Shiksha Classes Bhandara
CHAPTER TEST

Subject : Physics **Topic : Units and Dimensions** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 The unit of Young's modulus is $\left[Y = \frac{\text{Stress}}{\text{Strain}} = \frac{\text{force / area}}{\Delta\ell / L}\right]$

(A) Newton (B) Newton/metre

(C) Newton/metre^2 (D) Joule/metre^2

Q.2 If force F, length L and time T are taken as fundamental units, the dimensional formula for mass will be –

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

(C) $[FL^{-1}T^{-1}]$ (D) $[ML^5T^2]$

Q.3 Dimensions of relative density is –

(A) $[ML^{-2}]$ (B) $[ML^{-3}]$

(C) dimensionless (D) $[M^2L^{-6}]$

Q.4 In the relation : $\frac{dy}{dx} = 2\omega \sin(\omega t + \phi_0)$ the dimensional formula for $(\omega t + \phi_0)$ is :

(A) MLT (B) MLT^0

(C) ML^0T^0 (D) $M^0L^0T^0$

Q.5 If E = energy, G = gravitational constant, I = impulse and M = mass, then dimensions of $\frac{GIM^2}{E^2}$ are same as that of

(A) time (B) mass

(C) length (D) force

Q.6 Light year is used to measure –

(A) distance between stars

(B) distance between atoms

(C) revolution time of earth around the sun

(D) None of the above

Q.7 Which one of the following groups have quantities that do not have the same dimensions –

(A) Pressure, stress (B) Velocity, speed

(C) Force, impulse (D) Work, energy

Q.8 The dimensions of Planck's constant [E = hν] are same as–

(A) Energy (B) Power

(C) Momentum (D) Angular momentum

Q.9 The dimensions of universal gravitational constant are –

(A) $M^{-2}L^2T^{-1}$ (B) $M^{-1}L^3T^{-2}$

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

Q.10 The velocity v of a particle at time t is given by $v = at + \frac{b}{t+c}$, where a, b and c are constant. The dimensions of a, b and c are respectively –

(A) L^2, T and LT^2 (B) LT^2, LT and L

(C) L, LT and T^2 (D) LT^{-2}, L and T

Q.11 E, m, J and G denote energy, mass, angular momentum and gravitational constant respectively, then the dimension of $\frac{EJ^2}{m^5G^2}$ are –

(A) Angle (B) Length

(C) Mass (D) Time

Q.12 A highly rigid cubical block A of small mass M and side L is fixed rigidly onto another cubical block B of the same dimensions and of low modulus of rigidity η such that the lower face of A completely covers the upper face of B. The lower face of B rigidly held on a horizontal surface. A small force F is applied perpendicular to one of the side faces of A. After the force is withdrawn block A executes small oscillations. The time period of which is given by.

(A) $2\pi\sqrt{\frac{M\eta}{L}}$ (B) $2\pi\sqrt{\frac{L}{M\eta}}$

(C) $2\pi\sqrt{\frac{ML}{\eta}}$ (D) $2\pi\sqrt{\frac{M}{\eta L}}$

Q.13 If e is charge, V is potential difference, T is temperature, then units of $\frac{eV}{T}$ are same as of –

(A) Planck's constant $\left(\frac{\text{Energy}}{\text{Frequency}}\right)$

(B) Stefan's constant $\left(\frac{\text{Power}}{\text{Area} \times \text{temp}^4}\right)$

(C) Boltzman constant $\left(\frac{\text{Energy}}{\text{temperature}}\right)$

(D) Gravitational constant $\left(\frac{\text{Force} \times \text{distance}^2}{\text{mass}^2}\right)$

Q.14 The volume of a liquid of density ρ and viscosity η flowing in time t through a capillary tube of length ℓ and radius R, with a pressure difference P, across its ends is proportional to :

(A) $P^2R^2t/\eta\ell^2$ (B) $PR^4/\eta\ell t$

(C) $PR^4t/\eta\ell$ (D) $\eta R^4/\ell t$

Q.15 A spherical body of mass m and radius r is allowed to fall in a medium of viscosity η. The time in which the velocity of the body increases from zero to 0.63 times, the terminal velocity (v) is called time constant (τ). Dimensionally τ can be represented by :

(A) $\frac{mr^2}{6\pi\eta}$ (B) $\sqrt{\left(\frac{6\pi mr\eta}{g^2}\right)}$

(C) $\frac{m}{6\pi\eta rv}$ (D) None of these

Q.16 If force, acceleration and time are taken as fundamental quantities, then the dimensions of length will be-
(A) FT^2 (B) $F^{-1}A^2T^{-1}$
(C) FA^2T (D) AT^2

Q.17 The velocity of a particle depends upon as $v = a + bt + ct^2$; if the velocity is in m/sec, the unit of a will be
(A) m/sec (B) m/sec^2
(C) m^2/sec (B) m/sec^3

Q.18 The SI standard of measurement for which of the following fundamental quantities is not based on a universally constant measurement ?
(A) time (B) length
(C) mass (D) luminous intensity

Q.19 Which of the following reading is most accurate-
(A) 4.00 cm (B) 0.004 mm
(C) 40.00 cm (D) 4.00 m

Q.20 The unit of electric charge may be expressed as –
(A) ampere-newton-meter/watt (B) ampere-volt
(C) ampere/second (D) ampere-ohm

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be $[ML^XT^{-3}I^{-2}]$. Find the value of X.

Q.22 Assuming that the mass m of the largest stone that can be moved by a flowing river depends upon the velocity v of the water, its density ρ and the acceleration due to gravity g. Then m is directly proportional to v^X. Find the value of X.

Q.23 The moment of inertia of a body rotating about a given axis is 6.0 kg m^2 in the SI system. The value of the moment of inertia in a system of units in which the unit of length is 5 cm and the unit of mass is 10 g is 2.4×10^X. Find the value of X.

Q.24 In a certain system of units, 1 unit of time is 5 sec, 1 unit of mass is 20 kg and unit of length is 10m. In this system, one unit of power will correspond to (1/X) watts. Find the value of X.

Q.25 The surface tension of a liquid is 70 dyne/cm. In MKS system its value is ($X \times 10^{-2}$ N/m). Find the value of X.