Unit and measurements

09 July 2021 19:40

Convert momentum from SI to CGS

$P = mv = kg\,ms^{-1}$

$= 10^3\,g\;10^2\,cms^{-1}$

$= 10^5\,gcms^{-1}$

## Dimensional formula

1) Distance → [L]
2) Time → [T]
3) Mass → [m]
4) Tem → [θ] [K]
5) Current → [I] or [A]
6) Intensity → [I]
7) Amount of substance [n]

Ex:-

Area = $[m^0 L^2 T^0]$

Force = $[m^1 L T^{-2}] \Rightarrow F = ma$

$= kg\,ms^{-2}$

Work = $\vec{F} \cdot \vec{s}$

$= m\vec{a} \cdot \vec{s} = [m^1 L^2 T^{-2}]$

## Significant figures

i) non zero numbs are significant

Ex:- 1 → 1 14444 = 5

12 → 2

101 → 3

ii) zeros between non-zeros are significant

101 = 3 1040102 = 7

iii) perfect numbers have infinite significant figures

14 → ∞

14.0 → 2

0.14 → 3

Significant figures

iv) perfect numbers have infinite significant figures

14 → ∞

14.0 → 2

0.14 → 3

1040102 = 7

iii) sq the no. is 5

2m = T.V

mV

i) 1.98

ii) 2.20

iii) 1.97

iv) 2.1

v) 2

$\frac{\Delta A}{A} = 0.02$

$R_4 = \frac{0.1}{2} = 0.05$

$R_5 = 0$

$R.E = \frac{\overline{E}}{2} = \frac{0.07}{2} = 0.035$

5 $\frac{}{5} = 0.07$

% Error

$\frac{\Delta R}{R} \times 100 = 0.035 \times 100 = 3.5\ \%$

#

$y = \frac{p^a q^b}{R^c}$

$\frac{\Delta y}{y} = a\frac{\Delta p}{p} + b\frac{\Delta q}{q} + c\frac{\Delta R}{R}$

R ∝ P or q

R ∝ P or q → Differentiation

## EXERCISE - 1 : UNIT & DIMENSION, ERROR AND SIGNIFICANT FIGURES

**Unit and Dimension**

1. The unit of momentum is
   (a) N s (b) $Ns^{-1}$
   (c) N m (d) $N m^{-1}$

2. In the relation $y = r \sin(\omega t - kx)$, the dimensions of $\omega/k$ are
   (a) $[M^0L^0T^0]$ (b) $[M^0L^1T^{-1}]$
   (c) $[M^0L^0T^1]$ (d) $[M^0L^1T^0]$

3. If the acceleration due to gravity is 10 $ms^{-2}$ and the units of length and time are changed in kilometre and hour respectively, the numerical value of acceleration is
   (a) 360000 (b) 72000
   (c) 36000 (d) 129600

4. The value of universal gas constant is R = 8.3 J/K – mol. The value of R in atmosphere litre per kelvin mol
   (a) 8.12 (b) 0.00812
   (c) 81.2 (d) 0.0812

5. The expression for centripetal force depends upon mass of body, speed of the body and the radius of circular path

(a) $\sqrt{\frac{hc}{G}}$ (b) $\sqrt{\frac{Gc}{h}}$
(c) $\sqrt{\frac{hG}{c}}$ (d) $\sqrt{hGc}$

8. In the equation $S_{nth} = u + \frac{a}{2}(2n-1)$, the letters have their usual meanings. The dimensional formula of $S_{nth}$ is
   (a) $[M^0T]$ (b) $[ML^{-1}T^{-1}]$
   (c) $[M^0LT^{-1}]$ (d) $[M^0LT^0]$

9. If $L$ denotes the inductance of an inductor through which a current $I$ is flowing, then the dimensional formula of $LI^2$ is
   (a) $[MLT^{-2}]$
   (b) $[ML^2T^{-2}]$
   (c) $[M^2L^2T^{-2}]$
   (d) not expressible in terms of $M, L, T$.

$E = \frac{1}{2}LI^2$

② $\omega t = kx$

$\omega/k = x/t = \frac{m}{s} = [M^0L^1T^{-1}]$

③ $10\ ms^{-2} = 10\ \frac{m}{s^2}$

$1\ km = 1000\ m$

$1\ m = 10^{-3}\ km$

$1\ hr = 3600\ s$

$1\ s = \frac{1}{3600}\ hr$

$P = mv \times \frac{t}{t}$

$= \frac{mv}{t} \times t = ma \times t$

$P = N \cdot s$

(a) 8.12 (b) 0.00812
(c) 81.2 (d) 0.0812

5. The expression for centripetal force depends upon mass of body, speed of the body and the radius of circular path. Find the expression for centripetal force

(a) $F=\frac{mv^2}{2r^3}$ (b) $F=\frac{mv^2}{r}$

(c) $F=\frac{mv^2}{r^2}$ (d) $F=\frac{m^2v^2}{2r}$

(a) $[ML^{-1}]$
(b) $[ML^2T^{-2}]$
(c) $[M^2L^2T^{-2}]$
(d) not expressible in terms of *M. L. T.*

10. If $v=\frac{A}{t}+Bt^2+Ct^3$ where v is velocity, *t* is time and *A*, *B* and *C* are constants, then the dimensional formula of B is

(a) $[M^0LT^0]$ (b) $[ML^0T^0]$
(c) $[M^0L^0T]$ (d) $[M^0LT^{-3}]$

13. If p represents radiation pressure, C represents speed of light and q represents radiation energy striking a unit area pre second, then non–zero integers a, b and c are such that $p^aq^bC^c$ is dimensionless, then

(a) a = 1, b = 1, c = –1 (b) a = 1, b = –1, c = 1
(c) a = –1, b = 1, c = 1 (d) a = 1, b = 1, c = 1

14. In the equation $y=0\sin(\omega t+kx)$, the dimensional formula of ω is

(a) $[M^0LT^{-1}]$ (b) $[M^0LT^{-1}]$
(c) $[M^0L^{-1}T^0]$ (d) $[M^0L^{-1}T^0]$

15. The expression $[ML^{-1}T^{-1}]$ represents

(a) momentum (b) force
(c) pressure (d) coefficient of viscosity

16. The maximum static friction on a body is $F = \mu N$. Here, N = normal reaction force on the body $\mu$ = coefficient of static friction.

The dimensions of $\mu$ are

(a) $[MLT^{-2}]$ (b) $[M^0L^0T^0\theta^{-1}]$
(c) Dimensionless (d) None of these

17. If $F=6\pi\eta r^a v^b$

where F = viscous force

η = coefficient of viscosity

r = radius of spherical body

v = terminal velocity of the body

Find the values of a, b and c.

(a) a = 1, b = 2, c = 1 (b) a = 1, b = 1, c = 1
(c) a = 2, b = 1, c = 1 (d) a = 2, b = 2, c = 2

18. The surface tension is $T=\frac{F}{\ell}$, then the dimensions of surface tension are

(a) $[MLT^{-2}]$ (b) $[MT^{-2}]$
(c) $[M^0L^0T^0]$ (d) None of these

19. If $S=\frac{1}{3}\rho^3 f$ has the dimensions of

(a) $[M^0L^{-3}T^3]$ (b) $[MLT^{-3}]$
(c) $[M^0L^3T^{-3}]$ (d) $[M^0L^{-3}T^{-3}]$

20. If *I* is the moment of inertia and ω the angular velocity, what is the dimensional formula of rotational kinetic energy $\frac{1}{2}I\omega^2$?

(a) $[ML^2T^{-1}]$ (b) $[M^0L^{-1}T^{-2}]$
(c) $[ML^2T^{-2}]$ (d) $[M^0L^{-2}T^{-2}]$

21. A gas bubble from an explosion under water oscillates with a time period T, depends upon static pressure p, density of water ρ and the total energy of explosion E. Find the epression for the time period T. (where, k is a dimensionless constant)

(a) $T=kp^{-5/6}\rho^{1/2}E^{1/3}$ (b) $T=kp^{-4/7}\rho^{1/2}E^{1/3}$
(c) $T=kp^{-5/6}\rho^{1/2}E^{1/2}$ (d) $T=kp^{-4/7}\rho^{1/3}E^{1/2}$

22. The magnetic force on a point moving charge is

$\vec{F}=q(\vec{v}\times\vec{B})$.

Here, q = electric charge

$\vec{v}$ = velocity of the point charge

$\vec{B}$ = magnetic field

Dimension of B is

(a) $[MLT^{-1}A]$ (b) $[MLT^{-2}A^{-1}]$
(c) $[MT^{-2}A^{-1}]$ (d) None of these

23. The velocity v of water waves may depend on their wavelenght (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) $v^2\propto\lambda^{-1}\rho^{-1}$ (b) $v^2\propto g\lambda$
(c) $v^2\propto g\lambda\rho$ (d) $g^{-1}\propto\lambda^3$

24. If E, m, J and G represent energy, mass, angular momentum and gravitational constant respectively, then the dimensional formula of $EJ^2/m^5G^2$ is

(a) $[ML^0T^{-2}]$ (b) $[M^0L^0T]$
(c) $[M^0L^2T^0]$ (d) dimensionless

25. 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

26. The time dependence of a physical quantity P is given by $P=P_0e^{-\alpha t^2}$ where α is a constant and t is time. Then constnat α is

(a) Dimensionless (b) Dimension of $T^{-2}$
(c) Dimensions of P (d) Dimension of $T^2$

27. In the equation $X=3YZ^2$, X and Z have dimensions of capacitance and magnetic induction respectively. In MKSQ system, the dimensional formula of Y is

(a) $[M^{-1}L^{-2}T^{-2}Q^4]$ (b) $[ML^{-2}]$
(c) $[M^{-1}L^{-2}Q^4T^4]$ (d) $[M^{-1}L^{-2}Q^4T^4]$

28. 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) $[M^0LT^0]$ (b) $[M^0L^2T^{-4}]$
(c) $[M^0LT^{-3}]$ (d) $[M^0L^2T^{-1}]$

29. Given $X=(Gh/c^3)^{1/2}$ where G, h and c are gravitational constant, Planck's cosntant and the velocity of light respectively. Dimensions of X are the same as those of

(a) mass (b) time

32. 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 ie, amplitude?

(a) m s$^{-1}$ (b) m s
(c) J m (d) J s$^{-1}$

33. The velocity v (in cms$^{-1}$) of a particle is given in terms of time t (in sec) by the equation.

$v=at+\frac{b}{t+c}$. The dimensions of a, b and c are

| | a | b | c |
|---|---|---|---|
| (a) | $[L^2]$ | [T] | $[LT^2]$ |
| (b) | $[LT^2]$ | [LT] | [L] |
| (c) | $[LT^{-2}]$ | [L] | [T] |
| (d) | [L] | [LT] | $[T^2]$ |

**Error**

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

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

29. Given $X = (Gh/c^3)^{1/2}$ where G, h and c are gravitational constant, Planck's cosntant and the velocity of light respectively. Dimensions of X are the same as those of
(a) mass (b) time
(c) lenght (d) acceleration

30. The dimensional formula of coefficient of permittivity for free space ($\varepsilon_0$) in the equation $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$, where symbols have their usual meanings, is
(a) $[ML^3A^{-2}T^{-4}]$ (b) $[M^{-1}L^{-3}T^4A^2]$
(c) $[M^{-1}L^{-3}A^{-2}T^{-4}]$ (d) $[ML^3A^2T^{-4}]$

## Error

34. If x = a – b, the the maximum percentage error in the measurement of x will be
(a) $\left(\frac{\Delta a+\Delta b}{a-b}\right)\times 100\%$
(b) $\left(\frac{\Delta a}{a}-\frac{\Delta b}{b}\right)\times 100\%$
(c) $\left(\frac{\Delta a}{a-a}+\frac{\Delta b}{a-b}\right)\times 100\%$

36. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the mzximum error in the estimate of kinetic energy obtained by measuring mass and speed?
(a) 11% (b) 8%
(c) 5% (d) 1%

37. Error in the measurement of radius of sphere is 2%. The error in the measurement of volume is
(a) 1% (b) 5%
(c) 3% (d) 6%

38. If there is a positive error of 50% in the measurement of speed of a body, then the error in the measurement of kinetic energy is
(a) 25% (b) 50%
(c) 100% (d) 125%

39. The radius of the sphere is (4.3 ± 0.1)cm. The percentage error in its volume is
(a) $\frac{0.1}{4.3}\times 100$ (b) $3\times\frac{0.1\times 100}{4.3}$
(c) $\frac{1}{3}\times\frac{0.1\times 100}{4.3}$ (d) $\frac{1}{3}+\frac{0.1\times 100}{4.3}$

40. A public park, in the form of a square, has an area of (100±0.2) $m^2$. The side of park is
(a) (10 ± 0.01) m (b) (10 ± 0.1) m
(c) (10.0 ± 0.1) m (d) (10.0 ± 0.2) m

41. The specific resistance ρ of a circular wire of radius r, resistance R and lenght $\ell$ is given by $p = \frac{\pi r^2 R}{\ell}$.
Given, r = (0.24 ± 0.02) cm, R = (30 ± 1) Ω and $\ell$ = (4.80 ± 0.01) cm. The percentage error in p is nearly
(a) 7% (b) 9%
(c) 13% (d) 20%

44. The internal and external diameters of a hollow cylinder are measured with the help of a vernier callipers. Their values are 4.23± 0.01 cm and 3.87±0.01 cm respectively. The thickness of the wall of the cylinder is
(a) 0.36± 0.02cm (b) 0.18± 0.02cm
(c) 0.36± 0.01cm (d) 0.18± 0.01cm

45. In an experiment, we measure quantities a, b and c. Then x is calculated from the formula, $x = \frac{ab^2}{c^3}$. The percentage errors in a, b, c are ± 1%, ± 3%, and ± 2% respectively. The percentage error in x can be
(a) ±1% (b) ±4%
(c) 7% (d) ±13%

46. The pressure on a square plate is measured by measuring the force on the plate and the lenght of the sides of the plate by using the formula $p = \frac{F}{\ell^2}$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then the maximum error in the measurement of pressure is
(a) 1% (b) 2%
(c) 8% (d) 10%

47. Given, potential difference V = (8±0.5) volt and currect I = (2±0.2)A. the value of resistance R is
(a) 4 ± 16.25% (b) 4 ± 6.25%
(c) 4 ± 10% (d) 4 ± 8%

48. The focal length of a mirror is given by $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$ where u and v represent object and image distances respectively. The maximum relative error in f is

49. The lenght $\ell$, breadth b and thickness t of a block are measured with the help of a metre scale. Given l = 15.12 ± 0.01 cm, b = 10.15 ± 0.01 cm, t = 5.28 ± 0.01cm.
The percentage error in volume is
(a) 0.68% (b) 0.28%
(c) 0.37% (d) 0.48%

50. A wire has a mass (0.3 ± 0.003)g, radius (0.5 + 0.005)mm and length (6 ±0.06) cm. The maximum precentage error in the measurement of its density is
(a) 1 (b) 2
(c) 3 (d) 4

51. A student measures the time period of 100 oscillations of a simple pendulum four times. The data set is 90 s, 91s, 95 s and 92 s. If the minimum division in the measuring clock is 1 s, then the reported mean time should be :
(a) 92 ± 5.0 s (b) 92 ± 1.8 s
(c) 92 ± 3 s (d) 92 ± 2 s

## Significant Figures

52. The value of 0.99 – 0.989 is
(a) 0.001 (b) $0.010\times 10^{-1}$
(c) $0.01\times 10^{-1}$ (d) $0.1\times 10^{-3}$

53. If $3.8\times 10^{-6}$ is added to $4.32\times 10^{-5}$ giving due regard to significant figures, then the result will be
(a) $4.58\times 10^{-5}$ (b) $4.7\times 10^{-5}$
(c) $4.5\times 10^{-5}$ (d) None of these

54. A cube has a side of length $1.2\times 10^{-2}$ m. Calculate its volume
(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) $1.732\times 10^{-6}$ $m^3$

19. An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L. In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be:
**(2014 Online Set-1)**
(a) 1.7 % (b) 2.7 %
(c) 4.4 % (d) 2.27 %

20. 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:
**(2014 Online Set-2)**
(a) $\frac{\mu_0\,\epsilon_0}{c^2}\frac{G}{he^2}$ (b) $\frac{2\pi\sqrt{\mu_0\,\epsilon_0}}{ce^2}\frac{h}{G}$
(c) 0.94 ± 0.02 cm (d) 0.94 ± 0.005 cm

25. Time (T), velocity (C) and angular momentum (h) are chosen as fundamental quantities instead of mass, length and time. In terms of these, the dimensions of mass would be :
**(2017 Online Set-1)**
(a) $[M] = [T^{-1}C^{-2}h]$ (b) $[M] = [T^{-1}C^2h]$
(c) $[M] = [T^{-1}C^{-2}h^{-1}]$ (d) $[M] = [T\,C^{-2}h]$

26. 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%, t the relative error in P will be :
**(2017 Online Set-2)**
(a) 8% (b) 12%
(c) 32% (d) 25%

(expressed through their usual symbols) the only combination, that would have the same value in different systems of units, is: **(2014 Online Set-2)**

(a) $\frac{\mu_0 \epsilon_0}{c^2}\frac{G}{he^2}$ (b) $\frac{2\pi\sqrt{\mu_0 \epsilon_0}}{ce^2}\frac{h}{G}$

(c) $\frac{e^2}{2\pi \epsilon_0 G m_e^2}$ ($m_e$ = mass of electron)

(d) $\frac{ch}{2\pi \epsilon_0^2}$

**21.** A vector $\vec{A}$ is rotated by a small angle $\Delta\theta$ radians ($\Delta\theta << 1$) to get a new vector $\vec{B}$. In that case $|\vec{B}-\vec{A}|$ is : **(2015 Online)**

(a) $|\vec{A}|\Delta\theta$ (b) $|\vec{B}|\Delta\theta - |\vec{A}|$

(c) $|\vec{A}|\left(1-\frac{\Delta\theta^2}{2}\right)$ (d) 0

**22.** In the following 'I' refers to current and other symbols have their usual meaning. Choose the option that corresponds to the dimensions of electrical conductivity

respectively, are 2%, 1%, 3% and 5%, t the relative error in P will be : **(2017 Online Set-2)**

(a) 8% (b) 12%

(c) 32% (d) 25%

**27.** In an experiment to determine the period of a simple pendulum of length 1 m, it is attached to different spherical bobs of radii $r_1$ and $r_2$. The two spherical bobs have uniform mass distribution. If the relative difference in the periods, is found to be $5\times10^{-4}$ s, the difference in radii, $|r_1 - r_2|$ is best given by : $(\ell >>> (r_1, r_2))$ **(2017 Online Set-2)**

(a) 1 cm (b) 0.05 cm

(c) 0.1 cm (d) 0.01 cm

**28.** The relative error in the determination of the surface area of a sphere is $\alpha$. Then the relative error in the determination of its volume is : **(2018 Online Set-1)**

(a) $\frac{3}{2}\alpha$ (b) $\frac{2}{3}\alpha$

(c) $\frac{5}{2}\alpha$ (d) $\alpha$

**29.** The percentage errors in quantities P, Q, R and S are 0.5

(c) 0.005 cm (d) 0.52 cm

**10.** 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 30% each, then error in the vlaue of resistance of the wire is : **(2012)**

(a) 6% (b) zero

(c) 1% (d) 3%

**11.** A spectrometer gives the following reading when used to measure the angular of a prism.

Main scale reading 58.5 degree.

Vernier scale reading 9 divsions

Given that, I division on main scale corresponds to 0.5 degree. Total division on the vernier scale is 30 and match with 29 divisions of the main scale. The angular of the prism from the above data is : **(2012)**

(a) 58.59° (b) 59.77°

(c) 58.65° (d) 59°

**12.** Let $[\epsilon_0]$ denotes the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = time and A = electric current, then **(2013)**

(a) $[\epsilon_0] = [M^{-1}L^{-3}T^2A]$ (c) $[\epsilon_0] = [M^{-1}L^{-3}T^4A^2]$

(c) $[\epsilon_0] = [M^{-1}L^2T^{-1}A^{-2}]$ (d) $[\epsilon_0] = [M^{-1}L^2T^{-1}A^2]$

**13.** A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it : **(2014)**

(a) A meter scale

(b) A vernier calliper where the 10 division in vernier scale matches with 9 division in main scale and main scale has 10 division in 1 cm

(c) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm

(d) A screw gauge havin 50 divisions in the circular scale and pitch 1 mm

(c) $92 \pm 3s$ (d) $92 \pm 2s$

**16.** A screw gauge with a pitch of 0.5 mm and a circular scale with 50 divisions is used to measure the thickness of a thin sheet of Aluminium. Before starting the measurement, it is found that when the two jaws of the screw gauge are brought in contact, the 45th division coincides with the main scale line and that the zero of the main scale is barely visible. What is the thickness of the sheet if the main scale reading is 0.5mm and the 25th division coincides with the main scale line? **(2016)**

(a) 0.80 mm (b) 0.70 mm

(c) 0.50 mm (d) 0.75 mm

**17.** The following observations were taken for determining surface tension T of water by capillary method :

diameter of capillary, $D = 1.25\times10^{-2}$ m.

rise of water, $h = 1.45\times10^{-2}$ m.

Using $g = 9.80 m/s^2$ and the simplified relation

$T = \frac{rhg}{2}\times10^3$ N/m, the possible error in surface tension is closest to : **(2017)**

(a) 0.15% (b) 1.5%

(c) 2.4% (d) 10%

**18.** The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% amd 1% the maximum error in determining the density is : **(2018)**

(a) 4.5% (b) 6%

(c) 2.5% (d) 3.5%

(d) $\frac{ch}{2\pi \epsilon_0^2}$

**21.** A vector $\vec{A}$ is rotated by a small angle $\Delta\theta$ radians ($\Delta\theta << 1$) to get a new vector $\vec{B}$. In that case $|\vec{B}-\vec{A}|$ is : **(2015 Online)**

(a) $|\vec{A}|\Delta\theta$ (b) $|\vec{B}|\Delta\theta - |\vec{A}|$

(c) $|\vec{A}|\left(1-\frac{\Delta\theta^2}{2}\right)$ (d) 0

**22.** In the following 'I' refers to current and other symbols have their usual meaning. Choose the option that corresponds to the dimensions of electrical conductivity : **(2016 Online Set-1)**

(a) $ML^{-3}T^3I^2$ (b) $M^{-1}L^3T^3I$

(c) $M^{-1}L^{-3}T^3I^2$ (d) $M^{-1}L^{-3}T^3I$

**23.** A, B, C and D are four different physical quantities having different dimensions. None of them is dimensionless. But we know that the equation $AD = C\ ln\ (BD)$ holds true. Then which of the combination is not a meaningful quantity ? **(2016 Online Set-2)**

(a) $A^2 - B^2C^2$ (b) $\frac{(A-C)}{D}$

(c) $\frac{A}{B} - C$ (d) $\frac{C}{BD} - \frac{AD^2}{C}$

**24.** If the length of rod A is $3.25 \pm 0.01$ cm and that of B is $4.19 \pm 0.01$ cm then the rod B is longer than rod A by : **(2016 Online Set-2)**

(a) $0.94 \pm 0.00$ cm (b) $0.94 \pm 0.01$ cm

best given by : $(\ell >>> (r_1, r_2))$ **(2017 Online Set-2)**

(a) 1 cm (b) 0.05 cm

(c) 0.1 cm (d) 0.01 cm

**28.** The relative error in the determination of the surface area of a sphere is $\alpha$. Then the relative error in the determination of its volume is : **(2018 Online Set-1)**

(a) $\frac{3}{2}\alpha$ (b) $\frac{2}{3}\alpha$

(c) $\frac{5}{2}\alpha$ (d) $\alpha$

**29.** The percentage errors in quantities P, Q, R and S are 0.5 percent, 1 percent, 3 percent and 1.5 percent respectively in the measurement of a physical quantity $A = \frac{P^3Q^2}{\sqrt{R}\,S}$. The maximum percentage error in the value of A will be : **(2018 Online Set-3)**

(a) 6.0 percent (b) 7.5 percent

(c) 8.5 percent (d) 6.5 percent

**30.** Let $\vec{A} = \left(\hat{i} + \hat{j}\right)$ and $\vec{B} = \left(2\hat{i} - \hat{j}\right)$. The magnitude of a coplanar vector $\vec{C}$ such that $\vec{A}.\vec{C} = \vec{B}.\vec{C} = \vec{A}.\vec{B}$, is given by: **(2018 Online Set-3)**

(a) $\sqrt{\frac{10}{9}}$ (b) $\sqrt{\frac{5}{9}}$

(c) $\sqrt{\frac{20}{9}}$ (d) $\sqrt{\frac{9}{12}}$

29) a

30) b

## EXERCISE - 1 : UNIT & DIMENSION, ERROR AND SIGNIFICANT FIGURES

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1.** (a) | **2.** (b) | **3.** (d) | **4.** (d) | **5.** (b) | **6.** (a) | **7.** (a) | **8.** (c) | **9.** (b) |
| **10.** (d) | **11.** (c) | **12.** (a) | **13.** (b) | **14.** (a) | **15.** (d) | **16.** (c) | **17.** (b) | **18.** (b) |
| **19.** (c) | **20.** (c) | **21.** (a) | **22.** (c) | **23.** (b) | **24.** (d) | **25.** (d) | **26.** (b) | **27.** (d) |
| **28.** (d) | **29.** (c) | **30.** (b) | **31.** (a) | **32.** (c) | **33.** (c) | **34.** (a) | **35.** (d) | **36.** (b) |
| **37.** (d) | **38.** (c) | **39.** (b) | **40.** (a) | **41.** (d) | **42.** (a) | **43.** (b) | **44.** (b) | **45.** (d) |
| **46.** (c) | **47.** (a) | **48.** (d) | **49.** (c) | **50.** (d) | **51.** (d) | **52.** (c) | **53.** (b) | **54.** (a) |
| **55.** (d) | **56.** (d) | **57.** (d) | **58.** (b) | **59.** (a) | **60.** (b) | **61.** (c) | **62.** (a) | **63.** (a) |
| **64.** (d) | **65.** (b) | **66.** (c) | **67.** (b) | **68.** (b) | **69.** (b) | **70.** (c) | **71.** (d) | **72.** (c) |
| **73.** (c) | **74.** (c) | **75.** (c) | **76.** (b) | **77.** (b) | **78.** (c) | **79.** (b) | **80.** (c) | **81.** (c) |
| **82.** (d) | **83.** (b) | **84.** (b) | **85.** (b) | **86.** (a) | **87.** (a) | **88.** (a) | **89.** (a) | **90.** (b) |
| **91.** (b) | **92.** (d) | **93.** (d) | **94.** (d) | **95.** (a) | **96.** (c) | **97.** (d) | **98.** (a) | **99.** (c) |
| **100.** (d) | **101.** (b) | **102.** (b) | **103.** (b) | **104.** (c) | **105.** (c) | **106.** (d) | **107.** (c) | **108.** (c) |
| **109.** (c) | **110.** (a) | **111.** (b) | **112.** (a) | **113.** (b) | **114.** (b) | **115.** (d) | **116.** (b) | **117.** (c) |
| **118.** (d) | **119.** (c) | **120.** (d) | **121.** (a) | **122.** (c) | **123.** (a) | **124.** (a) | **125.** (c) | **126.** (d) |
| **127.** (a) | **128.** (a) | **129.** (d) | **130.** (b) | **131.** (c) | **132.** (c) | **133.** (c) | **134.** (c) | **135.** (c) |
| **136.** (c) | **137.** (d) | **138.** (a) | **139.** (d) | **140.** (a) | **141.** (a) | **142.** (d) | **143.** (c) | **144.** (a) |
| **145.** (d) | **146.** (a) | **147.** (b) | **148.** (a, d) | **149.** (a, c) | **150.** (b, c) | | | |

## EXERCISE - 2 : PREVIOUS YEAR JEE MAINS QUESTIONS

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