PHYSICS

BOOKS - MODERN PUBLICATION PHYSICS (KANNADA ENGLISH)

UNITS, MEASURMENTS, DIMENSIONS, ERRORS OF MEASUREMENTS

Multiple Choice Questions Level I

1. The dimensional formula of latent heat is :

A. $M^0L^2T^{-2}$

B. ML^2T^{-1}

C. MLT^{-1}

D. $M^0L^2T^{-1}$

Answer: A

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2. Which one of the following has the dimensions of $\left[ML^{-1}T^{-2}\right]$:

A. torque

B. surface tension

C. viscosity

D. stress

Answer: D

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3. If C and L denote the capacitance and inductance, then the units of LC are :

A. $M^0L^0T^2$

B. $M^0L^0T^{-2}$

C. MLT^2

D. M^0L^0T

Answer: A

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4. The measured mass and volume of the body are $22 \cdot 42g$ and $4 \cdot 7cm^3$ respectively with

permissible errors $0 \cdot 01g$ and $0 \cdot 1cm^3$. The maximum $\%$ error in density is about :

A. 0.2%

B. 2%

C. 5%

D. 10%

Answer: B

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5. A quantity X is given by $\frac{me^4}{8\varepsilon_0^2 ch^3}$ where m is mass of electron, e is the charge of electron, ε_0 is the permittivity of free space, c is the velocity of light and h is the Planck's constant. The dimensional formula for X is the same as that of :

A. length

B. frequency

C. velocity

D. wave number

Answer: D

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6. If a physical quantity X is represented by $X = M^a L^b T^{-c}$ and the $\%$ error in M, L and T are $\alpha\,\%$, $\beta\,\%$ and $\gamma\,\%$ resperctively, then total $\%$ error in X is :

A. $(\alpha a + \beta b - \gamma c)\,\%$

B. $(\alpha a + \beta b + \gamma c)\,\%$

C. $(\alpha a - \beta b - \gamma c)\,\%$

D. None of the above

Answer: B

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7. The frequency of vibrations of a mass m suspended from a spring of spring const. k is given by $v = cm^x k^y$, 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. $-\frac{1}{2}, \frac{1}{2}$

Answer: D

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8. The velocity v of a particle is given in terms of time t by the equation $v = at + \frac{b}{t+c}$ The dimensions of a, b and c are :

A. L^2, T, LT^2

B. LT^2, LT, L

C. LT^{-2}, L, T

D. L, LT, T^2

Answer: C

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9. If C, the velocity of light, g the acceleration due to gravity and P the atmospheric pressure in $M.K.S$ units are the

fundamental units then the dimension of length will be :

A. $\frac{C}{g}$

B. $\frac{C}{P}$

C. $P.C.g$

D. $\frac{C^2}{g}$

Answer: D

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10. Write the dimensional formula for resistivity.

A. $\left[ML^2T^{-2}A^{-2}\right]$

B. $\left[ML^3T^{-3}A^{-2}\right]$

C. $\left[ML^{-2}T^{-2}A^2\right]$

D. $\left[ML^2T^{-2}A^{-3}\right]$

Answer: B

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11. The quantities A and B are related by the relation $A/B = m$, where m is the linear density and A is force, the dimensions of B will be :

A. same as that of pressure

B. same as that of work

C. that of momentum

D. same as that of latent heat

Answer: D

12. If force F, acceleration A and time T are basic physical quantities, the dimensions of energy are :

A. $\left[F^2A^{-1}T\right]$

B. $\left[FAT^2\right]$

C. $\left[FAT^{-2}\right]$

D. $\left[FA^{-1}T\right]$

Answer: B

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13. The dimensions $\left[ML^{-1}T^{-2}\right]$ can correspond to :

A. Moment of force

B. surface tension

C. Modulus of elasticity

D. Coefficient of viscosity

Answer: C

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14. The dimensions of $\frac{1}{2}\varepsilon_0 E^2$ ($\varepsilon_0 =$ permitivity of free space and E= electric field) are :

A. $\left[ML^2T^{-1}\right]$

B. $\left[ML^{-1}T^{-2}\right]$

C. $\left[ML^2T^{-2}\right]$

D. $\left[MLT^{-1}\right]$

Answer: B

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15. A physical quantity X is represented by $x = \left(M^{x} L^{-y} T^{-z}\right)$. The maximum percentage errors in the measurement of M, L and T respectively are $a\,\%$, $b\,\%$ and $c\,\%$. The maximum percentage error in the measurement of X will be :

A. $(ax + by - cz)$ per cent

B. $(ax - by - cz)$ per cent

C. $(ax + by + cz)$ per cent

D. $(ax - by + cz)$ per cent

Answer: C

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16. Given $R_1 = 5.0 \pm 0.2\Omega, R_2 = 10 \cdot 0 \pm 0.1\Omega.$ What is total resistance in parallel with possible $\%$ error.?

A. $15\Omega \pm 2\,\%$

B. $3.3\Omega \pm 7\,\%$

C. $15\Omega \pm 7\,\%$

D. $3.3\Omega 2\ \%$

Answer: B

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17. Write the dimensions of a and b in the relation $P = \frac{b - x^2}{at}$, where P is power, x is distance and t is the time :

A. 1) MLT^2, L^2

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

C. $ML^{-1}T^{-2}, L$

D. $M^{-1}LT^{2}, L.$

Answer: B

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18. The dimensions of $\frac{a}{b}$ in the equation $P = \frac{a - t^2}{bx}$ where P is pressure, x is distance and t is time are

A. $M^{-1}L^{0}T^{-2}$

B. ML^0T^{-2}

C. ML^0T^2

D. MLT^{-2}

Answer: B

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19. If force (F), $\leq n > h(L)$ and time (T) be considered fundamental units, then units of mass will be :

A. $\left[FL^{-1}T^{2}\right]$

B. $\left[F^{2}LT^{-2}\right]$

C. $\left[FLT^{-2}\right]$

D. $\left[FL^{-2}T^{-1}\right]$

Answer: A

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20. The frequency (n) of vibration of a string is given as $n=\frac{1}{2l}\sqrt{\frac{T}{m}}$, where T is tension

and l is the length of vibrating string, then the dimensional formula for m is :

A. $\left[M^0L^1T^1\right]$

B. $\left[M^0L^0T^0\right]$

C. $\left[M^1L^{-1}T^0\right]$

D. $\left[ML^0T^0\right]$

Answer: C

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21. In the relation $y = r\sin(\omega t - kx)$ the dimensions of $\frac{\omega}{k}$ are :

A. $\left[M^0L^0T^0\right]$

B. $\left[M^0L^1T^{-1}\right]$

C. $\left[M^0L^0T^1\right]$

D. $\left[M^0L^1T^0\right]$

Answer: B

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22. Dimensions of $\in_0 \mu_0$ are :

A. $\left[LT^{-1}\right]$

B. $\left[LT^{-2}\right]$

C. $\left[L^2T^{-2}\right]$

D. $\left[L^{-2}T^2\right]$

Answer: D

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23. Two physical quantities, of which one is a vector and the other is a scalar, having same dimension are :

A. moment and momentum

B. power and pressure

C. impulse and momentum

D. torque and work.

Answer: D

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24. If the units of force and velocity are doubled, then the units of power will :

A. be halved

B. be doubled

C. be quadrupled

D. remain unaffected.

Answer: C

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25. The dimensions of the quantity namely $\frac{\mu_0 ce^2}{2h}$ is : where $\mu_0 -$ permebility of free space, c-velocity of light, e=electron charge and h being Plank's constant :

A. $\left[M^0 LT\right]$

B. $\left[M^0 L^0 T\right]$

C. $\left[M^0 L^0 T^0\right]$

D. $\left[M^{-2} L^{-1} T^3\right]$

Answer: C

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26. The period of a body under $S.H.M.$ is represented by $T \propto P^a D^b S^c$, where P is the pressure, D is the density and S is surface tension then the values of a, b and c are :

A. $1, 2, \frac{1}{3}$

B. $\frac{-3}{2}, \frac{1}{2}, 1$

C. $-1, -2, 3$

D. $\frac{-1}{2}, \frac{-3}{2}, \frac{-1}{2}$

Answer: B

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27. The relative density of a material of a body is found by weighing it first in air and then in water. If the wt. of the body in air is $W_1 = 8 \cdot 00 \pm 0 \cdot 05$ newton and weight in water is $W_2 = 6 \cdot 00 \pm 0 \cdot 05$ newton. Then the relative density, $p_r = \frac{W_1}{W_1 - W_2}$ with the maximum permissible error is :

A. $4 \cdot 00 \pm 0 \cdot 62\ \%$

B. $4 \cdot 00 \pm 0 \cdot 82\ \%$

C. $4 \cdot 00 \pm 3 \cdot 2\,\%$

D. $4 \cdot 00 \pm 5 \cdot 62\,\%$

Answer: D

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28. The length l, breadth b and thickness t of a block of wood were measured with the help of a metre scale. The results after calculating the errors are given as

$l = 15 \cdot 12 \pm 0 \cdot 01cm, b = 10 \cdot 15 \pm 0 \cdot 01cm$

$t = 5 \cdot 28 \pm 0 \cdot 01cm$. The percentage error in volume upto proper significant figure is :

A. $0 \cdot 36\ \%$

B. $0 \cdot 28\ \%$

C. $0 \cdot 48\ \%$

D. $0 \cdot 64\ \%$

Answer: A

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29. Which one of the following has not been expressed in proper units ?

A. Stefan's constant - $Wm^{-2}K^{-4}$

B. Latent heat - Jkg^{-1}

C. Coefficient of elasticity - Nm^{-2}

D. Universal gas constant JK

Answer: D

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30. The dimensions of intensity of wave are :

A. $\left[ML^2T^{-3}\right]$

B. $\left[ML^0T^{-3}\right]$

C. $\left[ML^{-2}L^{-3}\right]$

D. $\left[M^1L^2L^3\right]$

Answer: B

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31. Which of the following quantities has the same dimensions as the gravitational constant ?

A. $\frac{(velocity)^2}{\text{Mass per unit length}}$

B. Force/ mass

C. Work/ time

D. $\frac{(\text{Momentum})^2}{\text{Force}}$

Answer: A

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32. The same physical quantity is expressed in two different units x_1 and x_2. The corresponding numerical values of the quantity are n_1 and n_2 respectively. Then

A. $n_1 x_1 = n_2 x_2$

B. $n_1 x_2 = n_2 x_1$

C. $n_1 n_2 = x_1 x_2$

D. $n_2 - n_1 = x_2 - x_1$.

Answer: A

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33. A rectangular beam which is supported at its two ends and loaded in the middle with weight W sags by an amount δ such that $\delta = \frac{Wl^3}{4Yd^3x}$, where l, d and Y represent length, depth and elasticity respectively.

Guess the unknown factor using dimensional considerations :

A. breadth

B. $(\text{breadth})^2$

C. $(\text{breadth})^3$

D. mass.

Answer: A

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34. The dimensional formula of magnetic moment of a curent- carrying coil is :

A. $\left[L^2A^{-1}\right]$

B. $\left[L^2A\right]$

C. $\left[L^2A^{-3}\right]$

D. $\left[LA^2\right]$

Answer: B

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35. 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. $\frac{1}{\text{Current}}$

Answer: D

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36. The error in the measurement of the radius of a sphere is 1% . The error in the measurement of its volume is :

A. 1%

B. 3%

C. 5%

D. 8%

Answer: B

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37. If P represents radiation pressure, C represent speed of light and Q represents radiation energy striking a unit area per

second, then the non-zero integers, x, y and z such that $P^xQ^yC^z$ is dimensionless are :

A. $x = 1, y = 1, z = 1$

B. $x = 1, y = 1, z = -1$

C. $x = -1, y = 1, z = 1$

D. $x = 1, y = -1, z = 1$

Answer: D

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38. 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. $M^0L^3T^{-2}$

B. $ML^{-2}T^5$

C. ML^5T^{-2}

D. $M^0L^3T^0$

Answer: C

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39. 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 (Y) would be :

A. FA^2V^{-4}

B. FA^2V^{-5}

C. FA^2V^{-3}

D. FA^2V^{-2}

Answer: A

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40. 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. $\frac{1}{2}, \frac{-5}{6}, \frac{1}{3}$

Answer: C

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41. If the area of a square is $(100 \pm 0 \cdot 2)cm^2$ then the side of the square is :

A. $(10 \pm 0 \cdot 1)cm$

B. $(10 \pm 0 \cdot 2)cm$

C. $10 \cdot 0 \pm 0 \cdot 01cm$

D. None of these

Answer: C

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42. The least count of a stop watch is $1/5$ second. The time of 20 oscillations of a pendulum is measured to be 25 seconds. The

minimum percentage error in the measurement of time will be :

A. $0 \cdot 1\%$

B. $0 \cdot 8\%$

C. 8%

D. 1.8%

Answer: B

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43. Upon heating the length of each side of the cube changes by 2%. The volume of the cube would change by :

A. 1%

B. 2%

C. $2/3\%$

D. 6%

Answer: D

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44. A resistor of $6k\Omega$ with tolerance $10\,\%$ and another of $4k\Omega$ with tolerance $10\,\%$ are connected in series. The tolerance of combination is about :

A. $5\,\%$

B. $10\,\%$

C. $12\,\%$

D. $40\,\%$

Answer: B

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45. In the above question, the tolerance when resistors are connected in parallels :

A. $10\ \%$

B. $30\ \%$

C. $20\ \%$

D. $40\ \%$

Answer: B

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46. An experiment measures quantities a, b, c and then X is calculated from $X = \frac{a^{1/2}b^2}{c^3}$. If the percentage errors in a, b, c are $\pm 1\,\%$ $\pm 3\,\%$ and $\pm 2\,\%$ respectively, then the percentage error in X can be :

A. $\pm 12.5\,\%$

B. $\pm 7\,\%$

C. $\pm 1\,\%$

D. $\pm 4\,\%$

Answer: A

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47. The resistance of a metal is given by $R = \frac{V}{I}$, where V is potential difference and I is the current. In a circuit the potential difference across resistance is $V = (8 \pm 0 \cdot 5)$ V and current in resistance, $I = (4 \pm 0 \cdot 2)A$. And current in resistance with its percentage error :

A. $(2 \pm 5 \cdot 6\,\%)$ ohm

B. $(2 \pm 0 \cdot 7\,\%)$ ohm

C. $(2 \pm 35\,\%)$ ohm

D. $(2 \pm 11 \cdot 25\,\%)$ ohm

Answer: D

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48. Which one of the following is dimensionally incorrect ?

A. Capcitance $C = \left[M^{-1}L^{-2}T^{4}A^{2}\right]$

B. Maagnetic field inducation

$B = \left[ML^{0}T^{-2}A^{-1}\right]$

C. Coefficient of self - induction

$L = \left[ML^{2}T^{-2}A^{-1}\right]$

D. Specific resistance $P = \left[ML^{3}T^{-3}A^{-2}\right]$

Answer: C

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49. Which of the following product of e, h, μ, G (where μ is the permeability) be taken so that the dimensions of the product are same as that of speed of light ?

A. $he^{-2}\mu^{-1}G^{0}$

B. $h^{2}eG^{0}\mu$

C. $h^{0}e^{2}G^{-1}\mu$

D. $hGe^{-2}\mu^{0}$.

Answer: A

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50. If eneryg E, velocity v and time t are taken t are taken as the fundamental units, what is the dimensional formula of intensity of radiation ?

A. $Ev^{-2}t^{-3}$

B. $Ev^{-1}t^{-1}$

C. $Ev^{-1}t^{-2}$

D. $Ev^{-2}t^{-2}$.

Answer: A

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51. Which of the following does not have the dimensions of velocity ? (Given, ε_0 = permittivity of free space, μ_0 = permeability of free space, v = frequency , is the wavelength, P is the pressure and = density, k = wave number, ω is the angular frequency) :

A. ωk

B. $v\lambda$

C. $\sqrt{\varepsilon_0\mu_0}$

D. $\sqrt{\frac{P}{\rho}}$.

Answer: A

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52. The mass of the liquid flowing per second per unit area of cross section of the tupe is proportional to P^x and v^y where P is the

pressure difference and v is the velocity, then the relation between x and y is:

A. $x = y$

B. $x = -y$

C. $y^2 = x$

D. $y = -x^2$.

Answer: B

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53. A physical quantity x is calculate from $x = \frac{ab^2}{\sqrt{c}}$. Calculate the percentage error in measuring x when the percentage errors in measuring a, b, c are $4, 2$ and 3 percent respectively :

A. $7\,\%$

B. $9\,\%$

C. $11\,\%$

D. $9.5\,\%$.

Answer: D

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54. $\left[M^1L^{-2}T^{-2}\right]$ represents dimensional formula of which of the following physical quantities ?

A. energy

B. pressure

C. torque

D. pressure gradient.

Answer: D

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55. Dimensions of $\frac{L}{RCV}$ are :

A. A^{-1}

B. A^{-2}

C. A

D. A^2.

Answer: A

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56. The time dependance of a physical quantity P is given by $P = P_0 e^{\alpha t^2}$ where α is a constant and t is time. Then constant α is :

A. dimensionless

B. has dimension of T^{-2}

C. has dimension of P

D. has dimension of T^2.

Answer: B

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57. In the formula $X = 3YZ^2$, X and Z have the dimensions of capacitance and magnetic induction respectively. The dimensions of Y in MKS system are :

A. $\left[M^{-3}L^{-2}T^{-2}A^{-4}\right]$

B. $ML^{-2}\overset{\circ}{A}$

C. $\left[M^{-3}L^{-2}T^{8}A^{4}\right]$

D. $\left[M^{-3}L^{-2}T^{4}A^{-4}\right]$

Answer: C

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58. The velocity v of a particle is given in terms of time t by the equation $v = at + \frac{b}{t+c}$ The dimensions of a, b and c are :

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59. If L has the dimensions of length, V that of potential and ε_0 is the permittivity of free

space then quantity $\varepsilon_0 LV$ have the dimensions of :

A. Current

B. Charge

C. Resistance

D. Voltage

Answer: B

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60. A quantity x is defined by the equation $x = 3C^2B^2$, where C is capacitance in farads and B is magnetic field in tesla, the dimension of x are :

A. ML^{-2}

B. $ML^{-2}T^{-2}A$

C. $L^{-4}T^4A^2$

D. $L^{-1}A^{-1}$

Answer: A

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61. The dimensional formula for magnetic flux is :

A. $[ML^2T^{-2}A^{-1}]$

B. $[ML^0T^{-2}A^{-2}]$

C. $[M^0L^{-2}T^{-2}A^{-2}]$

D. $[ML^2T^{-1}A^3]$

Answer: A

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62. The speed of light c, acceleration due to gravity g and pressure p are taken as fundamental units, the dimensions of gravitational constant G are :

A. $c^0 g p^{-3}$

B. $c^2 g^3 p^{-2}$

C. $c^0 g^2 p^{-1}$

D. $c^2 g^2 p^{-2}$

Answer: C

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63. The dimensions of electric susceptibility are :

A. $M^{\circ}L^{\circ}T^{\circ}A^{\circ}$

B. $M^{\circ}L^{-2}T^{\circ}A^{2}$

C. $MLT^{-2}A$

D. $M^{\circ}L^{-1}T^{\circ}A$

Answer: A

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64. If $'G''c'$ and $'h'$ are usual constants of physics, the unit of time is expressed as :

A. $\sqrt{\frac{hc}{G}}$

B. $\sqrt{\frac{hc}{c^5}}$

C. $\frac{hc}{G}$

D. hGc^3

Answer: B

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65. A quantity x is given by $es\pi lon_0 L\frac{\Delta V}{\Delta t}$ where $es\pi lon_0$ is permittivity of free space L is length, ΔV is a potential difference and Δt is the time interval. The dimensional formula for x is the same as that of :

A. resistance

B. Charge

C. voltage

D. current

Answer: D

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66. E, m, L and G denote energy, mass, angular momentum and gravititional constant respectively, the quantity $\frac{E.L}{m^5 G^2}$ has the dimensions of :

A. angle

B. length

C. mass

D. time

Answer: A

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67. The potential energy of a particle varies with distance x as $U = \frac{Ax^{1/2}}{x^2 + B}$ where a and B are constants. The dimensional formula for AXB is :

A. $M^1 L^{7/2} T^{-2}$

B. $M^1L^{11/2}T^{-2}$

C. $M^1L^{5/2}T^{-2}$

D. $M^1L^{9/2}T^{-2}$

Answer: B

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68. What is the unit of k in the relation

$$U = \frac{ky}{y^2 + a^2}$$

where U represents the potential energy, y

represents the displacement and a represents the maximum displacement $i.e.$, amplitude ?

A. ms^{-1}

B. ms

C. Jm

D. Js^{-1}

Answer: C

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69. $\frac{B^2}{\mu_0}$, where B is magnetic induction and μ_0 is permeability of free space, has the same dimensions as :

A. energy

B. energy density

C. magnetic intensity

D. none of these.

Answer: B

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70. The time period of a large fluid star may depends upon its mean radius R, its mean density (p) and the gravitation constant G. Using dimensional consideration the value of T is :

A. $kpRG$

B. $kp^{\frac{1}{2}}G^{\frac{1}{2}}$

C. $kp^{\frac{1}{2}}G^{-\frac{1}{2}}R^{0}$

D. $kp^{\frac{1}{2}}G^{-1}R^{0}$

Answer: C

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71. The velocity of the wave v depends upon the wave length, density of water $'d'$ and acceleration due to gravity g Then :

A. $v^2 = K\lambda^{-1}g^{-1}d^{-1}$

B. $v^2 = K\lambda^{1}g^{1}d^{1}$

C. $v^2 = K\lambda^{1}g^{1}d^{0}$

D. $v^2 = K\lambda^{3}g^{-1}d^{-1}$

Answer: C

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72. If L, C, R denote the inductance, Capacitance and resistance repectively, the dimenstional formula of C^2LR is :

A. $ML^2T^{-1}I^0$

B. $M^0L^0T^3I^0$

C. $M^{-1}L^{-2}T^6I^2$

D. $M^0L^0T^2I^0$

Answer: B

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73. The position x of a particle at time t is given by :

$x = \frac{v_0}{a}\left(1 - e^{-at}\right)$ where v_0 is a constant and $a > 0$.

The dimensional formula of v_0 and a is :

A. $\left[M^0 L T^{-1}\right]$ and $\left[T^{-1}\right]$

B. $\left[M^0 L T^0\right]$ and $\left[T^{-1}\right]$

C. $\left[M^0 L T^{-1}\right]$ and $\left[T^{-2}\right]$

D. $\left[M^0LT^{-1}\right]$ and $[T]$

Answer: A

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74. The dimensional formula for hole mobility in a semiconductor is :

A. $\left[M^{-1}L^0T^2A\right]$

B. $\left[M^{-1}L^2T^{-2}A\right]$

C. $\left[M^0L^0T^0A\right]$

D. $\left[ML^{-2}T^{-2}A\right]$

Answer: A

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75. Identify the pair whose dimensions are equal :

A. Torque and work

B. Stress and energy

C. Force and stress

D. Force and work.

Answer: A

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76. Which one of the following represents the correct dimensions of the coefficient of viscosity ?

A. $\left[ML^{-1}T^{-2}\right]$

B. $\left[ML^{-2}T^{-2}\right]$

C. $\left[ML^{-1}T^{-1}\right]$

D. $\left[MLT^{-1}\right]$

Answer: C

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77. Out of following pairs which one does NOT have identical dimensions ?

A. angular momentum and Planck's constant

B. impulse and momentum

C. moment of inertia and moment of force

D. work and torque.

Answer: C

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78. Dimensions of $\frac{1}{\sqrt{\mu_0 \in_0}}$ are

A. $\left[L^{-1}T\right]$

B. $L^{-2}T^2$

C. L^2T^{-2}

D. LT^{-1}

Answer: C

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79. Which of the following units denote the dimensions of $\frac{ML^2}{Q^2}$ where Q is the electric charge ?

A. Wb/m^2

B. $\text{henry}(H)$

C. $\frac{H}{m^2}$

D. weber (Wb)

Answer: B

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80. The rad is the correct unit used to report the measurement of :

A. The ability of a beam of γ- rays to produce ions in a target.

B. The energy delivered by radiation to a target

C. The biological effect of radiation

D. The rate of decay of radioactive source.

Answer: B

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81. Two full turns of the circular scale of a screw gauge cover a distance of 1 mm on its main scale. The total number of divisions on the circular scale is 50. Further it is found that the screw gauge has a zero error of -0.03 mm. While measuring the diameter of a thin wire, a student notes the main scale reading of 3 mm and the number of circular scale division in line with the main scale as 35. The diameter of the wire is

A. 3.32 mm

B. 3.73 mm

C. 3.67 mm

D. 3.38 mm

Answer: D

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82. The respective number of significant figures for the numbers $23.023, 0.0003$ and 2.1×10^{-3} are :

A. $4, 4, 2$

B. $5, 1, 2$

C. $5, 1, 5$

D. $5, 5, 2.$

Answer: B

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83. A vernier calipers has 1 mm marks on the main scale. It has 20 equal divisions on the vernier scale which match with 16 main scale

divisions. For the vernier calipers, the least count is :

A. 0.02 mm

B. 0.05 mm

C. 0.1 mm

D. 0.2 mm

Answer: D

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Multiple Choice Questions Level Ii

1. The velocity v of a particle is given in terms of time t by the equation $v = at + \frac{b}{t+c}$ The dimensions of a, b and c are :

A. L, LT and T^2

B. LT^{-2}, L and T

C. L^2, T and LT^2

D. $LT^2 LT$ and L

Answer: B

Watch Video Solution

2. The intensity of a traveling wave has units of W/m^2, give the dimensional formula of intensity :

A. $\left[ML^0T^{-3}\right]$

B. $\left[ML^1T^{-2}\right]$

C. $\left[M^0L^{-1}T^2\right]$

D. $\left[M^{-1}L^0T^{-3}\right]$

Answer: A

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3. The radius of nucleus is $R = R_0 A^{1/3}$where A is the mass number of the atom. What are the dimensions of R_0 ?

A. $\left[M^0 L^0 T^{-1}\right]$

B. $\left[M^0 L T^0\right]$

C. $\left[M L^2 T^{-2}\right]$

D. $\left[M^0 L^0 T^0\right]$

Answer: B

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4. $\frac{B^2}{\mu_0}$, where B is magnetic induction and μ_0 is permeability of free space, has the same dimensions as :

A. that of energy

B. that of presssure

C. that of energy density

D. power

Answer: C

Watch Video Solution

5. If $x = \frac{a\cos\theta + b\cos\theta}{a+b}$, then

A. x has the same dimensions as a and b

B. a and b have different dimensions

C. x has no dimensions

D. x has dimensions of wavelength.

Answer: C

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6. If the energy of a photon of light is given by $E = kh^x c^y \lambda^z$, where h= Planck's constant, c = velocity of light and λ = wavelength then values of x, y, z in order are :

A. $1, 2, 1$

B. $1, 1, 1$

C. $1, -1, 1$

D. $1, 1, -1$

Answer: D

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7. The energy transfered to the battery of an invertor from the electric line is given by

$U = E.\, q$

where q = charge transfered. If A is the ammeter reading during transfer for a small time Δt, then the dimensions of $e.\, m.\, f.\ E$ of the battery are :

A. $ML^2T^{-3}A^{-1}$

B. $MLT^{-2}A^0$

C. $M^0L^0T^{-3}A^1$

D. $ML^2T^{-3}A^{-2}$

Answer: A

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8. In the formula $X = 3YZ^2$, X and Z have the dimensions of capacitance and magnetic

induction respectively. The dimensions of Y in MKS system are :

A. $M^{-2}L^{-2}T^{4}Q^{4}$

B. $M^{-3}L^{0}T^{4}Q^{-3}$

C. $M^{-3}L^{-2}T^{4}Q^{4}$

D. $M^{-3}L^{2}T^{4}Q^{-4}$

Answer: C

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9. Solar constant of the sun is the energy received by earth per minute per cm^2. Its dimensions will be :

A. $\left[ML^2T^{-3}\right]$

B. $\left[ML^0T^{-3}\right]$

C. $\left[ML^2T^{-1}\right]$

D. $\left[ML^0T^{-1}\right]$

Answer: B

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10. What will be the dimensions of the ratio of electric intensity of the electric field E to the magnetic induction B of the magnetic field in case of electromagnetic wave propagation ?

A. same as that of acceleration

B. same as that of velocity

C. same as that of force

D. same as that of energy

Answer: B

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11. Which of the following pair has same dimensions ?

A. Current density and charge density

B. Force constant and surface energy

C. Angular momentum and momentum

D. Moment of a force and force constant.

Answer: B

 Watch Video Solution

12. Given that force (F) is given $F = Pt^{-1} + Qt$. Here t is time. The unit of P is same as that of :

A. displacement

B. velocity

C. acceleration

D. momentum.

Answer: D

Watch Video Solution

13. If D represents the diameter,ρ the density , v the speed and η the coefficient of viscosity , then the quantity $\frac{D\rho v}{\eta}$ has :

A. dimensions of mass

B. dimensions of length

C. dimensions of time

D. no dimensions.

Answer: D

Watch Video Solution

14. What is the unit of k in the relation

$$U = \frac{ky}{y^2 + a^2}$$

where U represents the potential energy, y represents the displacement and a represents the maximum displacement $i.e.$, amplitude ?

A. power

B. couple

C. joule- metre

D. newton- sec.

Answer: C

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15. If $x = \frac{\varepsilon_0 l V}{t}$ where ε_0 is permittivity of free space, l is the length, V is the potential difference and t is the time, then dimensions of x are the same as that of :

A. resistance

B. current

C. charge

D. potential.

Answer: B

Watch Video Solution

16. The number of particles given by $n = -D\frac{n_2 - n_1}{x_2 - x_1}$ are crossing a unit area perpendicular to x-axis in unit time, where n_1 and n_2 are the number of particles per unit volume for the values x_1 and x_2 of x respectively. Then the

dimensional formula of diffusion constant D is :

A. $\left[M^0LT^2\right]$

B. $\left[M^0L^2T^{-4}\right]$

C. $\left[M^0LT^{-3}\right]$

D. $\left[M^0L^2T^{-1}\right]$

Answer: B

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17. On the basis of dimensions decide, which of the following relations for the displacement of a particle executing $S.H.M$ is incorrect ?

A. $y = a\sin\left(\frac{2\pi t}{T}\right)$

B. $y = a\sin\theta t$

C. $y = \frac{a}{T}\sin(t/a)$

D. $y = \sqrt{2}a\frac{\sin(2\pi t)}{T}$

Answer: C

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18. If momentum $/(p)$, area a and time (t) are taken to be the fundamental quantities then the energy has the dimensional formula :

A. $\left[p^1 a^{-1} t^1\right]$

B. $\left[p^0 a^1 t^1\right]$

C. $\left[p^1 a^{-\frac{1}{2}} t^1\right]$

D. $\left[p^1 a^{\frac{1}{2}} t^{-1}\right]$

Answer: D

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19. Youngs modulus for steel is $2 \times 10^{11} N/m^2$. What is its value in $C.G.S$ UNITS ?

A. 2×10^{10}

B. 2×10^{11}

C. 2×10^{12}

D. 2×10^{13}

Answer: C

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20. An artificial satellite is revolving round a planet of mass M and radius R in a circular orbit of radius $'r'$. If its period of revolution T obeys Kepler's law i.e. $T^2 \propto r^3$. What is relation for the period of revolution in terms of R, r and g the accelerations due to gravity on the planet ?

A. $T = kr^{\frac{3}{2}} R^{\frac{1}{2}} g^{\frac{1}{2}}$

B. $T = kr^3 R g^{\frac{1}{2}}$

C. $T = kr^{\frac{3}{2}} R^{-1} g^{\frac{1}{2}}$

D. $T = kr^{\frac{3}{2}}R^2g$

Answer: C

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21. A quantity $Q = \frac{El^2G^2}{m^5}$ where E, l, G and m are energy, angular momentum gravitational constant and mass respectively. What are the dimensional of Q ?

A. $\left[M^0L^0T^0\right]$

B. $\left[M^1L^0T^1\right]$

C. $\left[M^1L^1T^{-1}\right]$

D. $\left[M^{-1}L^{-1}T^1\right]$

Answer: A

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22. A physical quantity $Q = \frac{a^2b^3c^{\frac{5}{2}}}{x^2}$. If the percentage errors in the measurement of $'a', 'b', 'c'$ and x are $1\%, 2\%, 3\%, 4\%$

reperctively, What is the percentage error in the measurement of Q ?

A. $24\ \%$

B. $12\ \%$

C. $6\ \%$

D. $8\ \%$

Answer: A

Watch Video Solution

23. The mass and volume of a block of material are 4.237 g and $2.5cm^3$ respectively. The density of material of the block in correct significant figures is :

A. $1.6045gcm^{-3}$

B. $1.6gcm^{-3}$

C. $1.7gcm^{-3}$

D. $1.695gcm^{-3}$

Answer: C

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Watch Video Solution

24. For the equation $F \propto A^a v^b d^c$, where F is the force, A is the area,v is the velocity and d is the density, the values of a, b and c are respectively :

A. $1, 2, 1$

B. $2, 1, 1$

C. $1, 1, 2$

D. $0, 1, 1$

Answer: A

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25. An important milestone in the evolution of the universe just after the big bang is the Planck time t^p, the value of which deponds on three fundamental constants-speed c of light in vacuum, gravitational constant G and Planck's constant h. Then, $t_p \propto$

A. Ghc^5

B. $\frac{c^5}{Gh}$

C. $\frac{Gh}{c^5}$

D. $\left(\frac{Gh}{c^5}\right)^{1/2}$

Answer: D

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26. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. L is about 10 cm and is known to 1 mm accurancy. The period of

oscillation is about 0.5 second. The time of 100 oscillation is measured with a wrist watch of 1 s resolution. What is the accurancy in the determination of g ?

A. 3%

B. 2%

C. 5%

D. 4%

Answer: C

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27. Which of the following is false regarding significant figures ?

A. All non - zero digits are significant.

B. The zeros appearing in the middle of a number are significant while those at the end of a number without a decimal point are ambiguous.

C. The powers of 10 are counted while counting the number of significant

figures.

D. Greater the number of significant figures in a measurement, smaller is the percentage error.

Answer: C

Watch Video Solution

28. If w, x, y and z are mass, length, time and current respectively, then $\frac{x^2w}{y^3z}$ are the

dimensions of :

A. Electric potential

B. Capacitance

C. Electric field

D. Permittivity.

Answer: A

 Watch Video Solution

29. The volume of a cube in m^3 is numerically equal to its surface area in m^2. The volume of cube is :

A. $1000m^3$

B. $8m^3$

C. $256m^3$

D. $216m^3$

Answer: D

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30. If the velocity of light c, Planck's constant h and gravitation constant G are adopted as fundamental units of a system, the dimensions of force in the system would be :

A. G^4h^{-1}

B. $G^{-1}c^4h^0$

C. $G^{-1}c^0h^4$

D. $Gc^{-1}h^0$

Answer: B

Watch Video Solution

31. If force $= \frac{X}{density} + C$ is dimensionally correct, the dimensions of X are :

A. MLT^{-2}

B. MLT^{-3}

C. ML^2T^{-3}

D. $M^2L^{-2}T^{-2}$

Answer: D

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32. The length l, breadth b and thickness t of a block of wood were measured with the help of a metre scale. The results after calculating the errors are given as

$l = 15 \cdot 12 \pm 0 \cdot 01cm, b = 10 \cdot 15 \pm 0 \cdot 01cm$

$t = 5 \cdot 28 \pm 0 \cdot 01cm$. The percentage error in volume upto proper significant figure is :

A. $0.28\ \%$

B. $0.36\ \%$

C. $0.48\ \%$

D. 0.65%

Answer: B

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33. The density of a cube is measured by measuring mass and the length of its sides. If the maximum error in the measurement of mass and length are 3% and 2% respectively, then the maximum error in the measurement of the density of cube is :

A. 7%

B. 5%

C. 10%

D. 9%

Answer: D

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34. If the error in the measurement of momentum of a particle is $(+100\%)$, then

the error in the measurement of kinetic energy is :

A. $250\ \%$

B. $200\ \%$

C. $300\ \%$

D. $400\ \%$

Answer: C

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35. In the integral $\int \frac{dx}{(2ax - x^2)^{1/2}} = an \sin^{-1}\left(\frac{x}{a} - 1\right)$, the value of n should be (by dimensions):

A. 1

B. -1

C. 0

D. $\frac{1}{2}$

Answer: C

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36. If C is the restoring couple per unit radian twist and I is the moment of inertia, then the dimensional representation of $2\pi\sqrt{\frac{I}{c}}$ will be :

A. $\left[M^0L^0T^0\right]$

B. $\left[M^0L^0T^1\right]$

C. $\left[M^0L^1T^{-1}\right]$

D. $\left[M^1L^2T^{-2}\right]$

Answer: B

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37. A vernier calliper has 20 divisions on the vernier scale, which coincide with 19 on the main scale. The least count of the instrument is 0.1mm. The main scale divisions are of :

A. 0.5mm

B. 1mm

C. 2mm

D. $\frac{1}{4}$ mm

Answer: C

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38. The heat generated in a circuit is given by $Q = I^2Rt,$ where I is current, R is resistance and t is time. If the percentage errors in measuring I, R and t are $2\%, 1\%$ and 1% respectively, then the maximum error in measuring heat will be :

A. 2%

B. 3%

C. 4%

D. 6%

Answer: D

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39. The dimensions of the quantities in one of the following pairs are the same. Identify the pair :

A. Torque and energy

B. Angular momentum and work

C. Energy and Young's modulus

D. Light year and angular velocity.

Answer: A

Watch Video Solution

40. Which of the following is the SI unit of poynting vector ?

A. WS^{-1}

B. Wm^{-2}

C. $Wm^{-2}s^{-1}$

D. $Wm^{-3}s^{-1}$

Answer: B

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41. If $x = \frac{\varepsilon_0 lV}{t}$ where ε_0 is permittivity of free space, l is the length, V is the potential difference and t is the time, then dimensions of x are the same as that of :

A. resistance

B. Charge

C. voltage

D. current

Answer: D

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42. The physical quantities not having same dimensions are :

A. speed and $(\mu_0 \in_0)^{-1/2}$

B. torque and work

C. momentum and Planck's constant

D. stress and Young's modulus.

Answer: C

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43. A cube has a side of length $1 \cdot 2 \times 10^{-2}$m.

A. $1.7 \times 10^{-6} m^3$

B. $1.73 \times 10^{-6} m^3$

C. $1.70 \times 10^{-6} m^3$

D. $1.732 \times 10^{-6} m^3$

Answer: A

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44. In the relation $P = \frac{\alpha}{\beta} e^{-\alpha z / k\theta}$

where
$P =$ pressure
$z =$ distance
$k =$ Boltzman's constant
$\theta =$ Temperature

The dimensional formula of β will be :

A. $M^0L^2T^0$

B. ML^2T

C. ML^0T^{-1}

D. $M^0L^2T^{-1}$

Answer: A

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45. A wire has mass $m = 0.3 \pm 0 \cdot 003g$, radius $r = 0 \cdot 5 \pm 0 \cdot 005mm$ and length $l = 6 \pm 0 \cdot 06cm$.

The maximum percentage error in the measurement of its density is :

A. 1

B. 2

C. 3

D. 4

Answer: D

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46. The dimensions of magnetic field in M, LC (Coulomb) are given by :

A. $\left[MLT^{-1}C^{-1}\right]$

B. $\left[MT^{2}C^{-2}\right]$

C. $\left[MT^{-1}C^{-1}\right]$

D. $\left[MT^{-2}C^{-1}\right]$

Answer: C

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47. In an experiment the angle are required to be measured using an instrument 29 divisions of the main scale exactly coinecide 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. 1 minute

B. half minute

C. one degree

D. half degree

Answer: A

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Multiple Choice Questions Level Iii

1. A screw gauge gives the following reading when used to measure the diameter of a wire.

Main scale reading : 0 mm

Circular scale reading : 52 divisions

Given that 1 mm on main scale corresponds to 100 divisions of the circular scale.

The diameter of wire from the above data is :

A. 0.052 cm

B. 0.026 cm

C. 0.005 cm

D. 0.52 cm

Answer: A

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2. A spectrometer gives the following reading when used to measure the angle of a prism.

Main scale reading : 58.5 degree

Vernier scale reading : 09 divisions

Given that 1 division on main scale corresponds to 0.5 degree. Total divisions on the vernier scale is 30 and match with 29 divisions of the main scale. The angle of the prism from the above data :

A. 59 degree

B. 58.59 degree

C. 58.77 degree

D. 58.65 degree.

Answer: D

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3. 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 error in the value of resistance of the wire is :

A. 3%

B. 6%

C. Zero

D. 1%

Answer: B

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4. Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of vacuum. If M=mass,L =length, T=time and A= electric current, then :

A. $[\varepsilon_0] = [M^{-1}L^{-3}T^4A^2]$

B. $[\varepsilon_0] = [M^{-1}L^2T^{-1}A^{-2}]$

C. $[\varepsilon_0] = [M^{-1}L^2T^{-1}A]$

D. $[\varepsilon_0] = [M^{-1}L^{-3}T^2A]$

Answer: A

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5. A student measured the length of a rod wrote it as 3.50 cm. Which instrument did he use to measure it ?

A. A screw gauge having 50 divisions in the circular scale and pitch as 1 mm.

B. A meter scale.

C. A vernier calliper where the 10 divisions in vernier scale matches with 9 division in main scale and main scale has 10 divisions in 1 cm.

D. A screw gauge having 100 divisions in the circular scale and pitch as 1 mm.

Answer: C

Watch Video Solution

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

What is the accuracy in the determination of g

?

A. 3%

B. 1%

C. 5%

D. 2%

Answer: A

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Recent Competitive Questions

1. The dimensions of 'resistance' are same as those of . . . . . Where h is the Planck's constant e is the charge .

A. $\frac{h}{e^2}$

B. $\frac{h}{e}$

C. $\frac{h^2}{e^2}$

D. $\frac{h^2}{e}$

Answer: A

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2. If C be the capacitance and V be the electric potential ,then the dimensional formula of CV^2 is

A. $M^1L^2T^{-2}A^0$

B. $M^1L^2T^{-2}A^{-1}$

C. $M^0L^1T^{-2}A^0$

D. $M^1L^{-3}T^1A^1$.

Answer: A

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3. The dimensional formula of physical quantity is $M^aL^bT^c$. Then that physical quantity is

A. surface tension if $a = 1, b = 1, c = -2$

B. force if $a = 1, b = 1, c = 2$

C. angular frequency if $a = 0, b = 0, c = -1$

D. spring constant if $a = 1, b = -1, c = -2.$

Answer: C

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4. Which one of the following is NOT correct?

A. Dimensional formula of thermal conductivity (K) is $M^1L^1T^{-3}K^{-1}$

B. Dimensional formula of potential (V) is $M^1L^2T^3A^{-1}$

C. Dimensional formula of permeability of free space (μ_0) is $M^1L^1T^{-2}A^{-2}$

D. Dimensional formula of RC is $M^0L^0T^{-1}$.

Answer: D

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5. A physical quantity Q is found to depend on observables x, y and z, obeying relation

$Q = \frac{x^3 y^2}{z}$. The percentage error in the measurements of x, y and z are 1% , 2% and 4% respectively. What is percentage error in the quantity Q ?

A. 4%

B. 3%

C. 11%

D. 1%

Answer: C

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6. The ratio of the dimensions of Planck constant and that of moment of inertia has the dimensions of

A. frequency

B. velocity

C. time

D. angular momentum.

Answer: A

 Watch Video Solution

7. A body accelerates from rest with a uniform acceleration a for time t. The uncertainty in a is 8% and the uncertainty in t is 4%. The uncertainty in speed is :

A. 32%

B. 12%

C. 8%

D. 20%

Answer: B

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