PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

UNITS, DIMENIONS AND MEASUREMENTS

Example

1. Find the dimensional formulae of the following quantities:

(a) the universal gravitational constant G

(b) the coefficient of viscosity η

(c) surface tension

Some formula involving these quantities are

$$F = \frac{Gm_1 m_2}{r_2}, F = 6\pi\eta r v, s = \frac{F}{l}$$

where F: force, m: mass,r: distance, radius, v: speed and l: length.

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2. Find the dimensional formulae of the following quantites:

(a) the specific heat s

(b) the gas constant R

(c) the Boltzmann constant k

(d) the latent heat L

(e) the coefficient of linear expansion alpha

(f) Stefan 's constant sigma

(g) Wien 's constant b

some formulae involving these quantities are

$Q = ms\Delta\theta, PV = nRT, PV = NkT, Q = mL$

$\Delta l = l\alpha\Delta\theta, u = \sigma AT^4, \lambda T = b$

where Q: heat, m: mass, $\Delta\theta$: temperature difference,

P: pressure, V: volume, n: number of moles, T: temperature, N: number of molecules, l: length, u: energy/time, A: area and λ: wavelength.

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3. Find the dimensional formulae of the following quantities:

(a) the charge Q

(b) the permittivity of free space ε_0

(c) the electric field E

(d) the electric potential V

(e) the capacitance C

Q=It, $F = \frac{l}{4\pi\varepsilon^0} \cdot \frac{q_1 q_2}{r^2}, E = \frac{F}{q}, V = \frac{W}{q} = CV$

where I: current, F: force,q: charge, r: distance and W: work.

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4. Find the dimensional formulae of the following quantities:

(a) the resistance R

(b) the inductance L

© the magnetic field B

(d) the permeability of free space μ_0

(e) the magnetic dipole moment M

(f) Planck' s constant h

some formulae containing these qunatities are

$$V = iR, U = \frac{1}{2}Li^2, F = Bil, B = \frac{\mu_0^i}{2r}, M = iA, E = hv$$

where V:electric potential, i: electric current, F: force, l:length r : radius, A area, E: energy, v: frequency and U: energy.

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5. (a) In the formula $X = 3YZ^2$, X and Z have dimensions of capcitnce and magnetic inlduction, respectively. What are the dimensions of Y in $MKSQ$ system?

(b) A qunatity X is given by $\varepsilon_0\ L\ \frac{(\Delta)V}{(\Delta)r}$, where ε_0 is the permittivity of free space, L is a lenght, ΔV is a potential difference and Δt is a time interval. Find the dimensions of X.

(c) If E, M, J and G denote energy , mass , angular momentum and gravitational constant, respectively. find dimensons of $\frac{EJ^2}{M^5G^2}$

(d) If e, h, c and ε_0 are electronic charge, Planck 's constant speed of light and permittivity of free space. Find the dimensions of $\frac{e^2}{2\varepsilon_0 hc}$.

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6. Check whether the following relations are dimensionally correct :

(a) $V = \frac{\pi p r^4}{8\eta l}$ (b) $h = \frac{2s}{\rho r g}$

(c) $T = 2\pi\sqrt{\frac{I}{MB}}$ (d) $v = \frac{E}{B}$

Where V: volume, p: pressure, r: radius, η: coefficient of viscosity, l: length, h: height, s: surface tension, ρ: density, g: acceleration due to gravity, I: moment of inertia, M: magnetic moment, B: magnetic field, v: speed and E: electric field.

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7. (a) Density of water in CGS system is g/cm^3. Convert it into SI unit.

(b) Young's modulus of steel is $2 \times 10^{11} N/m^2$ (SI unit). Convert in into CGS unit (in dyne/cm^2).

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8. (a) The unit of coefficient of viscosity in CGS system is poise $(g/cm.\ s)$ Convert it into SI unit.

(b) The SI unit of work is joule, convert it into CGS unit.

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9. (a) The displacement s of a particale in time t related as $s=\alpha+\beta t+\gamma t^2+\delta t^2$

(b) The veloctiy v of particle varies with time as

$$v=\alpha t+\beta t^2+\frac{\gamma}{t+s}$$

Findk the dimension fo α, β, γ and δ.

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10. (a) the displacement of a particle is given by $s - a\sin(\omega t = kx)$, where t is in second and x is in meter. Find the dimensions of ω and k.

(b) The velocity of a praticle is given by $v = v_0 e^{-\lambda t}$, where t is time. Find the dimensions of v_0 and λ.

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11. In the relation $P = \frac{\alpha}{\beta} e^{\frac{\alpha Z}{k\theta}}$, P is pressure, Z is height, k is Boltzmann constant and θ is the temperature. Find the dimensions of α and β

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12. The equation of a state of a real gas is given by $\left(P+\frac{a}{V^2}\right)(V-b)=RT$, where T is absolute temperature, P is pressure, V is volume and R is universal gas constant. What are the dimensions of constant a and b ?

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13. Find the value of a and b in the following cases :

(a) The velocity v of the ball falling freely under gravity is proportional to $g^a h^b$, where g is the acceleration due to gravity, h is the height from which the ball is dropped.

(b) The kinetic energy K of a rotating body is proportional to $I^a \omega^b$ where I is the moment if inertia and ω is the angular speed.

(c) The time-period T of spring pendulum is proportiona to $m^a k^b$, where m is the mass of block attached to the spring and

k is the spring constant.

The speed of sound v in a gaseous medium is proportional to $P^a \rho^b$, where P is the pressure and ρ is the density of medium.

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14. The viscous force F_v acting on a small ball of radius r moving in medium of coefficient of viscosity η with speed v is proportional to $\eta^a r^b v^c$. Find the values of a, b and c.

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15. A particles of mass m moving in a circle of radius r with unform speed v. The force F acting on a particle is proportional ot $m^a v^b r^c$. Find the values of a, b and c.

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16. The frequency f of vibration of a string between two fixed ends is proportional to $L^a T^b \mu^c$, where L is the length of string, T is tension in the string and `mu is the linear mass density (or mass per unit length) of string. Find the value of a,b and c.

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17. A gas bubble from an explosion under water oscillates with a period T proportional to $P^a d^b E^c$, where P is the pressure, d is density of water and E is the total energy of the explosion. Find the value of a,b and c`.

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18. The time period T of a simple pendulum depends on length L and acceleration due to gravity g Establish a relation using dimensions.

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19. The speed of transverse wave v in a stretched string depend on length tension T in the string and liner mass density (mass per unit length). μ. Find the relation using method of dimensions.

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20. The speed v of a satellite moving in a circular orbit around the earth depends on the gravitational constant G, mass of the earth m_e and radius of circular orbit r. Estabish the relation using dimensions.

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21. The buoyant force F acting on a body depends on the density of medium ρ, volume of body immerese V and acceleration due to gravity g. Establish the relation using method of dimensions.

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22. Using method of dimensions, establish the relation among the given quantities.

(a) The potential difference V across a conductor depends on current i flowing in it and resistance of conductor R.

(b) The speed of light c can be expressed in terms of free space

μ_0.

The energy U stored in an inductor is function of inductance L and current i flowing through it.

(d) The time constant τ to $R - C$ circuit can be expressed in terms of resistance R and capacitance. C.

Dimensional formulae:

$V: ML^2T^{-3}A^{-1}$. $R: ML^2T^{-3}A^{-2}$,

$\in_0 : M^{-1}L^{-3}T^4A^2$, $\mu_0 : MLT^{-2}A^2$,

$L: ML^2T^{-2}A^{-2}$, $C: M^{-1}L^{-2}T^4A^2$

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23. Using method of dimensions, establish relation among given physical quantities :

(a) Heat H produced in a wire depends on current i flowing through it, its resistance R and time t.

(b) The magentic field F_m acting on a moving charged particle in magnetic field depends on charge on particle q, its speed v and magnetic field B

Dimensional formulae : $R: ML^2T^{-3}A^{-2}, B: MT^{-2}A^{-1}$

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24. If momentum, time and energy were chosen as basic quantities, find dimensions of (a) mass and (b) force.

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25. If the gravitational constant G, Plank's constant h and speed of light c be chosen as basic units, find the dimension of mass.

Dimensional formulae: $G: M^{-1}L^3T^{-2}, hML^2T^{-1}$

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26. The temperatures of two bodies measured are $\theta_1 = 10^\circ C \pm 0.4^\circ C$ and $\theta_2 = 10^\circ C \pm 0.3^\circ C$. Find the sum and difference in temperatures with error limits.

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27. The resistance of a conductor $R = V/I$, where $V = (50 \pm 2)V$ and $I = (9 \pm 0.3)A$. Find the percentage error in R.

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28. Two conductors of resistance $R_1(50 \pm 2)$ ohm and $R_2 = (100 \pm 4)$ ohm are connected in (a) series and (b)

parallel. Find the equivalent resistance.

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29. What is the maximum percentage error?

(a) In measurement of kinetic energy if the percentage error in mass and speed are 1% and 2%, respectively.

(b) In measurement of pressure if maximum errors in the measurement of force and length of square plate are 3% and 2%, respectively.

In measurement of time period of simple pendulum if the percentage error in measurement of length and acceleraton due to gravity are respectively 2% and 3%

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30. The time period of a simple pendulum is given by $T = 2\pi\sqrt{L/g}$, where L is length and g acceleration due to gravity. Measured value of length is $10cm$ known to $1mm$ accuracy and time for 50 oscillations of the pendulum is 80 s using a wrist watch of 1 s resloution. What is the accuracy in the determination of g?

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31. A student performs an experiment to determine the Young's modulus of a wire, exactly$2m$ long, by Searle's method. In a partcular reading, the student measures the extension in the length of the wire to be $0.8mmwithanuncerta\int yof$+- 0.05mm $ataloadofexactly$1.0kg

$, thestudentalsomeasuresthediameterofthewire \rightarrow be$

04mm$withanuncerta\int yof$+-0.01mm. $Take$g=9.8m//s^(2)`

(exact). the Young's modulus obtained from the reading is

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32. In Searl's experiment, which is used to find Young's Modulus of elasticity, the diameter of experimental wire is $D = 0.05cm$ (measured by a scale of least count $0.001cm$) and length is $L = 110cm$ (measured by a scale of least count $0.1cm$). A weight of $50N$ causes an extension of $X = 0.125cm$ (measured by a micrometer of least count $0.001cm$). find the maximum possible error in the values of Young's modulus. Screw gauge and meter scale are free error.

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33. If n^{th} division of main scale coincides with $(n+1)^{th}$ divisions of vernier scale. Given one main scale division is equal to 'a' units. Find the least count of the vernier.

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Exercises

1. Which of the following is not a dimensionless physical quatity?

A. Mechanical equivalent of heat (J)

B. Volumetric strain

C. Atomic mass unit (amu)

D. Avogado's number

Answer: C

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2. Out of the following pair, which one NOT have identical dimensions is

A. Moment of inertia and moment of a force

B. Work and torque

C. Angular momentum and Planck's constant

D. Impulse and momentum

Answer: A

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3. The pairs of physical quantities that have the same dimensions is (are):

A. Reynolds number and coefficient of friction

B. Curie and frequency of a light wave

C. Latent heat and gravitational potential

D. Plank's constant and torque

Answer: D

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4. The physical quantities not having the same dimensions are

A. Torque and work

B. Linear momentum and Plank's constant

C. Stress and Young's modulus

D. Speed and $(\mu_0 \varepsilon_0)^{-1/2}$

Answer: A

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5. Which of the following sets have different dimensions ?

A. Young's modulus, pressure, stress

B. Work , heat, energy

C. Electromotive force, potential difference, voltage

D. Electric dipole, electric flux, electric field

Answer: D

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6. Which two of the following five physical parameter have the same dimension

A. (a) and (d)

B. (a) and (e)

C. (b) and (d)

D. (c) and (e)

Answer: A

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7. A physical quantity is measured and the result is expressed as nu where u is the unit used and n is the numberical value. If the result is expressed in various units then

A. $n \propto$ size of u

B. $n \propto u^2$

C. $n \propto \sqrt{u}$

D. $n \propto \frac{1}{u}$

Answer: D

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8. The young's modulus of a material of wire is $12.6 \times 10^{11} \text{dyne} / cm^2$. Its value is MKS system is

A. $12.6 \times 10^{12} N / m^2$

B. $12.6 \times 10^{10} N / m^2$

C. $12.6 \times 10^6 N / m^2$

D. $12.6 \times 10^8 N / m^2$

Answer: B

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9. The dinesity of meterial in CGS system of mass is $4gcm^3$ in a system of unit in which unit of length is $10cm$ and unit of mass is $100g$ the value of density of meterial will be

A. 400

B. 0.04

C. 0.4

D. 40

Answer: D

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10. A dimensionless quantity

A. never has a unit

B. always has a unit

C. may have a unit

D. does not exist

Answer: C

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11. Which of the following sets cannot enter into the list of fundamental quatities in any system of units?

A. length, mass and velocity

B. length, time and velocity

C. mass, time and velocity

D. length, time and mass

Answer: A

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12. Choose the wrong option

A. All quantities may be represented dimensonally in terms of the base quantities.

B. A base cannot be represented dimensionally in terms of the rest of the base quantities.

C. The dimension of a base quantitiy in other base quantities is alwasys zero.

D. The dimension of a derived quantity is never zero in any base quantity.

Answer: D

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13. Choose the wrong option.

A. A dimesnionally correct equaiton may be correct.

B. A dimensionally correct equaiton may be incorrect.

C. A dimensionally incorrect equation may be correct.

D. A dimensions incorrect equaiton may be incorrect.

Answer: C

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14. Suppose a quantilty x can be dimensionally represented in terms of M,L and T, that is $[x], M^a L^b T^c$. The quantity mass

A. can always be dimensionally represented in terms of L, T and x

B. can never be dimensionally represented in terms of L, T and x

C. may be represented in terms of L, T and x if $a = 0$

D. may be represented in terms of L, T and x if $a \neq 0$

Answer: D

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15. The time dependence 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//has

A. is dimesionless

B. has dimesions of T^{-2}

C. has dimensions as that of P

D. has dimensions equal to the dimensions of PT^{-2}

Answer: A

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

A. $L^2\ T\ LT^2$

B. $LT^2\ LT\ L$

C. $LT^2\ T\ L$

D. $L\ LT\ T^2$

Answer: C

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17. A force F is given by $F = at + bt^2$, where t is time . What are the dimensions of a and b?

A. MLT^{-3} and ML^2T^{-4}

B. MLT^{-3} and MLT^{-4}

C. MLT^{-1} and MLT^0

D. MLT^{-4} and MLT^1

Answer: B

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18. The position of a particle at time t is given by the relation $x(t) = \frac{v_0}{A}\left(1 - e^{-At}\right)$, where v_0 is constant and $A > 0$. The dimensions of v_0 and A respectively

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

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

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

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

Answer: D

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19. The function f is given by $f = A\sin\alpha x + B\cos\beta t$, where x is displacement and t is the time. The dimensions of α / β is

A. $[M^0L^0T^0]$

B. $[MLT^{-1}]$

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

D. $[M^0LT^{-1}]$

Answer: C

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20. The frequency of vibration of string is given by $v = \frac{p}{2l}\left[\frac{F}{m}\right]^{1/2}$. Here p is number of segment is the string and l is the length. The dimension formula for m will be

A. $[M^0LT^{-1}]$

B. $[ML^0T^{-1}]$

C. $[ML^{-1}T^0]$

D. $[M^0L^0T^0]$

Answer: C

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21. The number of particles is given by $n = -D\frac{n_2 - n_1}{x_2 - x_1}$ crossing a unit area perpendicular to X - axis in unit time , where n_1 and n_2 are particles per unit volume for the value of x meant to x_2 and x_1 . Find the dimensions of D called diffusion constant.

A. M^0LT

B. ML^2T^{-4}

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

D. M^0LT^{-1}

Answer: C

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22. Turpentine oil is flowing through a tube of length L and radius r. The pressure difference between the two ends of the tube is p , the viscosity of the coil is given by $\eta = \frac{p(r^2 - x^2)}{4vL}$, where v is the velocity of oil at a distance x from the axis of the tube. From this relation, the dimensions of viscosity η are

A. $[M^0L^0T^0]$

B. $[MLT^{-1}]$

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

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

Answer: D

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23. The viscous force F on a sphere of radius a moving in a medium with velocity v is given by $F = 6\pi nav.$ The dimension of η is

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

B. MT^{-1}

C. MLT^{-2}

D. ML^{-3}

Answer: A

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24. In the fromla $X = 1YZ^2$, X and Z have dimensions of capacitance and amgnetic induction, respectively. The dimension of Y in $MKSQ$ system are

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

B. $M^{-1}L^{-3}T^4Q^4$

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

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

Answer: A

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25. If $E, M, J,$ and G , respectively , denote energy , mass , angular momentum , and gravitational constant , then EJ^2 / M^5G^2 has the dimensions of

A. length

B. mass

C. time

D. angle

Answer: D

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26. The frequency f of vibrations of a mass m suspended from a spring of spring constant k is given by $f = Cm^x k^y$, where C is a dimensionnless constant. The values of x and y are, respectively,

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = -\frac{1}{2}, y = -\frac{1}{2}$

C. $x = \frac{1}{2}, y = -\frac{1}{2}$

D. $x = -\frac{1}{2}, y = \frac{1}{2}$

Answer: D

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27. If the orbital velocity of a planet is given by $v = G^a M^b R^c$ then

A. $a = \frac{1}{2}, b = \frac{1}{2}, c = \frac{1}{2}$

B. $a = \frac{1}{2}, b = \frac{1}{2}, c = -\frac{1}{2}$

C. $a = \frac{1}{2}, b = -\frac{1}{2}, c = \frac{1}{2}$

D. $a = \frac{1}{3}, b = -\frac{1}{3}, c = -\frac{1}{3}$

Answer: B

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28. The period T of a soap bubble under SHM is given by $T = P^a D^b S^c$, where P is pressure, D, is density and S is surface tension. Then the values of a, b and c are

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

B. $-1, -2, 3$

C. $\frac{1}{3}, -\frac{3}{2}, -1/2$

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

Answer: A

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29. A gas bubble, from an exlosion under water, oscillates with a period T proportional to p^(a)d^(b)E^(c). $Where$'P' $isthestaticpressure$, 'd'$isthedensityofwater$'E' $isthe \rightarrow tale \neq rgyofthe \exp losion. F \in dthevaluesof$a, b and, c`.

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

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

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

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

Answer: A

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30. The velocity of water wave v may depend on their wavelength λ, the density of water ρ and the acceleration due to gravity g. The method of dimensions gives the relation between these quantities as

A. $v^2 \propto \lambda g \rho$

B. $v^2 \propto \lambda^{-1} g^{-1} \rho^{-1}$

C. $v^2 \propto g\lambda$

D. $v^2 \propto \rho\lambda$

Answer: C

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31. Frequency is the function of density ρ, length λ and tension T. The period of oscillation is proporttional to

A. $\rho^{1/2}\lambda^{2}T^{1/2}$

B. $\rho^{3/2}\lambda^{3/2}T^{-1/2}$

C. $\rho^{1/2}\lambda^{3/2}T^{-3/3}$

D. $\rho^{1/2}\lambda^{1/2}T^{3/2}$

Answer: A

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32. 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 find the expression of T.

A. $T = k\sqrt{\rho r^3 / S}$

B. $T = k\sqrt{\rho^{1/2}\rho^3 / S}$

C. $T = k\sqrt{\rho r^3 / S^{1/2}}$

D. None of these

Answer: A

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33. If "force" F, "length" L and "time T" are taken as fundamental units , the dimensional formula of mass will be

A. $FL^{-1}T^2$

B. $FL^{-1}T^{-1}$

C. $FL^{-1}T^{-1}$

D. FL^2T^2

Answer: A

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34. If pressure P, velocity V and time T are taken as fundamental physical quantities, the dimensional formula of force if

A. $[pv^2T^2]$

B. $[p^{-1}v^2T^{-2}]$

C. $[pvT^2]$

D. $[p^{-1}vT^2]$

Answer: A

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35. 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

Answer: A

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36. The speed of light (c), gravitational constant (G) and plank's constant (h) are taken as fundamental units in a system. The dimensions of time in this new system should be.

A. $G^{1/2}h^{1/2}c^{-5/2}$

B. $g^{1/2}h^{1/2}c^{1/2}$

C. $G^{1/2}h^{1/2}c^{-3/2}$

D. $G^{1/2}h^{1/2}c^{1/2}$

Answer: A

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37. If P represents radiation pressure , C represents the speed of light , and Q represents radiation energy striking a unit area per second , then non - zero integers x, y, z such that $P^xQ^yC^z$ is dimensionless , find the values of $x, y, \text{ and } z$.

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: B

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38. The rate of flow Q (volume of liquid flowing per unit time) through a pipe depends on radius r, length L of pipe, pressure difference p across the ends of pipe and coefficient of viscosity of liquid η as $Q \propto r^a p^b \eta^c L^d$, then

A. $a = 4, b = 1, c = -1, d = -1$

B. $a = 4, b = -1, c = 1, d = -1$

C. $a = 4, b = 1, c = 1, d = -1$

D. values of a,b,c ang d cannot be detemind

Answer: D

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

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

B. $[MLT^{-1}]$

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

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

Answer: C

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40. The dimensions of universal gas constant is

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

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

C. $[ML^3T^{-2}\theta^{-1}]$

D. None of these

Answer: D

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41. The dimensions of coefficient of thermal conductivity is

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

B. $MLT^{-3}K^{-1}$

C. $MLT^{-2}K^{-1}$

D. $MLT^{-3}K$

Answer: B

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42. The dimensions of permittivity ε_0 are

A. $ML^3T^{-4}A^2$

B. $M^{-1}L^{-3}T^4A^2$

C. $ML^3T^{-4}A^2$

D. $ML^{-3}T^{-4}A^2$

Answer: B

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43. The dimension of $\left(\frac{1}{2}\right)\varepsilon_0 E^2$ (ε_0 : permittivity of free space,

E electric field

A. $[MLT^{1}]$

B. $[ML^2T^2]$

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

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

Answer: C

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44. $ML^3T^{-1}Q^{-2}$ is dimension of

A. Resistivity

B. Conductivity

C. Resistance

D. None of these

Answer: A

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45. The dimension of magnetic field in M, L, T and C (coulomb) is given as

A. MT^2C^{-2}

B. $MT^{-1}C^{-1}$

C. $MT^{-2}C^{-1}$

D. $MLT^{-1}C^{-1}$

Answer: B

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46. Dimensional formula of magentic flux is

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

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

C. $M^0L^{-2}A^{-3}$

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

Answer: A

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47. Dimensions of permeability are

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

B. MLT^{-2}

C. $ML^{0}T^{-1}$

D. $A^{-1}MLT^{2}$

Answer: A

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48. Inductance L can be dimensional represented as

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

B. $ML^{2}T^{-4}A^{-3}$

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

D. $ML^{2}T^{4}A^{3}$

Answer: A

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49. Which of the followin combinations have the dimensions of time? L, C, R represent inductance, capacitance and resistance, respectively. Choose the incorrect option.

A. RC

B. $\sqrt{LC}$

C. L/R

D. C/L

Answer: D

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50. The dimensions of mobility are

A. $M^{-1}LAT^{-2}$

B. $MLA^{-1}T^{-2}$

C. $MA^{-1}T^{-2}$

D. $M^{-1}AT^{2}$

Answer: D

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51. The respective number of signficant figures for the numbers $23.023, 0.0003 \text{ and } 2.1 \times 10^{-3}$ are

A. 4, 4, 2

B. 5, 1 , 2

C. 5, 1 , 5

D. 5, 5, 2

Answer: A

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52. The length, breadth and thickness of a strip are given by $l = (10.0 \pm 0.1)cm, h = (1.00 \pm 0.01)cm, t = (0.100 \pm 0.001)cm$. The most probable error in volume will be

A. $0.03cm^3$

B. $0.111cm^3$

C. $0.012cm^3$

D. $0.12cm^3$

Answer: A

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53. The measured mass and volume of a body are $22.42g$ and $4.\ cm^3$, respectively, with possible errors of $0.01g$ and $0.1cm^3$. The maximum error in density is

A. $0.2\ \%$

B. $2\ \%$

C. $5\ \%$

D. $10\ \%$

Answer: B

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54. A wire has a mass $0.3 \pm 0.003g$, radius $0.5 \pm 0.005mm$ and length $6 \pm 0.06cm$. 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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55. An experiment measures quantites a, b, c and X is calculated from the formula

$$X = \frac{ab^2}{c^3}$$

If the percentage errors in a, b, c are $\pm 1\%$, $\pm 3\%$, $\pm 2\%$ respectively, the perentage error in X can be

A. $\pm 13\%$

B. $\pm 7\%$

C. $\pm 4\%$

D. $\pm 1\%$

Answer: A

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56. A student measures that distance traversed in free fall of a body, initially at rest in given time. He uses this data to estimated g, the acceleration due to gravity. If the maximum percentage error in measurement of the distance and the time are e_1 and e_2, respectively, the percentage error in the estimation of g is

A. $e_2 - e_1$

B. $e_1 + 2e_2$

C. $e_1 + e_2$

D. $e_1 - 2e_2$

Answer: B

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57. The heat generated in a circuit is given by $Q = I^2 Rt$, where I is current, R is resistance, and t is time. If the percentage errors in measuring $I, R,$ and $tare2\%, 1\%,$ and 1%, respectively, then the maximum error in measuring heat will be

A. 2%

B. 4%

C. 6%

D. 8%

Answer: C

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58. The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$ where l is about 100 cm and is known to have 1 mm accuracy. The period is about 2 s. The time of 100 oscillation is measrued by a stop watch of least count 0.1 s. The percentage error is g is

A. 0.1%

B. 1%

C. 0.2%

D. 0.8%

Answer: C

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59. A student performs an experiment for determination of $g\left[=\frac{4\pi^2 L}{T^2}\right]$, $L \approx 1m$, and he commits an error of ΔL. For T he takes the time of n oscillations with the stop watch of least count ΔT . For which of the following data , the measurement of g will be most accurate ?

A. $\Delta l 5mm$ $\Delta T 0.2s$ $n 10$

B. $\Delta l 5mm$ $\Delta T 0.2s$ $n 20$

C. $\Delta l 5mm$ $\Delta T 0.1s$ $n 20$

D. $\Delta l 1mm$ $\Delta T 0.1s$ $n 50$

Answer: D

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60. In the determination if Young's modulus $\left(\left(Y = \frac{4MLg}{\pi l d^2}\right.\right.$ by using searle's method, a wire of length $L = 2m$ and diameter $d = 0.5mm$ is used. For a load $M = 2.5kg$, an extension $l = 0.25mm$ in the length of the wire is observed. Quantites D and l are measured using a screw gauge and a micrometer, respectively. they have the same pitch of $0.5mm$. the number of divisions on their circular scale is 100. the contrubution to the maximum probable error of the Y measurement

A. Due to the errors in the mesurement of d and l are the same

B. Due to the error in the measurement of d is twice to that of the error in the measurement of l

C. Due ot the error in the measurement of l is twice to that of the error in the measurement of d

D. Due to the error in the measurement of d is four time to that of the error in the measurement of l

Answer: A

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61. A screw gauge gives the following reading when used to measure the diameter of a wire. Main scale reading $= 0mm$, circular scale reading $= 52$ divisions. Given that $1mm$ on main scale corresponds to 100 divisions of the circular scale. The diameter of the wire from the above data is

A. $0.52cm$

B. $0.052cm$

C. $0.026cm$

D. $0.005cm$

Answer: B

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62. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is $0.5mm$ and there are 50 divisions on the circular scale. The reading on the main scale is $2.5mm$ and that on circular scale is 20 divisions. if the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

A. 0.9%

B. 2.4%

C. 3.1%

D. 4.2%

Answer: C

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63. If force (F) velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are

A. $[FVT^{-2}]$

B. $[FV^{-1}T^{-1}]$

C. $[FVT^{-1}]$

D. $[FV^{-1}T]$

Answer: D

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