 'a' are ML^5T^{-2} (B) $ML^{-1}T^{-2}$
 - $M^{0}L^{3}T^{0}$ (D) $M^0 L^6 T^0$
 - of the following, the only pair that does not have idendimensions is
 - Angular momentum and (B) Moment of inertia and moment of a force Planck's constant
 - (D) Impulse and momentum Work and torque

(B) Angular momentum

(B) $[MLT^{-2}Q^{-1}]$

(D) $[ML^2T^{-2}Q]$

(B) Energy

ANSWER KEY

PHYSICS

1 - C	2 - A	3 - C	4 - A	5 - D	6 - C	7 - C	8 - B	9 - A	10 - B
11 - A	12 - C	13 - B	14 - B	15 - A	16 - A	17 - D	18 - B	19 - C	20 - D
21 - B	22 - B	23 - A	24 - A	25 - C	26 - D	27 - D	28 - D	29 - B	30 - B
31 - A	32 - B	33 - D	34 - A	35 - A	36 - D	37 - C	38 - A	39 - B	40 - A
41 - C	42 - B	43 - B	44 - A	45 - B	46 - A	47 - C	48 - D	49 - A	50 - B

SOLUTION

PHYSICS

1. The dimensions of CV^2 matches with the dimensions of (A) $L^2 I$ $(D) \tau 2 \tau 2$

$(A) \ L \ I$	(D) L I
(C) $\checkmark LI^2$	(D) $\frac{1}{LI}$
	<i>د L</i>

Sol : (c) Both are the formula of energy.

$$\left(E = \frac{1}{2}CV^2 = \frac{1}{2}LI^2\right)$$

- 2. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity η . After some time the velocity of the ball attains a constant value known as terminal velocity v_T . The terminal velocity depends on (i) the mass of the ball m_i (ii) η_i (iii) r and (iv) acceleration due to gravity g. Which of the following relations is dimensionally correct
 - (A) $\checkmark v_T \propto \frac{mg}{\eta r}$ (B) $v_T \propto \frac{\eta r}{mg}$ (D) $v_T \propto \frac{m_g^3 r}{\eta}$ (C) $v_T \propto \eta rmg$

Sol : (a) By substituting dimension of each quantity in R.H.S. of option (a) we get

 $\left[\frac{M\times LT^{-2}}{ML^{-1}T^{-1}\times L}\right] = [LT^{-1}].$ mg ηr

This option gives the dimension of velocity

- 3. Dimensional formula of velocity of sound is (A) $M^0 L T^{-2}$ (B) LT^0
 - (D) $M^0 L^{-1} T^{-1}$ (C) $\checkmark M^0 L T^{-1}$ Sol: (c)
- 4. An athletic coach told his team that muscle times speed equals power. What dimensions does he view for muscle (B) ML^2T^{-2}

(A)
$$\sqrt{MLT^{-2}}$$
 (B) *M*
(C) *MLT*² (D) *L*

Sol : (a) According to problem muscle \times speed = power

 $\mathsf{muscle} = \frac{\mathsf{power}}{\mathsf{speed}} = \frac{ML^2T^{-3}}{LT^{-1}} = MLT^{-2}$

- 5. Dimensions of the following three quantities are the same (B) Velocity, momentum, (A) Work, energy, force impulse
 - (C) Potential energy, kinetic (D) √ Pressure, stress, coeffienergy, momentum cient of elasticity

Sol : (d) [Pressure] = [Stress] = [coefficient of elasticity] = $[ML^{-1}T^{-2}]$

6. Dimensions of time in power are

(A)
$$T^{-1}$$
 (B) T^{-2}
(C) $\sqrt{T^{-3}}$ (D) T^{0}

Sol : (c) Dimensions of power is
$$[ML^2T^{-3}]$$

7. If the velocity of light (c), gravitational constant (G) and Planck's constant (h) are chosen as fundamental units, then the dimensions of mass in new system is (A

(A)
$$c^{1/2}G^{1/2}h^{1/2}$$
 (B) $c^{1/2}G^{1/2}h^{-1/2}$
(C) $\sqrt{c^{1/2}G^{-1/2}h^{1/2}}$ (D) $c^{-1/2}G^{1/2}h^{1/2}$

Sol : (c) Let $m \propto C^x G^y h^z$

By substituting the following dimensions :

$$[C] = LT^{-1}$$
; $[G] = [M^{-1}L^3T^{-2}]$ and $[h] = [ML^2T^{-1}]$
Now comparing both sides we will get

x = 1/2; y = -1/2, z = +1/2So $m \propto c^{1/2} G^{-1/2} h^{1/2}$ 8. Dimension of R is (A) ML^2T^{-1} (B) $\sqrt{ML^2T^{-3}A^{-2}}$ (C) $ML^{-1}T^{-2}$ (D) None of these Sol : (b) $R = \frac{V}{I} = \left[\frac{ML^2T^{-3}A^{-1}}{A}\right] = [ML^2T^{-3}A^{-2}]$

9. The dimensions of resistivity in terms of M, L, T and Qwhere Q stands for the dimensions of charge, is

(A)
$$\sqrt{ML^{3}T^{-1}Q^{-2}}$$
 (B) $ML^{3}T^{-2}Q^{-1}$
(C) $ML^{2}T^{-1}Q^{-1}$ (D) $MLT^{-1}Q^{-1}$
Sol : (a) $\rho = \frac{RA}{l}$

i.e. dimension of resistivity is $[ML^3T^{-1}Q^{-2}]$

10. The dimensional formula for impulse is (A) MLT^{-2} (B) $\checkmark MLT^{-1}$ (C) ML^2T^{-1} (D) $M^2 L T^{-1}$

Sol : (b) Impulse = Force × Time =
$$[MLT^{-2}][T] = [MLT^{-1}]$$

1. The dimensions of power are

The dimensions of power are (A) $(M^{1}I^{2}T^{-3})$

(A)
$$\checkmark M^1 L^2 T^{-3}$$
 (B) $M^2 L^1 T^{-2}$
(C) $M^1 L^2 T^{-1}$ (D) $M^1 L^1 T^{-2}$
Sol : (a) Power = $\frac{\text{Workdone}}{\text{Time}} = \left[\frac{ML^2 T^{-2}}{T}\right] = [ML^2 T^{-3}]$

- 12. Dimensions of magnetic field intensity is (A) $[M^0 L^{-1} T^0 A^1]$ (B) $[MLT^{-1}A^{-1}]$ (C) $\sqrt{[ML^0T^{-2}A^{-1}]}$ (D) $[MLT^{-2}A]$ Sol: (c) $B = \frac{F}{IL} = \frac{[MLT^{-2}]}{[A][L]} = [MT^{-2}A^{-1}]$
- 13. The pair having the same dimensions is

(A) Angular momentum,

(C) Potential energy, linear (D) Kinetic energy, velocity momentum

Sol : (b) Dimension of work and torque = $[ML^2T^{-2}]$

14. The velocity of a freely falling body changes as $g^p h^q$ where g is acceleration due to gravity and h is the height. The values of p and q are

1,
$$\frac{1}{2}$$
 (B) $\sqrt{\frac{1}{2}}, \frac{1}{2}$
 $\frac{1}{1}$ (D) 1, 1

(C)
$$\frac{1}{2}$$
, 1 (D) 1,

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

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

$$\Rightarrow p + q = 1, \ -2p = -1,$$

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

15. The dimensional formula for *r.m.s.* (root mean square) velocity is

(A)
$$\sqrt{M^0 L T^{-1}}$$
 (B) $M^0 L^0 T^{-2}$
(C) $M^0 L^0 T^{-1}$ (D) $M L T^{-3}$

Sol : (a)

(A) $[ML^{-2}T^{-1}I^0]$

(C) $[M^{-1}L^{-2}T^6I^2]$

(A)

16. The dimension of the ratio of angular to linear momentum is

(A)
$$\checkmark M^0 L^1 T^0$$
 (B) $M^1 L^1 T^{-1}$
(C) $M^1 L^2 T^{-1}$ (D) $M^{-1} L^{-1} T^{-1}$
Sol: (a) $\frac{\text{Angular momentum}}{\text{Linear momentum}} = \frac{mvr}{mv} = r = [M^0 L^1 T^0]$
7. The dimensions of surface tension are
(A) $ML^{-1}T^{-2}$ (B) MLT^{-2}
(C) $ML^{-1}T^{-1}$ (D) $\checkmark MT^{-2}$
Sol: (d) Surface tension = $\frac{\text{Force}}{\text{Length}} = \frac{[MLT^{-2}]}{L} = [MT^{-2}]$
8. If L, C and R denote the inductance, capacitance and resistance respectively, the dimensional formula for $C^2 LR$ is

(B) $\sqrt{[M^0 L^0 T^3 I^0]}$

(D) $[M^0 L^0 T^2 I^0]$

2

1

1

Sol: (b)
$$C^2 LR = [C^2 L^2] \times \left[\frac{R}{L}\right] = [T^4] \times \left[\frac{1}{T}\right] = [T^3]$$

As $\left[\frac{L}{R}\right] = T$ and $\sqrt{LC} = T$

19. The foundations of dimensional analysis were laid down by

(A) Gallileo	(B) Newton
(C) √Fourier	(D) Joule

Sol : (c)

- 20. Which of the following quantities has the same dimensions as that of energy
 - (A) Power (B) Force
 - (D) √Work (C) Momentum

Sol : (d) Energy = Work done [Dimensionally]

21. The expression $[ML^2T^{-2}]$ represents

(A) Pressure	(B) √Kinetic energy
(C) Momentum	(D) Power

Sol : (b)

- 22. In a system of units if force (F), acceleration (A) and time (T) are taken as fundamental units then the dimensional formula of energy is
 - (B) $\checkmark FAT^2$ (A) FA^2T (C) F^2AT (D) *FAT*
 - Sol: (b) $E = KF^a A^b T^c$

 $\left[ML^2T^{-2}\right] = \left[MLT^{-2}\right]^a \left[LT^{-2}\right]^b [T]^c$

 $\left[ML^2T^{-2}\right] = \left[M^aL^{a+b}T^{-2a-2b+c}\right]$

 $\therefore a = 1, a + b = 2 \Rightarrow b = 1$

and $-2a - 2b + c = -2 \implies c = 2$

 $\therefore E = KFAT^2.$

23. Dimensions of kinetic energy are

(A) $\checkmark ML^2T^{-2}$ (B) $M^2 L T^{-1}$ (C) ML^2T^{-1} (D) $ML^{3}T^{-1}$

Sol : (a) Kinetic energy = $\frac{1}{2}mv^2 = M[LT^{-1}]^2 = [ML^2T^{-2}]$

- 24. The dimension of $\frac{1}{\sqrt{\varepsilon_0\mu_0}}$ is that of
 - (A) √Velocity (B) Time (C) Capacitance (D) Distance

Sol : (a) $\frac{1}{\sqrt{\varepsilon_0\mu_0}} = C =$ velocity of light

- 25. Which pair has the same dimensions
 - (A) Work and power (B) Density and relative density
 - (C) ✓ Momentum and im-(D) Stress and strain pulse

Sol : (c) Impulse = change in momentum so dimensions of both quantities will be same and equal to MLT^{-1}

26. The dimensional formula of relative density is

(A) ML^{-3} (B) LT^{-1}

(C) MLT^{-2} (D) √Dimensionless

Sol : (d) Relative density = $\frac{\text{Density of substance}}{\frac{1}{2} - \frac{1}{2} - \frac{1}{2}$ density of water

- 27. Of the following quantities, which one has dimensions different from the remaining three
 - (B) Force per unit area (A) Energy per unit volume
 - (C) Product of voltage and (D) √Angular momentum charge per unit volume per unit mass

Sol : (d) Energy per unit volume = $\frac{[ML^2T^{-2}]}{[L^3]} = [ML^{-1}T^{-2}]$ Force per unit area = $\frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$ Product of voltage and charge per unit volume $= rac{V imes Q}{ ext{Volume}} =$ $\frac{VIt}{\text{Volume}} = \frac{\text{Power} \times \text{Time}}{\text{Volume}}$ $\Rightarrow \frac{[ML^2T^{-3}][T]}{[L^3]} = [ML^{-1}T^{-2}]$ Angular momentum per unit mass = $\frac{[ML^2T^{-1}]}{[M]} = [L^2T^{-1}]$ So angular momentum per unit mass has different dimension. 28. Out of the following which pair of quantities do not have same dimensions (B) Work and energy (A) Planck's constant and angular momentum (C) Pressure and Young's (D) √Torque & moment of modulus inertia Sol : (d) Torque = $[ML^2T^{-2}]$, Moment of inertia = $[ML^2]$ 29. The dimensions of permittivity ε_0 are (B) $\checkmark A^2 T^4 M^{-1} L^{-3}$ (A) $A^2T^2M^{-1}L^{-3}$ (C) $A^{-2}T^{-4}ML^3$ (D) $A^2T^{-4}M^{-1}L^{-3}$ Sol: (b) $F = \frac{1}{4\pi\varepsilon_0} \frac{q_1q_2}{r^2}$ $[A^2T^2]$ $\Rightarrow \varepsilon_0 = \frac{|q_1| |q_2|}{[F] [r^2]} = \frac{[A^2 T^2]}{[MLT^{-2}] [L^2]} = [A^2 T^4 M^{-1} L^{-3}]$ 30. Dimensional formula ML^2T^{-3} represents (B) √ Power (A) Force (C) Energy (D) Work Sol : (b) Power = $\frac{\text{Work}}{\text{Time}} = \frac{ML^2T^{-2}}{T} = ML^2T^{-3}$ 31. Inductance L can be dimensionally represented as (A) $\checkmark ML^2T^{-2}A^{-2}$ (B) $ML^2T^{-4}A^{-1}$ (C) $ML^{-2}T^{-2}A^{-2}$ (D) $ML^2T^4A^3$ Sol : (a) $E = \frac{1}{2}Li^2$ hence $L = [ML^2T^{-2}A^{-2}]$ 32. The physical quantity which has the dimensional formula $M^1 T^{-3}$ is (A) Surface tension (B) √ Solar constant (C) Density (D) Compressibility Sol : (b) Solar constant is energy received per unit area per unit time i.e. $\frac{[ML^2T^{-2}]}{[L^2][T]} = [M^1T^{-3}]$ $[L^2][T]$ 33. Out of following four dimensional quantities, which one quantity is to be called a dimensional constant (A) Acceleration due to (B) Surface tension of water gravity (C) Weight of a standard (D) \checkmark The velocity of light in vacuum kilogram mass Sol : (d) 34. Dimensional formula for torque is (B) $L^{-1}MT^{-2}$ (A) $\checkmark L^2 MT^2$ (C) $L^2 M T^{-3}$ (D) LMT^{-2} Sol : (a) Torque = force \times distance = $[ML^2T^{-2}]$

- 35. The period of a body under SHM i.e. presented by T = $P^a D^b S^c$; where P is pressure, D is density and S is surface tension. The value of a, b and c are
 - (A) $\sqrt{-\frac{3}{2}}, \frac{1}{2}, 1$ (B) -1, -2, 3(C) $\frac{1}{2}, -\frac{3}{2}, -\frac{1}{2}$ (D) $1, 2, \frac{1}{3}$ Sol : (a) By substituting the dimension of each quantity we get

 $T = [ML^{-1}T^{-2}]^a [L^{-3}M]^b [MT^{-2}]^c$

- By solving we get a = -3/2, b = 1/2 and c = 1
- 36. The physical quantity that has no dimensions
 - (B) Linear momentum (A) Angular Velocity (C) Angular momentum (D) √ Strain
 - Sol : (d) Strain has no dimensions.
- 37. The dimensional formula for Planck's constant (h) is (C) $\sqrt{ML^2T^{-1}}$ (A) $ML^{-2}T^{-3}$ (B) ML^2T^{-2} (D) $ML^{-2}T^{-2}$
 - Sol: (c) $E = hv \Rightarrow [ML^2T^{-2}] = [h] [T^{-1}] \Rightarrow [h] = [ML^2T^{-1}]$

38. If the time period (T) of vibration of a liquid drop depends on surface tension (S), radius (r) of the drop and density (ρ) of the liquid, then the expression of T is (A) $\checkmark T = k\sqrt{\rho r^3/S}$ (B) $T = k \sqrt{\rho^{1/2} r^3/S}$ (C) $T = k \sqrt{\rho r^3 / S^{1/2}}$ (D) None of these Sol : (a) Let $T \propto S^x r^y \rho^z$ by substituting the dimension of [T] = [T] $[S] = [MT^{-2}], [r] = [L], [\rho] = [ML^{-3}]$ and by comparing the power of both the sides x = -1/2, y = 3/2, z = 1/2so $T \propto \sqrt{\rho r^3/S} \Rightarrow T = k \sqrt{\frac{\rho r^3}{S}}$ 39. Whose dimensions is ML^2T^{-1} (A) Torque (B) √Angular momentum (D) Work (C) Power Sol : (b) Angular momentum = $mvr = MLT^{-1} \times L =$ ML^2T^{-1} 40. The dimensions of electric potential are (A) $\sqrt{[ML^2T^{-2}Q^{-1}]}$ (B) $[MLT^{-2}Q^{-1}]$ (C) $[ML^2T^{-1}Q]$ (D) $[ML^2T^{-2}Q]$ Sol : (a) $V = \frac{W}{Q} = [ML^2T^{-2}Q^{-1}]$ 41. Dimensions of CR are those of (A) Frequency (B) Energy (C) √Time period (D) Current Sol : (c) Capacity × Resistance = $\frac{\text{Charge}}{\text{Potential}} \times \frac{\text{Volt}}{\text{amp}}$ $\frac{\operatorname{amp}\times\operatorname{second}\times\operatorname{Volt}}{\operatorname{Second}}=\operatorname{Second}$ $Volt \times amp$ 42. Let $[\varepsilon_0]$ denotes the dimensional formula of the permittivity of the vacuum and $[\mu_0]$ that of the permeability of the vacuum. If M = mass, L = length, T = Time and I = electric current, then (A) $[\varepsilon_0] = M^{-1}L^{-3}T^2I$ (B) $\checkmark [\varepsilon_0] = M^{-1}L^{-3}T^4I^2$ (C) $[\mu_0] = ML^2T^{-1}I$ (D) None of these Sol : (b)

43. If *C* and *L* denote capacitance and inductance respectively, then the dimensions of *LC* are $(z) = z^{0} z^{0} z^{0}$

(A) $M^0 L^0 T^0$	(B)	$\checkmark M^0 L^0 T^2$
(C) $M^2 L^0 T^2$		MLT^2
Sol : (b) $f=rac{1}{2\pi^2}$	$\frac{1}{\sqrt{LC}} \Rightarrow LC = \frac{1}{f^2}$	$= [M^0 L^0 T^2]$

- 44. Frequency is the function of density $(\rho),$ length (a) and surface tension (T). Then its value is
 - (A) $\sqrt{k\rho^{1/2}a^{3/2}}/\sqrt{T}$ (B) $k\rho^{3/2}a^{3/2}/\sqrt{T}$ (C) $k\rho^{1/2}a^{3/2}/T^{3/4}$ (D) $k\rho^{1/2}a^{1/2}/T^{3/2}$

Sol : (a) Let $n=k\rho^aa^bT^c$ where $[\rho]=[ML^{-3}],\;[a]=[L]$ and $[T]=[MT^{-2}]$

Comparing both sides, we get

$$a = \frac{1}{2}, b = \frac{3}{2} \text{ and } c = \frac{-1}{2}$$

 $\eta = \frac{k\rho^{1/2}a^{3/2}}{\sqrt{T}}$

45. MLT^{-1} represents the dimensional formula of (B) √Momentum (A) Power (C) Force (D) Couple Sol : (b) Momentum = $mv = [MLT^{-1}]$ 46. Dimension of electric current is (A) $\checkmark [M^0 L^0 T^{-1} Q]$ (B) $[ML^2T^{-1}Q]$ (C) $[M^2 L T^{-1} Q]$ (D) $[M^2 L^2 T^{-1} Q]$ Sol : (a) $I = \frac{Q}{t} = \frac{[Q]}{[T]} = [M^0 L^0 T^{-1} Q]$ 47. The dimensions of pressure are (B) $ML^{-2}T^2$ (A) MLT^{-2} (C) $\checkmark ML^{-1}T^{-2}$ (D) MLT^2 Sol : (c) 48. Planck's constant has the dimensions (unit) of (A) Energy (B) Linear momentum (C) Work (D) √Angular momentum Sol: (d) $[h] = [\text{Angularmomentum}] = [ML^2T^{-1}]$ 49. The equation of state of some gases can be expressed as $\left(P+\frac{a}{V^2}\right)(V-b)=RT$. Here P is the pressure, V is the volume, T is the absolute temperature and a, b, R are constants. The dimensions of 'a' are (B) $ML^{-1}T^{-2}$ (A) $\checkmark ML^5T^{-2}$ (D) $M^0 L^6 T^0$ (C) $M^0 L^3 T^0$ Sol : (a) By principle of dimensional homogenity $\left|\frac{a}{V^2}\right| =$

[P]

 $\therefore [a] = [P] \; [V^2] = [ML^{-1}T^{-2}] \; \times [L^6] = [ML^5T^{-2}]$

- 50. Out of the following, the only pair that does not have identical dimensions is
 - (A) Angular momentum and (B) ✓ Moment of inertia and Planck's constant moment of a force
 - (C) Work and torque (D) Impulse and momentum

Sol: (b) Momentofinertia = $mr^2 = [M] [L^2]$

Moment of Force = Force \times Perpendicular distance

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