

PHYSICAL WORLD, UNITS AND MEASUREMENTS

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MCQs with One Correct Answer

- If $x = at + bt^2$, where x is the distance travelled by the body in kilometers while t is the time in seconds, then the unit of b is
 (a) km/s (b) kms
 (c) km/s² (d) kms²
- A metal sample carrying a current along X-axis with density J_x is subjected to a magnetic field B_z (along z-axis). The electric field E_y developed along Y-axis is directly proportional to J_x as well as B_z . The constant of proportionality has SI unit.
 (a) $\frac{m^2}{A}$ (b) $\frac{m^3}{As}$
 (c) $\frac{m^2}{As}$ (d) $\frac{As}{m^3}$
- The refractive index of water measured by the relation $\mu = \frac{\text{real depth}}{\text{apparent depth}}$ is found to have values of 1.34, 1.38, 1.32 and 1.36; the mean value of refractive index with percentage error is
 (a) $1.35 \pm 1.48\%$ (b) $1.35 \pm 0\%$
 (c) $1.36 \pm 6\%$ (d) $1.36 \pm 0\%$
- Write the dimensions of $a \times b$ in the relation $E = \frac{b - x^2}{at}$, where E is the energy, x is the displacement and t is time
 (a) ML^2T (b) $M^{-1}L^2T^1$
 (c) ML^2T^{-2} (d) MLT^{-2}
- In the relation $P = \frac{\alpha}{\beta} e^{-\frac{\alpha z}{k\theta}}$ where P is pressure, Z is distance, k is Boltzmann constants and θ is the temperature. The dimensional formula of β will be
 (a) $[M^0L^2T^0]$ (b) $[M^1L^2T^1]$
 (c) $[M^1L^0T^{-1}]$ (d) $[M^0L^2T^{-1}]$
- In a new system of units, the fundamental quantities mass, length and time are replaced by acceleration ' a ', density ' ρ ' and frequency ' f '. The dimensional formula for force in this system is
 (a) $[\rho a^4 f]$ (b) $[\rho a^4 f^{-6}]$
 (c) $[\rho^{-1} a^{-4} f^{-6}]$ (d) $[\rho^{-1} a^{-4} f^{-1}]$
- A formula is given as $P = \frac{b}{a} \sqrt{1 + \frac{k \cdot \theta \cdot t^3}{m \cdot a}}$ where P = pressure; k = Boltzmann's constant; θ = temperature; t = time; ' a ' and ' b ' are constants. Dimensional formula of ' b ' is same as
 (a) Force
 (b) Linear momentum
 (c) Angular momentum
 (d) Torque
- The pair of physical quantities that has the different dimensions is :
 (a) Reynolds number and coefficient of friction
 (b) Curie and frequency of a light wave
 (c) Latent heat and gravitational potential
 (d) Planck's constant and torque

9. Force F is given in terms of time t and distance x by $F = A \sin(Ct) + B \cos(Dx)$. Then, dimensions of $\frac{A}{B}$ and $\frac{C}{D}$ are
 (a) $[M^0 L^0 T^0]$, $[M^0 L^0 T^{-1}]$
 (b) $[MLT^{-2}]$, $[M^0 L^{-1} T^0]$
 (c) $[M^0 L^0 T^0]$, $[M^0 L T^{-1}]$
 (d) $[M^0 L^1 T^{-1}]$, $[M^0 L^0 T^0]$
10. The respective number of significant figures for the numbers 23.023, 0.0003 and 2.1×10^{-3} are
 (a) 5, 1, 2 (b) 5, 1, 5
 (c) 5, 5, 2 (d) 4, 4, 2
11. N divisions on the main scale of a vernier calliper coincide with $(N+1)$ divisions of the vernier scale. If each division of main scale is ' a ' units, then the least count of the instrument is
 (a) a (b) $\frac{a}{N}$
 (c) $\frac{N}{N+1} \times a$ (d) $\frac{a}{N+1}$
12. Given that K = energy, V = velocity, T = time. If they are chosen as the fundamental units, then what is dimensional formula for surface tension?
 (a) $[KV^{-2}T^{-2}]$ (b) $[K^2V^2T^{-2}]$
 (c) $[K^2V^{-2}T^{-2}]$ (d) $[KV^2T^2]$
13. In the formula $X = 5YZ^2$, X and Z have dimensions of capacitance and magnetic field, respectively. What are the dimensions of Y in SI units?
 (a) $[M^{-3} L^{-2} T^8 A^4]$ (b) $[M^{-1} L^{-2} T^4 A^2]$
 (c) $[M^{-2} L^0 T^{-4} A^{-2}]$ (d) $[M^{-2} L^{-2} T^6 A^3]$
14. The relative error in the determination of the surface area of a sphere is α . Then the relative error in the determination of its volume is
 (a) $\frac{2}{3}\alpha$ (b) $\frac{2}{3}\alpha$
 (c) $\frac{3}{2}\alpha$ (d) α
15. In an experiment the angles are required to be measured using an instrument, 29 divisions of the main scale exactly coincide with the 30 divisions of the vernier scale. If the smallest division of the main scale is half-a degree ($= 0.5^\circ$), then the least count of the instrument is:
 (a) halfminute (b) one degree
 (c) halfdegree (d) one minute
16. In SI units, the dimensions of $\sqrt{\frac{\epsilon_0}{\mu_0}}$ is:
 (a) $A^{-1}TML^3$ (b) $AT^2 M^{-1}L^{-1}$
 (c) $AT^{-3}ML^{3/2}$ (d) $A^2T^3 M^{-1}L^{-2}$
17. From the following combinations of physical constants (expressed through their usual symbols) the only combination, that would have the same value in different systems of units, is:
 (a) $\frac{ch}{2\pi\epsilon_0^2}$
 (b) $\frac{e^2}{2\pi\epsilon_0 G m_e^2}$ (m_e = mass of electron)
 (c) $\frac{\mu_0\epsilon_0}{c^2} \frac{G}{he^2}$
 (d) $\frac{2\pi\sqrt{\mu_0\epsilon_0}}{ce^2} \frac{h}{G}$
18. A student measuring the diameter of a pencil of circular cross-section with the help of a vernier scale records the following four readings 5.50 mm, 5.55 mm, 5.45 mm, 5.65 mm, The average of these four reading is 5.5375 mm and the standard deviation of the data is 0.07395 mm. The average diameter of the pencil should therefore be recorded as :
 (a) $(5.5375 \pm 0.0739)\text{mm}$
 (b) $(5.5375 \pm 0.0740)\text{mm}$
 (c) $(5.538 \pm 0.074)\text{mm}$
 (d) $(5.54 \pm 0.07)\text{mm}$
19. A quantity x is given by (IFv^2/WL^4) in terms of moment of inertia I , force F , velocity v , work W and Length L . The dimensional formula for x is same as that of :
 (a) planck's constant
 (b) force constant
 (c) energy density
 (d) coefficient of viscosity

20. The period of revolution (T) of a planet moving round the sun in a circular orbit depends upon the radius (r) of the orbit, mass (M) of the sun and the gravitation constant (G). Then T is proportional to

- (a) $r^{1/2}$ (b) r
(c) $r^{3/2}$ (d) r^2

Numeric Value Answer

21. The current voltage relation of a diode is given by $I = (e^{1000 V/T} - 1)$ mA, where the applied voltage V is in volts and the temperature T is in degree kelvin. If a student makes an error measuring ± 0.01 V while measuring the current of 5 mA at 300 K, what will be the error in the value of current in mA?
22. A physical quantity P is described by the relation $P = a^{1/2} b^2 c^3 d^{-4}$. If the relative errors in the measurement of a , b , c and d respectively, are 2%, 1%, 3% and 5%, then the percentage error in P will be :
23. The density of a material in SI unit is 128 kg m^{-3} . In certain units in which the unit of length is 25 cm and the unit of mass is 50 g, the numerical value of density of the material is:
24. If the screw on a screw-gauge is given six rotations, it moves by 3 mm on the main scale. If there are 50 divisions on the circular scale the least count (in cm) of the screw gauge is:
25. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors

in the measurement of the current and the voltage difference are 3% each, then percentage error in the value of resistance of the wire is

26. If 3.8×10^{-6} is added to 4.2×10^{-5} giving the regard to significant figures then the result will be $x \times 10^{-5}$. Find the value of x .
27. The mass of a liquid flowing per second per unit area of cross section of a tube is proportional to P^x and v^y , where P is the pressure difference and v is the velocity. Then $x \div y$ is
28. The specific resistance ρ of a circular wire of radius r , resistance R and length ℓ is given by $\rho = \frac{\pi r^2 R}{l}$. Given, $r = 0.24 \pm 0.02$ cm, $R = 30 \pm 1$ W and $l = 4.80 \pm 0.01$ cm. The percentage error in ρ is nearly
29. To determine the Young's modulus of a wire, the formula is

$Y = \frac{F}{A} \times \frac{L}{\Delta L}$: where L = length, A = area of cross-section of the wire, ΔL = change in length of the wire when stretched with a force F . The conversion factor to change it from CGS to MKS system is

30. The period of oscillation of a simple pendulum is $T = 2\pi \sqrt{\frac{L}{g}}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using a wrist watch of 1s resolution. The percentage accuracy in the determination of g is:

ANSWER KEY

1	(c)	4	(b)	7	(b)	10	(a)	13	(a)	16	(d)	19	(c)	22	(32)	25	(6)	28	(20)
2	(b)	5	(a)	8	(d)	11	(d)	14	(c)	17	(b)	20	(c)	23	(40)	26	(4.6)	29	(0.1)
3	(a)	6	(b)	9	(c)	12	(a)	15	(d)	18	(d)	21	(0.2)	24	(0.001)	27	(-1)	30	(3)