DIMENSIONS

Subject: Physics
DIMENSIONS

PHYSICS

1. The dimensions of CV^2 matches with the dimensions of
(A) L^2I (B) L^2I^2
(C) LI^2 (D) $\frac{1}{LI}$

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, (ii) η, (iii) r and (iv) acceleration due to gravity g. Which of the following relations is dimensionally correct
(A) $v_T \propto \frac{mg}{\eta r}$ (B) $v_T \propto \frac{\eta r}{mg}$
(C) $v_T \propto \eta rmg$ (D) $v_T \propto \frac{mgr}{\eta}$

3. Dimensional formula of velocity of sound is
(A) M^0LT^{-2} (B) LT^0
(C) M^0LT^{-1} (D) $M^0L^{-1}T^{-1}$

4. An athletic coach told his team that muscle times speed equals power. What dimensions does he view for muscle
(A) MLT^{-2} (B) ML^2T^{-2}
(C) MLT^2 (D) L

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

6. Dimensions of time in power are
(A) T^{-1} (B) T^{-2}
(C) T^{-3} (D) T^0

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) $c^{1/2}G^{1/2}h^{1/2}$ (B) $c^{1/2}G^{1/2}h^{-1/2}$
(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
(A) ML^2T^{-1} (B) $ML^2T^{-3}A^{-2}$
(C) $ML^{-1}T^{-2}$ (D) None of these

9. The dimensions of resistivity in terms of M, L, T and Q where Q stands for the dimensions of charge, is
(A) $ML^3T^{-1}Q^{-2}$ (B) $ML^3T^{-2}Q^{-1}$
(C) $ML^2T^{-1}Q^{-1}$ (D) $MLT^{-1}Q^{-1}$

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

11. The dimensions of power are
(A) $M^1L^2T^{-3}$ (B) $M^2L^1T^{-2}$
(C) $M^1L^2T^{-1}$ (D) $M^1L^1T^{-2}$

12. Dimensions of magnetic field intensity is
(A) $[M^0L^{-1}T^0A^1]$ (B) $[MLT^{-1}A^{-1}]$
(C) $[ML^0T^{-2}A^{-1}]$ (D) $[MLT^{-2}A]$

13. The pair having the same dimensions is
(A) Angular momentum, work (B) Work, torque
(C) Potential energy, linear momentum (D) Kinetic energy, velocity

14. The velocity of a freely falling body changes as g^ph^q where g is acceleration due to gravity and h is the height. The values of p and q are
(A) $1, \frac{1}{2}$ (B) $\frac{1}{2}, \frac{1}{2}$
(C) $\frac{1}{2}, 1$ (D) $1, 1$

15. The dimensional formula for $r.m.s.$ (root mean square) velocity is
(A) M^0LT^{-1} (B) $M^0L^0T^{-2}$
(C) $M^0L^0T^{-1}$ (D) MLT^{-3}

16. The dimension of the ratio of angular to linear momentum is
(A) $M^0L^1T^0$ (B) $M^1L^1T^{-1}$
(C) $M^1L^2T^{-1}$ (D) $M^{-1}L^{-1}T^{-1}$

17. The dimensions of surface tension are
(A) $ML^{-1}T^{-2}$ (B) MLT^{-2}
(C) $ML^{-1}T^{-1}$ (D) MT^{-2}

18. If L, C and R denote the inductance, capacitance and resistance respectively, the dimensional formula for C^2LR is
(A) $[ML^{-2}T^{-1}I^0]$ (B) $[M^0L^0T^3I^0]$
(C) $[M^{-1}L^{-2}T^6I^2]$ (D) $[M^0L^0T^2I^0]$

19. The foundations of dimensional analysis were laid down by
(A) Gallileo (B) Newton
(C) Fourier (D) Joule

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

21. The expression $[ML^2T^{-2}]$ represents
(A) Pressure (B) Kinetic energy
(C) Momentum (D) Power

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
(A) FA^2T (B) FAT^2
(C) F^2AT (D) FAT

23. Dimensions of kinetic energy are
(A) ML^2T^{-2} (B) M^2LT^{-1}
(C) ML^2T^{-1} (D) ML^3T^{-1}

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

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

26. The dimensional formula of relative density is
(A) ML^{-3} (B) LT^{-1}
(C) MLT^{-2} (D) Dimensionless

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

28. Out of the following which pair of quantities do not have same dimensions
(A) Planck's constant and angular momentum (B) Work and energy
(C) Pressure and Young's modulus (D) Torque & moment of inertia

29. The dimensions of permittivity ε_0 are
(A) $A^2T^2M^{-1}L^{-3}$ (B) $A^2T^4M^{-1}L^{-3}$
(C) $A^{-2}T^{-4}ML^3$ (D) $A^2T^{-4}M^{-1}L^{-3}$

30. Dimensional formula ML^2T^{-3} represents
(A) Force (B) Power
(C) Energy (D) Work

31. Inductance L can be dimensionally represented as
(A) $ML^2T^{-2}A^{-2}$ (B) $ML^2T^{-4}A^{-3}$
(C) $ML^{-2}T^{-2}A^{-2}$ (D) $ML^2T^4A^3$

32. The physical quantity which has the dimensional formula M^1T^{-3} is
(A) Surface tension (B) Solar constant
(C) Density (D) Compressibility

33. Out of following four dimensional quantities, which one quantity is to be called a dimensional constant
(A) Acceleration due to gravity (B) Surface tension of water
(C) Weight of a standard kilogram mass (D) The velocity of light in vacuum

34. Dimensional formula for torque is
(A) L^2MT^{-2} (B) $L^{-1}MT^{-2}$
(C) L^2MT^{-3} (D) LMT^{-2}

35. The period of a body under SHM i.e. presented by $T = P^aD^bS^c$; where P is pressure, D is density and S is surface tension. The value of a, b and c are
(A) $-\frac{3}{2}, \frac{1}{2}, 1$ (B) $-1, -2, 3$
(C) $\frac{1}{2}, -\frac{3}{2}, -\frac{1}{2}$ (D) $1, 2, \frac{1}{3}$

36. The physical quantity that has no dimensions
(A) Angular Velocity (B) Linear momentum
(C) Angular momentum (D) Strain

37. The dimensional formula for Planck's constant (h) is
(A) $ML^{-2}T^{-3}$ (B) ML^2T^{-2}
(C) ML^2T^{-1} (D) $ML^{-2}T^{-2}$

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) $T = k\sqrt{\rho r^3/S}$ (B) $T = k\sqrt{\rho^{1/2}r^3/S}$
(C) $T = k\sqrt{\rho r^3/S^{1/2}}$ (D) None of these

39. Whose dimensions is ML^2T^{-1}
(A) Torque (B) Angular momentum
(C) Power (D) Work

40. The dimensions of electric potential are
(A) $[ML^2T^{-2}Q^{-1}]$ (B) $[MLT^{-2}Q^{-1}]$
(C) $[ML^2T^{-1}Q]$ (D) $[ML^2T^{-2}Q]$

41. Dimensions of CR are those of
(A) Frequency (B) Energy
(C) Time period (D) Current

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 $M = \text{mass}$, $L = \text{length}$, $T = \text{Time}$ and $I = \text{electriccurrent}$, then
(A) $[\varepsilon_0] = M^{-1}L^{-3}T^2I$ (B) $[\varepsilon_0] = M^{-1}L^{-3}T^4I^2$
(C) $[\mu_0] = ML^2T^{-1}I$ (D) None of these

43. If C and L denote capacitance and inductance respectively, then the dimensions of LC are
(A) $M^0L^0T^0$ (B) $M^0L^0T^2$
(C) $M^2L^0T^2$ (D) MLT^2

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

45. MLT^{-1} represents the dimensional formula of
(A) Power (B) Momentum
(C) Force (D) Couple

46. Dimension of electric current is
(A) $[M^0L^0T^{-1}Q]$ (B) $[ML^2T^{-1}Q]$
(C) $[M^2LT^{-1}Q]$ (D) $[M^2L^2T^{-1}Q]$

47. The dimensions of pressure are
(A) MLT^{-2} (B) $ML^{-2}T^2$
(C) $ML^{-1}T^{-2}$ (D) MLT^2

48. Planck's constant has the dimensions (unit) of
(A) Energy (B) Linear momentum
(C) Work (D) Angular momentum

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
(A) ML^5T^{-2} (B) $ML^{-1}T^{-2}$
(C) $M^0L^3T^0$ (D) $M^0L^6T^0$

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

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^2I (B) L^2I^2
   (C) ✓LI^2 (D) $\frac{1}{LI}$
   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, (ii) η, (iii) r and (iv) acceleration due to gravity g. Which of the following relations is dimensionally correct
   (A) ✓$v_T \propto \frac{mg}{\eta r}$ (B) $v_T \propto \frac{\eta r}{mg}$
   (C) $v_T \propto \eta rmg$ (D) $v_T \propto \frac{mgr}{\eta}$
   Sol : (a) By substituting dimension of each quantity in $R.H.S.$ of option (a) we get
   $\left[\frac{mg}{\eta r}\right] = \left[\frac{M \times LT^{-2}}{ML^{-1}T^{-1} \times L}\right]$=$[LT^{-1}]$.
   This option gives the dimension of velocity

3. Dimensional formula of velocity of sound is
   (A) M^0LT^{-2} (B) LT^0
   (C) ✓M^0LT^{-1} (D) $M^0L^{-1}T^{-1}$
   Sol : (c)

4. An athletic coach told his team that muscle times speed equals power. What dimensions does he view for muscle
   (A) ✓MLT^{-2} (B) ML^2T^{-2}
   (C) MLT^2 (D) L
   Sol : (a) According to problem muscle × speed = power
   muscle = $\frac{\text{power}}{\text{speed}} = \frac{ML^2T^{-3}}{LT^{-1}}$= MLT^{-2}

5. Dimensions of the following three quantities are the same
   (A) Work, energy, force (B) Velocity, momentum, impulse
   (C) Potential energy, kinetic energy, momentum (D) ✓Pressure, stress, coefficient 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) ✓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) $c^{1/2}G^{1/2}h^{1/2}$ (B) $c^{1/2}G^{1/2}h^{-1/2}$
   (C) ✓$c^{1/2}G^{-1/2}h^{1/2}$ (D) $c^{-1/2}G^{1/2}h^{1/2}$
   Sol : (c) Let $m \propto C^xG^yh^z$
   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
   $x = 1/2$; $y = -1/2$, $z = +1/2$
   So $m \propto c^{1/2}G^{-1/2}h^{1/2}$

8. Dimension of R is
   (A) ML^2T^{-1} (B) ✓$ML^2T^{-3}A^{-2}$
   (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 Q where Q stands for the dimensions of charge, is
   (A) ✓$ML^3T^{-1}Q^{-2}$ (B) $ML^3T^{-2}Q^{-1}$
   (C) $ML^2T^{-1}Q^{-1}$ (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) ✓MLT^{-1}
   (C) ML^2T^{-1} (D) M^2LT^{-1}
   Sol : (b) Impulse = Force × Time = $[MLT^{-2}]\,[T]$= $[MLT^{-1}]$

11. The dimensions of power are
   (A) ✓$M^1L^2T^{-3}$ (B) $M^2L^1T^{-2}$
   (C) $M^1L^2T^{-1}$ (D) $M^1L^1T^{-2}$
   Sol : (a) Power = $\frac{\text{Workdone}}{\text{Time}}$= $\left[\frac{ML^2T^{-2}}{T}\right] = [ML^2T^{-3}]$

12. Dimensions of magnetic field intensity is
   (A) $[M^0L^{-1}T^0A^1]$ (B) $[MLT^{-1}A^{-1}]$
   (C) ✓$[ML^0T^{-2}A^{-1}]$ (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, work (B) ✓Work, torque
   (C) Potential energy, linear momentum (D) Kinetic energy, velocity
   Sol : (b) Dimension of work and torque = $[ML^2T^{-2}]$

14. The velocity of a freely falling body changes as g^ph^q where g is acceleration due to gravity and h is the height. The values of p and q are
   (A) $1, \frac{1}{2}$ (B) ✓$\frac{1}{2}, \frac{1}{2}$
   (C) $\frac{1}{2}, 1$ (D) $1, 1$
   Sol : (b) $v \propto g^ph^q$ (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) ✓M^0LT^{-1} (B) $M^0L^0T^{-2}$
   (C) $M^0L^0T^{-1}$ (D) MLT^{-3}
   Sol : (a)

16. The dimension of the ratio of angular to linear momentum is
   (A) ✓$M^0L^1T^0$ (B) $M^1L^1T^{-1}$
   (C) $M^1L^2T^{-1}$ (D) $M^{-1}L^{-1}T^{-1}$
   Sol : (a) $\frac{\text{Angular momentum}}{\text{Linear momentum}} = \frac{mvr}{mv} = r = [M^0L^1T^0]$

17. The dimensions of surface tension are
   (A) $ML^{-1}T^{-2}$ (B) MLT^{-2}
   (C) $ML^{-1}T^{-1}$ (D) ✓MT^{-2}
   Sol : (d) Surface tension = $\frac{\text{Force}}{\text{Length}} = \frac{[MLT^{-2}]}{L} = [MT^{-2}]$

18. If L, C and R denote the inductance, capacitance and resistance respectively, the dimensional formula for C^2LR is
   (A) $[ML^{-2}T^{-1}I^0]$ (B) ✓$[M^0L^0T^3I^0]$
   (C) $[M^{-1}L^{-2}T^6I^2]$ (D) $[M^0L^0T^2I^0]$

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

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
(C) Momentum (D) ✓Work
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
(A) FA^2T (B) ✓FAT^2
(C) F^2AT (D) FAT
Sol : (b) $E = KF^aA^bT^c$

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

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

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

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

$\therefore E = KFAT^2$.

23. Dimensions of kinetic energy are
(A) ✓ML^2T^{-2} (B) M^2LT^{-1}
(C) ML^2T^{-1} (D) ML^3T^{-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 impulse (D) Stress and strain
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 = $\frac{\text{Density of substance}}{\text{density of water}} = [M^0L^0T^0]$

27. Of the following quantities, which one has dimensions different from the remaining three
(A) Energy per unit volume (B) Force per unit area
(C) Product of voltage and charge per unit volume (D) ✓Angular momentum 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 $= \frac{V \times Q}{\text{Volume}} = \frac{VIt}{\text{Volume}} = \frac{\text{Power} \times \text{Time}}{\text{Volume}}$

$\Rightarrow \frac{[ML^2T^{-3}][T]}{[L^3]} = [ML^{-1}T^{-2}]$

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
(A) Planck's constant and angular momentum (B) Work and energy
(C) Pressure and Young's modulus (D) ✓Torque & moment of inertia
Sol : (d) Torque = $[ML^2T^{-2}]$, Moment of inertia = $[ML^2]$

29. The dimensions of permittivity ε_0 are
(A) $A^2T^2M^{-1}L^{-3}$ (B) ✓$A^2T^4M^{-1}L^{-3}$
(C) $A^{-2}T^{-4}ML^3$ (D) $A^2T^{-4}M^{-1}L^{-3}$
Sol : (b) $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$

$\Rightarrow \varepsilon_0 = \frac{|q_1||q_2|}{[F][r^2]} = \frac{[A^2T^2]}{[MLT^{-2}][L^2]} = [A^2T^4M^{-1}L^{-3}]$

30. Dimensional formula ML^2T^{-3} represents
(A) Force (B) ✓Power
(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) ✓$ML^2T^{-2}A^{-2}$ (B) $ML^2T^{-4}A^{-3}$
(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^1T^{-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. $\frac{[ML^2T^{-2}]}{[L^2][T]} = [M^1T^{-3}]$

33. Out of following four dimensional quantities, which one quantity is to be called a dimensional constant
(A) Acceleration due to gravity (B) Surface tension of water
(C) Weight of a standard kilogram mass (D) ✓The velocity of light in vacuum
Sol : (d)

34. Dimensional formula for torque is
(A) ✓L^2MT^{-2} (B) $L^{-1}MT^{-2}$
(C) L^2MT^{-3} (D) LMT^{-2}
Sol : (a) Torque = force × distance = $[ML^2T^{-2}]$

35. The period of a body under SHM i.e. presented by $T = P^aD^bS^c$; where P is pressure, D is density and S is surface tension. The value of a, b and c are
(A) ✓$-\frac{3}{2}, \frac{1}{2}, 1$ (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
(A) Angular Velocity (B) Linear momentum
(C) Angular momentum (D) ✓Strain
Sol : (d) Strain has no dimensions.

37. The dimensional formula for Planck's constant (h) is
(A) $ML^{-2}T^{-3}$ (B) ML^2T^{-2}
(C) ✓ML^2T^{-1} (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) ✓$T = k\sqrt{\rho r^3/S}$ (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

$x = -1/2$, $y = 3/2$, $z = 1/2$

so $T \propto \sqrt{\rho r^3/S} \Rightarrow T = k\sqrt{\frac{\rho r^3}{S}}$

39. Whose dimensions is ML^2T^{-1}

(A) Torque (B) ✓Angular momentum

(C) Power (D) Work

Sol : (b) Angular momentum = $mvr = MLT^{-1} \times L = ML^2T^{-1}$

40. The dimensions of electric potential are

(A) ✓$[ML^2T^{-2}Q^{-1}]$ (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 $\times$ Resistance = $\frac{\text{Charge}}{\text{Potential}} \times \frac{\text{Volt}}{\text{amp}}$

= $\frac{\text{amp} \times \text{second} \times \text{Volt}}{\text{Volt} \times \text{amp}} = \text{Second}$

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 $M = \text{mass}$, $L = \text{length}$, $T = \text{Time}$ and $I = \text{electriccurrent}$, then

(A) $[\varepsilon_0] = M^{-1}L^{-3}T^2I$ (B) ✓$[\varepsilon_0] = M^{-1}L^{-3}T^4I^2$

(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

(A) $M^0L^0T^0$ (B) ✓$M^0L^0T^2$

(C) $M^2L^0T^2$ (D) MLT^2

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

44. Frequency is the function of density (ρ), length (a) and surface tension (T). Then its value is

(A) ✓$k\rho^{1/2}a^{3/2}/\sqrt{T}$ (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 $n = k\rho^a a^b T^c$ where $[\rho] = [ML^{-3}]$, $[a] = [L]$ and $[T] = [MT^{-2}]$

Comparing both sides, we get

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

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

45. MLT^{-1} represents the dimensional formula of

(A) Power (B) ✓Momentum

(C) Force (D) Couple

Sol : (b) Momentum = mv = $[MLT^{-1}]$

46. Dimension of electric current is

(A) ✓$[M^0L^0T^{-1}Q]$ (B) $[ML^2T^{-1}Q]$

(C) $[M^2LT^{-1}Q]$ (D) $[M^2L^2T^{-1}Q]$

Sol : (a) $I = \frac{Q}{t} = \frac{[Q]}{[T]} = [M^0L^0T^{-1}Q]$

47. The dimensions of pressure are

(A) MLT^{-2} (B) $ML^{-2}T^2$

(C) ✓$ML^{-1}T^{-2}$ (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

(A) ✓ML^5T^{-2} (B) $ML^{-1}T^{-2}$

(C) $M^0L^3T^0$ (D) $M^0L^6T^0$

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 Planck's constant (B) ✓Moment of inertia and moment of a force

(C) Work and torque (D) Impulse and momentum

Sol : (b) $\text{Momentofinertia} = mr^2 = [M]\,[L^2]$

Moment of Force = Force $\times$ Perpendicular distance

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