PHYSICS

Q.1 Which of the following physical quantities has neither dimensions nor unit ?
(A) angle
(B)Luminous intensity
(C) coefficient of friction
(D) current **[C]**

Q.2 The dimensional formula of latent heat is –
(A) $M^0L^2T^{-2}$ (B) ML^2T^{-1}
(C) MLT^{-1} (D) $M^0L^2T^{-1}$ **[A]**

Q.3 The dimensional formula of angular momentum is–
(A) ML^2T^{-2} (B) MLT^{-2}
(C) ML^2T^{-2} (D) ML^2T^{-1} **[B]**

Q.4 A pressure of 10^6 dynes/cm^2 is equivalent to
(A) 10^5 N/m^2 (B) 10^4 N/m^2
(C) 10^6N/m^2 (D) 10^7N/m^2 **[A]**

Q.5 Which one of the following has the dimensions of $[ML^{-1}T^{-2}]$
(A) torque (B) surface tension
(C) viscosity (D) stress **[D]**

Q.6 If C and L denote the capacitance and inductance, then the units of LC are –
(A) $M^0L^0T^2$ (B) $M^0L^2T^{-2}$
(C) MLT^{-2} (D) M^0L^0T **[A]**

Q.7 The dimensions of torque are –
(A) $[MLT^{-2}]$ (B) $[ML^{-1}T^{-2}]$
(C) $[ML^2T^{-2}]$ (D) $[ML^{-2}T^{-2}]$ **[C]**

Q.8 The frequency of vibrations of a mass m suspended from a spring of spring constant k is given by
$\nu = cm^x k^y$, where c is a dimensionless constant. The values of x and y are respectively.
(A) $\frac{1}{2}, \frac{1}{2}$ (B) $-\frac{1}{2}, -\frac{1}{2}$
(C) $\frac{1}{2}, -\frac{1}{2}$ (D) $-\frac{1}{2}, \frac{1}{2}$ **[D]**

Q.9 The velocity v of a particles is given in terms of time t by the equation.
$\mathbf{v} = at + \frac{b}{t+c}$. The dimension of a, b and c are
(A) L^2, T, L T^2 (B) LT^2, LT, L
(C) LT^{-2}, L, T (D) L, LT, T^2 **[C]**

Q.10 Which of the following pairs of physical quantities have different dimensions.
(A) Stress, pressure
(B) Young's modulus, energy
(C) Density, relative density
(D) Energy, torque **[C]**

Q.11 Which of the following pairs have identical dimensions
(A) Momentum and force
(B) Pressure and surface tension
(C) Moment of force and angular momentum
(D) Surface tension and surface energy **[D]**

Q.12 if force F, acceleration A and time T are basic physical quantities, the dimensions of energy are –
(A) $[F^2A^{-1}T]$ (B) $[FAT^2]$
(C) $[FAT^{-2}]$ (D) $[FA^{-1}T]$ **[B]**

Q.13 The dimensional formula of resistivity of Conductor is –
(A) $[ML^2T^{-2}A^{-2}]$ (B) $[ML^3T^{-3}A^{-2}]$
(C) $[ML^{-2}T^{-3}A^{-2}]$ (D) $[ML^2T^{-2}A^{-3}]$ **[B]**

Q.14 The dimensions of $\frac{1}{2}\varepsilon_0E^2$($\varepsilon_0$ = permittivity of free space and E = electric field) are –
(A) $[ML^2T^{-1}]$ (B) $[ML^{-1}T^{-2}]$
(C) $[ML^2T^{-2}]$ (D) $[MLT^{-1}]$ **[B]**

Q.15 If force (F), length (L) and time (T) be considered fundamental units, then units of mass will be –
(A) $[F L^{-1}T^{-2}]$ (B) $[F^2 L T^{-2}]$
(C) $[F L T^{-2}]$ (D) $[F L^{-2} T^{-1}]$ **[A]**

Q.16 Which of the following pairs do not have identical dimensions –
(A) Pressure and stress
(B) Work and pressure energy
(C) Angular momentum and Plank's constant

(D) Moment of force and momentum **[D]**

Q.17 The product (PV) has the dimensions –

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

(C) $[M^1 L^2 T^{-2}]$ (D) $[M^1 L^2 T^{-3}]$ **[C]**

Q.18 kg m/s^2 stand for the unit of –

(A) Energy (B) acceleration

(C) Force (D) Momentum **[C]**

Q.19 In the SI system, the unit of temperature is –

(A) Degree centigrade (B) Degree Celsius

(C) Kelvin (D) Degree Fahrenheit **[C]**

Q.20 The dimensional formula for impulse is –

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

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

Q.21 Choose the physical quantity that is different from others –

(A) Moment of Inertia

(B) Electric current

(C) Pressure energy

(D) Rate of change of velocity **[D]**

Q.22 The frequency (n) of vibration of a string is given as n = $\frac{1}{2\ell}\sqrt{\frac{T}{m}}$, where T is tension and ℓ is the length of vibrating string, then the dimensional formula for m is –

(A) $[M^0L^1T^1]$ (B) $[M^0L^0T^0]$

(C) $[M^1L^{-1}T^0]$ (D) $[ML^0T^0]$ **[C]**

Q.23 In the relation y = r sin (ωt – kx) the dimensions of $\frac{\omega}{k}$ are–

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

(C) $[M^0 L^0 T^1]$ (D) $[M^0L^1T^0]$ **[B]**

Q.24 Dimensions of $\in_0\mu_0$ are –

(A) $[L T^{-1}]$ (B) $[L T^{-2}]$

(C) $[L^2T^{-2}]$ (D) $[L^{-2} T^2]$ **[D]**

Q.25 The equation of state of a real gas can be expressed as $\left(P+\frac{a}{V^2}\right)$(V– b) = cT, where P is the pressure, V the volume, T the absolute temperature and a, b, c are constants. What are the dimensions of 'a'–

(A) $M^0 L^3 T^{-2}$ (B) $M L^{-2} T^5$

(C) $M L^5 T^{-2}$ (D) $M^0 L^3 T^0$ **[C]**

Q.26 What is the physical quantity whose dimensions are $M L^2 T^{-2}$ –

(A) Pressure (B) Kinetic energy

(C) Power (D) Momentum **[B]**

Q.27 If the velocity (V), acceleration (A) and force (F) are taken as fundamental quantities instead of mass (M), length (L) and time (T), the dimensions of Young's modulus would be –

(A) $FA^2 V^{-4}$ (B) $FA^2 V^{-5}$

(C) $FA^2 V^{-3}$ (D) $FA^2 V^{-2}$ **[A]**

Q.28 If L, R, C and V respectively represent inductance, resistance, capacitance and potential difference then the dimensions of $\frac{L}{RCV}$ are the same as those of –

(A) Charge (B) $\frac{1}{\text{Charge}}$

(C) Current (D) $\frac{1}{\text{Current}}$ **[D]**

Q.29 A gas bubble from an explosion under water oscillates with a period proportional to $P^a d^b E^c$, where P is the static pressure, d is the density of water and E is the energy of explosion. Then a, b, c are respectively –

(A) 1, 1, 1 (B) $\frac{1}{3},\frac{1}{2},\frac{-5}{6}$

(C) $\frac{-5}{6},\frac{1}{2},\frac{1}{3}$ (D) $\frac{1}{2},\frac{-5}{6},\frac{1}{3}$ **[A]**

Q.30 Subtract 0.2 J from 5.27 J and express the result with correct number of significant figures -

(A) 5.1 J (B) 5.06 J

(C) 5.0 J (D) 5 J **[A]**

Q.31 Error in the measurement of radius of a sphere is 2%. Then error in the measurement of volume is -

(A) 2% (B) 4%

(C) 8% (D) 6% **[D]**

Q.32 The velocity v of waves produced in water depends on their wavelength λ, the density of water ρ, and acceleration due to gravity g. The square of velocity is proportional to -

(A) $\lambda^{-1}g^{-1}\rho^{-1}$ (B) λg

(C) $\lambda\rho g$ (D) $\lambda^2 g^{-2}\rho^{-1}$ **[B]**

Q.33 The maximum error in the measurement of mass and length of the side of a cube are 2% and 1% respectively. The maximum error in its density is-

(A) 2% (B) 1% (C) 3% (D) 5%

[D]

Q.34 The equation $\frac{dv}{dt}$ = At – Bv is describing the rate of change of velocity of a body falling from rest in a resisting medium. The dimensions of A and B are -

(A) LT^{-3}, T (B) LT^{-3}, T^{-1}

(C) LT, T (D) LT, T^{-1} **[B]**

Q.35 If x = a – b, the maximum percentage error in the measurement of x will be -

(A) $\left(\frac{\Delta a}{a}+\frac{\Delta b}{b}\right)\times 100\%$

(B) $\left(\frac{\Delta a}{a}-\frac{\Delta b}{b}\right)\times 100\%$

(C) $\left(\frac{\Delta a}{a-b}+\frac{\Delta b}{a-b}\right)\times 100\%$

(D) $\left(\frac{\Delta a}{a-b}-\frac{\Delta b}{a-b}\right)\times 100\%$ **[C]**

Q.36 When 96.54 is divided by 2.40, the correct result is -

(A) 40.2250 (B) 40.225

(C) 40.23 (D) 40.2 **[D]**

Q.37 The velocity 'v' of a particle at time t is given by, $v=\frac{a}{t}+\frac{bt}{t^2+c}$. The dimensions of a, b, c are respectively -

(A) LT^{-2}, L, T (B) L, L, T^2

(C) L, LT, T^{-2} (D) L, L, LT^2 **[B]**

Q.38 The time dependence of physical quantity P is given by $P = P_0\ e^{-\alpha t^2+\beta t+\gamma}$, where α, β, γ are constants and their dimensions are given by (where t is time) -

(A) $M^0 L^0 T^{-2}$, $M^0 L^0 T^{-1}$, $M^0 L^0 T^0$

(B) $M^0 L^{-1}$,T^{-2}, $M^0 L^0 T^{-1}$, $M^0 L^0 T$

(C) $M^0 L^0 T^{-1}$, $M L T^{-2}$, $M^0 L^0 T^{-1}$

(D) M, L, T, $M L T^0$, $M^0 L^0 T^0$ **[A]**

Q.39 The potential energy of a particle varies with distance x from a fixed origin as $V=\frac{A\sqrt{x}}{x+B}$ where A and B are constants. The dimensions of AB are -

(A) $ML^{5/2} T^{-2}$ (B) $M^1L^2T^{-2}$

(C) $M^{3/2} L^{5/2} T^{-2}$ (D) $M^1L^{7/2}T^{-2}$ **[D]**

Q.40 Error in measurement of radius of a sphere is 1%. Then error in measurement of area is-

(A) 2% (B) 3%

(C) 4 % (D) 5% **[A]**

Q.41 The time period of a body under S.H.M. is represented by : $T = P^{\alpha} D^{\beta} S^{\gamma}$ where P is pressure, D is density and S is surface tension, then values of α, β and γ are -

(Surface tension $S=\frac{F}{\ell}$)

(A) $-\frac{3}{2},\frac{1}{2},1$ (B) $1, 2, \frac{1}{3}$

(C) –1,–2 , 3 (D) $\frac{1}{2},\frac{-3}{2},\frac{-1}{2}$ **[A]**

Q.42 If x = ab, the maximum percentage error in the measurement of x will be-

(A) $\left(\frac{\Delta a}{a}\times 100\%\right)\times\left(\frac{\Delta b}{b}\times 100\%\right)$

(B) $\left(\frac{\Delta a}{a}\times 100\%\right)\div\left(\frac{\Delta b}{b}\times 100\%\right)$

(C) $\left(\frac{\Delta a}{a}-\frac{\Delta b}{b}\right)\times 100\%$

(D) $\left(\frac{\Delta a}{a}+\frac{\Delta b}{b}\right)\times 100\%$ **[D]**

Q.43 The percentage errors in measurement of mass and speed are 3 % and 2% respectively. The error in kinetic energy will be-

(A) 6% (B) 7 %

(C) 10% (D) 12% **[B]**

Q.44 What is the fractional error in g calculated from $T = 2\pi\sqrt{\ell / g}$? Given fraction errors in T and ℓ are ± x and ± y respectively-

(A) x + y (B) 2x – y

(C) 2x + y (D) x – 2y **[C]**

Q.45 In the equation $\left(P + \frac{a}{V^2}\right)$ (V–b) = constant, the unit (s) a is/are-

(A) N m^5 (B) N m^4

(C) N m^3 (D) N m^2 **[B]**

Q.46 If P = 2.347 cm, Q = 2.4 cm, then P + Q =

(A) 4.747 (B) 4.75

(C) 4.8 (D) 4.7 **[C]**

Q.47 Which physical quantities have same dimensions?

(A) Torque and work

(B) Force and power

(C) Latent heat and specific heat

(D) Work and power **[A]**

Q.48 The wavelength associated with a moving particle depends upon power p of its mass m, qth power of its velocity v and rth power of Planck's constant h. Then the correct set of values of p, q and r is –

(A) p =1, q = – 1, r = 1

(B) p = 1, q = 1, r = 1

(C) p = –1, q = –1, r = –1

(D) p = –1, q = –1, r = 1 **[D]**

Q.49 Which of the following is the most accurate ?

(A) 200.0m (B) 20 × 10^1m

(C) 2 × 10^2m (D) Data is inadequate

[A]

Q.50 The number of significant figures in 0.01020 is

(A) 3 (B) 4

(C)5 (D) 6 **[B]**

PHYSICS

Q.1 The dimensional formula of a physical quantity x is $[M^{-1}L^{3}T^{-2}]$ the percentage error in measuring the quantities M, L and T are 2%, 3% and 4%. Find the maximum percentage error that occurs in measuring the quantity x.

[0019]

Q.2 Force applied by water jet from a pipe depends upon (i) velocity of water (ii) density of water (iii) cross-sectional area of pipe. How many times force will be increased if velocity of a water is increased 2 times ?

Sol. **[4]**

$F \propto v^a$

$\propto \rho^b$

$\propto A^c$

$\Rightarrow F = k\, v^a \rho^b A^c$ k : dimensional constant.

By dimension analysis $a = 2 \Rightarrow F \propto v^2$.

Q.3 A student measures diameter of a sphere using vernier calliper having least count 0.1 mm and reports diameter equal to 0.025307 meter. Numbers of significant figure in diameter will be-

Sol. **[4]**

Numbers of significant digits in a number is equal numbers of all reliable digits in that number plus 1.

Q.4 A quantity x is defined as $x = \dfrac{a^3 - b^2}{\sqrt{c+d}}$. Value of a, b, c and d are reported as a = 3 ± 0.001, b = 5 ± 0.0013, c = 6 ± 0.24 and d = 10 ± 0.4. Percentage error in x will be -

Sol. **[4]**

% error in x = x error in $(a^3 - b^2)$ + $\dfrac{1}{2}$ % error in (c + d)

% error in $(a^3 - b^2) = \dfrac{3a^2\Delta a + 2b\Delta b}{a^3 - b^2} \times 100$

% error in (c + d) = $\dfrac{\Delta c + \Delta d}{c + d} \times 100$

Q.5 Lifting power of helicopter depends upon hovering speed of blades (ω), length of blades (ℓ) and density of air (ρ). how many times lifting power will increase if hovering speed is increased two times. **[0008]**

Sol. $P = k\, \omega^a \rho^b \ell^c$

$\Rightarrow \quad ML^2T^{-3} = (T^{-1})^a (ML^{-3})^b L^c$

$\Rightarrow \quad a = 3 \qquad \therefore P \propto \omega^3$

Q.6 Dimension of a base quantity in other base quantities is equal to .... **[0000]**

Q.7 Find the missing number in the expression given below $A = s\, e^{-\frac{at^{[\ ]}}{A}}$ where s : displacement, t : time , a : acceleration.

[0002]

Sol. $\left[\dfrac{at^x}{A}\right] = 1 \Rightarrow \dfrac{[a][t]^x}{[s]} = 1 \Rightarrow x = 2$

Q.8 A physical quantity A is dependent on other four physical quantities p, q, r and s as given below

$A = \dfrac{\sqrt{pq}}{r^2 s^3}$. The percentage error of measurement in p, q, r and s are 1%, 3%, 0.5% and 0.33% respectively, then what is the maximum percentage error in A ?

Sol. **[4]**

$$\frac{\Delta A}{A} = \frac{1}{2}\left(\frac{\Delta P}{P} + \frac{\Delta q}{q}\right) + \frac{2\Delta r}{r} + \frac{3\Delta S}{S}$$

$$= \frac{1}{2}[1\% + 3\%] + 2 \times 0.5 + 3 \times 0.33 = 2 + 1 + 1 = 4\%$$

Q.9 The lengths of sides of cuboid are a, 2a and 3a. If the relative percentage error in the measurement of a is 1%, then what is the relative percentage error in the measurement of volume of cube.

Sol. **[3]**

$V = a \times 2a \times 3a \quad \Rightarrow \quad V = 6a^3$

$\dfrac{\Delta V}{V} = 3\dfrac{\Delta a}{a} = 3\%$

Q.10 The length of a cylinder is measured with a metre rod having least count 0.1 cm. Its diameter is measured with vernier calipers having least count 0.01 cm. Given that length is 5.0 cm and radius is 2.0 cm. The percentage error in the calculated value of the volume will be -

Sol. **[3]**

$V = \pi r^2 h$ or $\frac{\Delta V}{V} = 2\frac{\Delta r}{r} + \frac{oh}{h}$

$\frac{\Delta V}{V} \times 100 = \left(2 \times \frac{0.01}{2} + \frac{0.1}{5}\right) \times 100$

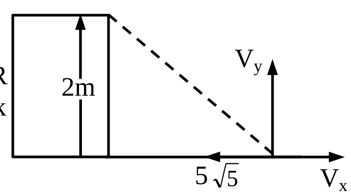
$= (0.01 + 0.02) \times 100$

$\frac{\Delta V}{V} \times 100 = (0.03) \times 100 = 3\%$

Q.11 A 2m wide truck is moving with a speed of $5\sqrt{5}$ m/s along a straight horizontal road. A man starts crossing the road with a uniform speed v when the truck is 4m away from him. The minimum value of v (in m/s) to cross the truck safely is-

Sol. **[5]**

In F. OR of Truck



In frame of out of track, track will be at rest

$\frac{V_y}{5\sqrt{5} - V_x} = \frac{2}{4} = \frac{1}{2}$ or $2V_y = 5\sqrt{5} - V_x$ ....(i)

$V_x^2 + V_y^2 = V^2$

for V to be minimum $\frac{dV}{dV_x} = 0$

Solving we get V = 5 m/s

Q.12 A particle of mass m is located in a region where its potential energy [U(x)] depends on the position x as Potential Energy $[U(x)] = \frac{a}{x^2} - \frac{b}{x}$ here a & b are positive constants….

(i) Write dimensional formula of a & b

(ii) If the time period of oscillation which is calculated from above formula is stated by a student as $T = 4\pi a\sqrt{\frac{ma}{b^2}}$, check whether his answer is dimensionally correct.

Sol. (i) ML^4T^{-2}, ML^3T^{-2} (ii) Incorrect

Q.13 Find the number of significant digits in 0.01050

Sol. **[4]**

Q.14 Dimensional formula of capacitance is written as $[M^{-1} L^{-2} T^{x} A^{+2}]$. Find x. $C = \frac{q^2}{2U}$ where U stands for energy and q charge.

Sol. **[x = 4]** $[\overline{C}] = M^{-1}L^{-2}T^4A^{+2}$

Q.15 The area of a rectangle of size 1.25 cm ×1.55 cm is 1.9 y, where y is single digit numbers. Find y.

Sol. [4] 1.25× 1.55 = 1.94

Q.16 Dimensional formula of electric potential (V) is given by $[ML^2T^{-x}A^{-1}]$. Find x.

Given : $\boxed{V = \frac{\text{Energy}}{\text{Charge}}}$

Sol.[3] $[V] = \frac{ML^2T^{-2}}{AT} = ML^2T^{-3}A^{-1}$

Q.17 Dimensional formula of inductance (L) is given by $[ML^2T^{-x} A^{-2}]$. Find x.

Given : Inductance (L) = $\frac{2 \times \text{energy}}{(\text{current})^2}$

Sol. **[x = 2]** $[L] = \frac{ML^2T^{-2}}{A^2} = ML^2T^{-2}A^{-2}$