KATTAR NEET 2026

Physics By Manish Raj Sir

Units and Measurements

Q1 The most precise reading of the mass of an object, among the following is;
(A) 20 g
(B) 20.0 g
(C) 20.01 g
(D) 20 $\times 10^0$ g

Q2 The most accurate reading of the length of a 6.28 cm long fibre is;
(A) 6 cm (B) 6.5 cm
(C) 5.99 cm (D) 6.0 cm

Q3 A far off planet is estimated to be at a distance D from the earth. If its diametrically opposite extremes subtend an angle θ (in radian) at an observatory situated on the earth, the approximate diameter of the planet is:
(A) $\frac{\theta}{D}$ (B) $\frac{D}{\theta}$
(C) $D\theta$ (D) $\frac{1}{D\theta}$

Q4 The equation $\frac{dv}{dt} = At - Bv$ is describing the rate of change of velocity of a body falling from rest in a resistive medium. The dimensions of A and B are:
(A) $[LT^{-3}]$, $[T]$ (B) $[LT^{-3}]$, $[T^{-1}]$
(C) $[LT]$, $[T]$ (D) $[LT]$, $[T^{-1}]$

Q5 The number of significant figures in a pure number 410 is
(A) Two (B) Three
(C) One (D) Infinite

Q6 A packet contains silver powder of mass 20.23 g ± 0.01 g. Some of the powder of mass 5.75 g ± 0.01 g is taken out from it. The mass of the powder left back is;
(A) 14.48 g ± 0.00 g
(B) 14.48 ± 0.02 g
(C) 14.5 g ± 0.1 g
(D) 14.5 g ± 0.2 g

Q7 The length of a cylinder is measured with a metre rod having least count 0.1 cm. Its diameter is measured with vernier callipers having least count 0.01 cm. Given that length is 5.0 cm and radius is 2.0 cm. The percentage error in the calculated value of the volume will be
(A) l% (B) 3%
(C) 2% (D) 4%

Q8 The number of significant figures in the measured value 4.700 m is the same as that in the value:
(A) 4700 m (B) 0.047 m
(C) 4070 m (D) 470.0 m

Q9 If the buoyant force F acting on an object depends on its volume V immersed in a liquid, the density ρ of the liquid and the acceleration due to gravity g. The correct expression for F can be
(A) $V\rho g$
(B) $\frac{\rho g}{V}$
(C) $\rho g V^2$
(D) $\sqrt{\rho g V}$

Q10 The dimensionally correct expression for the resistance R among the following is;
[P = electric power, I = electric current, t = time, V = voltage and E = electric energy]
(A) $R = \sqrt{PI}$ (B) $R = \frac{E}{I^2 t}$
(C) $R = V^2 P$ (D) $R = VI$

Q11 The circular scale of screw gauge has 100 equal divisions. When it is given 4 complete rotations, it moves through 2mm. The L.C. of screw gauge is
(A) 0.005 cm (B) 0.0005 cm
(C) 0.001 cm (D) 0.0001 cm

Q12 The amount of heat energy Q, used to heat up a substance depends on its mass m, its specific heat capacity (s) and the change in temperature ΔT of the substance. Using dimensional method, find the expression for s is (Given that [s] = [$L^2T^{-2}K^{-1}$]) is;

(A) $Q m \Delta T$ (B) $\frac{Q}{m \Delta T}$

(C) $\frac{Q m}{\Delta T}$ (D) $\frac{m}{Q \Delta T}$

Q13 If dimension of critical velocity of liquid flowing through a tube are expressed as $v_c \propto [\eta^x \rho^y r^z]$ where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by:

(A) $1, 1, 1$ (B) $1, -1, -1$

(C) $-1, -1, 1$ (D) $-1, -1, -1$

Q14 The ratio of the dimensions of Planck's constant and that of moment of inertia is the dimension of

(A) Time

(B) Frequency

(C) Angular momentum

(D) Velocity

Q15 If the dimensions of a physical quantity are given by $M^aL^bT^c$, then the physical quantity will be;

(A) Force if a = 0, b = -1, c = -2

(B) Pressure if a = 1, b = -1, c = -2

(C) Velocity if a = 1, b = 0, c = -1

(D) Acceleration if a = 1, b = 1, c = -2

Q16 If y represents pressure and x represents velocity gradient, then the dimensions of $\frac{d^2y}{dx^2}$ are

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

(B) $[M^2L^{-2}T^{-2}]$

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

(D) $[M^2L^{-2}T^{-4}]$

Q17 In a new system of units, energy (E), density (d) and power (P) are taken as fundamental units, then the dimensional formula of universal gravitational constant G will be

(A) $[E^{-1}d^{-2}P^2]$ (B) $[E^{-2}d^{-1}P^2]$

(C) $[E^2d^{-1}P^{-1}]$ (D) $[E^1d^{-2}P^{-2}]$

Q18 In equation $y = x^2 \cos^2 2\pi \frac{\beta\gamma}{\alpha}$, the units of x, α, β are m, s^{-1} and $(ms^{-1})^{-1}$ respectively. The units of y and γ are

(A) m^2, ms^{-2} (B) m, ms^{-1}

(C) m^2, m (D) m, ms^{-2}

Q19 On the basis of detail given about two measuring instruments, select the correct statement.

(i) Vernier callipers having main scale division = 0.05 cm and Vernier scale division = $\frac{2.45}{0.49}$ cm

(ii) Screw gauge having pitch 0.5 mm and its circular scale division measures 0.01 mm.

(A) Both the instruments have same least count.

(B) Least count of screw gauge is lesser than that of vernier callipers.

(C) Screw gauge is more precise.

(D) Screw gauge is less precise.

Q20 Write the dimensions of b and a in the relation, $\mathrm{P} = \frac{\mathrm{b}-\mathrm{x}^2}{\mathrm{at}}$, where P is power, x is distance and t is time.

(A) $[M^0L^2T^0]$, $[M^{-1}L^0T^2]$

(B) $[M^1L^2T^0]$, $[M^1L^0T^2]$

(C) $[M^2L^2T^0]$, $[M^1L^0T^2]$

(D) $[M^0L^2T^2]$, $[M^0L^1T^2]$

Q21 The Sun's angular diameter is measured to be $1920''$. The distance D of the Sun from the Earth is 1.496×10^{11} m. What is the diameter of the Sun?

(A) 1.39×10^9 m

(B) 1.5×10^9 m

(C) 1.9×10^9 m

(D) 3.6×10^9 m

Q22 Match the following lists for correct dimensions in list-II of physical quantities given in list-I.

	LIST I		LIST II
(a)	Boltzmann constant	(p)	$[ML^2T^{-1}]$
(b)	Coefficient of viscosity	(q)	$[MT^{-1}T^{-1}]$
(c)	Planck Constant	(r)	$[MLT^{-3}K^{-1}]$

(d)	Thermal conductivity	(s)	$[ML^2T^{-2}K^{-1}]$

(A) **(a) $\rightarrow$ p, (b) $\rightarrow$ q, (c) $\rightarrow$ r, (d) $\rightarrow$ s**
(B) **(a) $\rightarrow$ r, (b) $\rightarrow$ s, (c) $\rightarrow$ q, (d) $\rightarrow$ p**
(C) **(a) $\rightarrow$ q, (b) $\rightarrow$p, (c) $\rightarrow$r, (d) $\rightarrow$s**
(D) **(a) $\rightarrow$ s, (b) $\rightarrow$ q, (c) $\rightarrow$ p, (d) $\rightarrow$ r**

Q23 A screw gauge has a least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is;
(A) 0.01 mm (B) 0.25 mm
(C) 0.5 mm (D) 1.0 mm

Q24 In an experiment, the percentage of error occurring in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2 B^{(1/2)}}{C^{(1/3)} D^3}$, will be
(A) 10% (B) (3/13)%
(C) 16% (D) -10%

Q25 The main scale of a vernier calliper has *n* divisions/cm. *n* divisions of the vernier scale coincide with (*n*-1) divisions of main scale. The least count of the vernier callipers is;
(A) $\frac{1}{(n+1)(n-1)} cm$
(B) $\frac{1}{n} cm$
(C) $\frac{1}{n^2} cm$
(D) $\frac{1}{n(n+1)} cm$

Q26 A student measures the distance traversed in free fall of a body, initially at rest, in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors 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) $e_1 - 2e_2$

Q27 The position of particle at time t is given by the relation $x(t) = \left(\frac{v_0}{\alpha}\right)\left(1 - e^{-\alpha t}\right)$ where v_0 is a constant and $\alpha > 0$. The dimensions of v_0 and α are respectively:
(A) $M^0 L^1 T^{-1}$ and T^{-1}
(B) $M^0 L^1 T^0$ and T^{-1}
(C) $M^0 L^1 T^{-1}$ and LT^{-2}
(D) $M^0 L^1 T^{-1}$ and T

Q28 The dimensions of RC is
(A) square of time
(B) square of inverse time
(C) time
(D) inverse of time

Q29 Of the following quantities, which one has dimensions different from the remaining three?
(A) Energy per unit volume
(B) Force per unit area
(C) Product of voltage and charge per unit volume
(D) Angular momentum

Q30 If $a = (8 \pm 0.08)$ and $b = (6 \pm 0.06)$, let $x = a + b, y = a - b, z = ab$. The correct order of $\%$ error in x, y and z is
(A) $x = y < z$ (B) $x = y > z$
(C) $x < z < y$ (D) $x > z < y$

Q31 If in a new system of units, the unit of length is 10 m, mass is 10 kg and time is 1 minute then what is the unit of linear momentum in this new system?
(A) $\frac{5}{3}$kg-m/s (B) $\frac{3}{5}$kg-m/s
(C) $\frac{4}{3}$kg-m/s (D) $\frac{3}{4}$kg-m/s

Q32 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 the vibrating string. Then, the dimensional formula for *m* is:
(A) $\left[M^0 L^1 T^1\right]$
(B) $\left[M^0 L^0 T^0\right]$
(C) $\left[M^1 L^{-1} T^0\right]$
(D) $\left[M^1 L^0 T^0\right]$

Q33 An experiment measures quantities *a*, *b* and *c*, and *X* is calculated from $X = \frac{ab^2}{c^3}$. If the percentage error in a, b and c are ±1%, ±3% and ±2% respectively, the percentage error in X will be:

(A) ±13% (B) ±7%
(C) ±4% (D) ±1%

Q34 In an experiment, the values of two resistances were measured as $R_1 = (5.0 \pm 0.2)\ \Omega$ and $R_2 = (10.0 \pm 0.1)\ \Omega$, their equivalent resistance in parallel is:

(A) (4.4 ± 6%)
(B) (3.3 ± 7%)
(C) (5.5 ± 5%)
(D) (3.3 ± 3%)

Q35 A man grows into a giant such that his linear dimensions increase by a factor of 9. Assuming that his density remains the same, the stress in the leg will change by a factor of: $\left(\text{stress} = \frac{\text{force}}{\text{area}}\right)$

(A) 81 (B) $\frac{1}{81}$
(C) 9 (D) $\frac{1}{9}$

Q36 In the measured value 0.0021020, the number of zeroes that are significant is/are:

(A) 4 (B) 5
(C) 2 (D) 1

Q37 Which of the following measurements has three significant digits?

(a) 0.021
(b) 1.02
(c) 0.21
(d) 1.021

(A) (b) and (c) only
(B) (b) only
(C) (c) and (d) only
(D) (a), (b), (c) and (d)

Q38 What is the dimensional formula for power which is ratio of energy with time?

(A) $[ML^2T^{-3}]$ (B) $[ML^2T^{-2}]$
(C) $[MLT^{-2}]$ (D) $[ML^2T^{-1}]$

Q39 If the speed of a body (v) is given by $v = v_0\ e^{-at}$ where t is time, then the dimensional formula of $[av_0]$ will be:

(A) $[L^{-1}T^2]$ (B) $[LT^{-1}]$
(C) $[L]$ (D) $[LT^{-2}]$

Q40 The internal and external radii of a hollow cylinder are measured with the help of a vernier calliper. Their values are (3.87 ± 0.01) cm and (4.23 ± 0.01) cm, respectively. The thickness of the wall of the cylinder is :

(A) (0.36 ± 0.02) cm
(B) (0.18 ± 0.02) cm
(C) (0.36 ± 0.01) cm
(D) (0.18 ± 0.01) cm

Q41 A body travels a distance of (12.0 ± 0.2) m in a time (4.0 ± 0.1) s with constant speed. Its speed with error limits is:

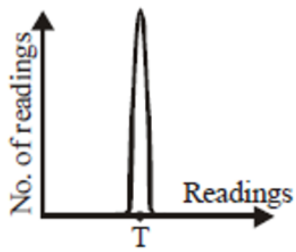
(A) (3.0 ± 0.3) m/s
(B) (3.0 ± 0.6) m/s
(C) (4.0 ± 0.2) m/s
(D) (3.0 ± 0.1) m/s

Q42 The angle of 1' (minute of arc) in radian is nearly equal to:

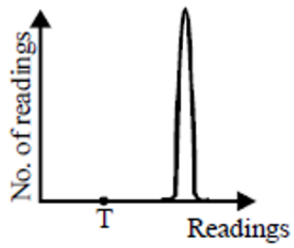
(A) 2.91×10^{-4} rad
(B) 4.85×10^{-4} rad
(C) 4.80×10^{-6} rad
(D) 1.75×10^{-2} rad

Q43 A quantity is measured repeatedly many times with an instrument. The readings are shown in figure where T represent true value of the measurement. Which of the following measurement is imprecise but accurate?

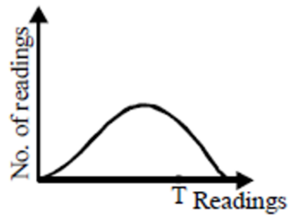
(A)



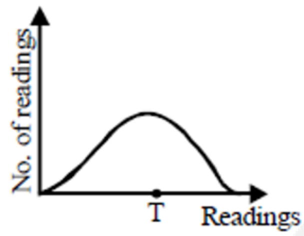
(B)



(C)



(D)



Q44 Consider following statements :
I. Any physical quantity may have more than one unit.
II. Any physical quantity has only one dimensional formula.
III. More than one physical quantity may have same dimension & same unit.
IV. We can add & subtract only those quantities which are having same dimensions.
How many of the given statements are **correct**?
(A) 4 (B) 3
(C) 2 (D) 1

Q45 If the acceleration due to gravity is $10ms^{-2}$ and the units of length and time are changed to kilometer and hour respectively, the numerical value of the acceleration is:
(A) 360000 (B) 72,000
(C) 36,000 (D) 129600

Q46 **Assertion A:** The number 4.365 when rounded off to three significant figures will become 4.36.
Reason R: In rounding off if the insignificant digit is 5 and its preceding digit is even then the insignificant digit is simply dropped.
(A) A is true but R is false.
(B) A is false but R is true.
(C) Both A and R are true and R is the correct explanation of A.
(D) Both A and R are true but R is NOT the correct explanation of A.

Q47 Displacement (x) of a particle is given as $x = \frac{A}{B}\left(1 - e^{-Bt}\right)$ where, B is a positive constant. The dimensions of A and B are, respectively
(A) $[M^0LT^0]$ and $[T]$
(B) $[M^0LT^{-1}]$ and $[LT^{-2}]$
(C) $[M^0LT^{-2}]$ and $[T]$
(D) $[M^0LT^{-1}]$ and $[T^{-1}]$

Q48 What will be the value of 15.7500 after rounding off to three significant digits?
(A) 15.8 (B) 15.7
(C) 15.6 (D) 15.0

Q49 A gas bubble from an explosion under water oscillates with a period T proportional to $p^a d^b E^c$ where p is static pressure, d is density of water, E is the total energy of the explosion. The values of a, b and c respectively are:
(A) $\frac{5}{6}, \frac{-1}{2}, \frac{-1}{3}$ (B) $\frac{-5}{6}, \frac{1}{2}, \frac{1}{3}$
(C) $\frac{5}{6}, \frac{1}{2}, \frac{1}{3}$ (D) $\frac{1}{2}, \frac{5}{6}, \frac{-1}{3}$

Q50 Length and diameter of a uniform cylinder are measured as (10 + 0.1) cm and (4 + 0.2) mm respectively. Then
I. absolute error in volume is nearly $0.14\ cm^3$
II. relative error in volume is 0.11
III. percentage error in lateral surface area of the cylinder is 8%
IV. relative error in measurement of diameter is twice of that in radius
(A) I, IV are correct
(B) I, II are incorrect
(C) I, II, IV are correct
(D) I,II are correct

Q51 If force (F), velocity (V) and time (T) are taken as fundamental quantities, then the dimensional formula of mass will be:

(A) $[FVT^{-2}]$
(B) $[FVT^{-1}]$
(C) $[FV^{-1}T^{-1}]$
(D) $[FV^{-1}T]$

Q52 A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it?
(A) A meter scale
(B) A vernier caliper where the 10 divisions in vernier scale matches with 9 divisions in main scale and main scale has 10 divisions in 1 cm
(C) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm.
(D) A screw gauge having 50 divisions in the circular scale and pitch as 1 mm.

Q53 The least count of the main scale of a screw gauge is 1 mm. The minimum number of divisions on its circular scale required to measure 5 μm diameter of a wire is:
(A) 50 (B) 200
(C) 500 (D) 100

Q54 Which of the following option is **correct**?
(A) A dimensionally incorrect equation may be correct.
(B) A dimensionally correct equation is always correct.
(C) A dimensionally incorrect equation is always incorrect.
(D) None of these

Q55 The initial temperature of a liquid is (80.0 ± 0.1) °C. After it has been cooled, its temperature is (10.0 ± 0.1)°C. The fall in temperature in degree centigrade is:
(A) 70.0
(B) 70.0 ± 0.3
(C) 70.0 ± 0.2
(D) 70.0 ± 0.1

Q56 Using screw gauge of pitch 0.1 cm and 50 divisions on its circular scale, the thickness of an object is measured. It should correctly be recorded as:
(A) 2.121 cm (B) 2.124 cm
(C) 2.125 cm (D) 2.123 cm

Q57 If A and B are two physical quantities having different dimensions then which of the following option may never denote a physical quantity?
(A) $A+\frac{A^3}{B}$ (B) $\log\left(-\frac{A}{B}\right)$
(C) AB^2 (D) $\frac{A}{B^4}$

Q58 A scientist performs an experiment in order to measure a certain physical quantity and takes 100 observations. He repeats the same experiment and takes 400 observations, by doing so the random error:
(A) remains same
(B) is doubled
(C) becomes 4 times
(D) is reduced to one fourth

Q59 The resistance is $R=\frac{V}{I}$, where $V=(100\pm5)$ Volt and $i=10\pm0.2$ ampere. What is the total percentage error in R?
(A) 5% (B) 7%
(C) 5.2% (D) $\left(\frac{5}{2}\right)\%$

Q60 When a wave transverses in a medium, the displacement of a particle located at distance x at time t is given by $y = a\sin(bt - cx)$ where a, b and c are constants of the wave. The dimension of b/c are same as that of:
(A) Wave velocity (B) Wavelength
(C) Wave number (D) Wave frequency

Answer Key

Q1	(C)	Q31	(A)
Q2	(B)	Q32	(C)
Q3	(C)	Q33	(A)
Q4	(B)	Q34	(D)
Q5	(D)	Q35	(C)
Q6	(B)	Q36	(C)
Q7	(B)	Q37	(B)
Q8	(D)	Q38	(A)
Q9	(A)	Q39	(D)
Q10	(B)	Q40	(A)
Q11	(B)	Q41	(D)
Q12	(B)	Q42	(A)
Q13	(B)	Q43	(D)
Q14	(B)	Q44	(A)
Q15	(B)	Q45	(D)
Q16	(C)	Q46	(C)
Q17	(B)	Q47	(D)
Q18	(A)	Q48	(A)
Q19	(A)	Q49	(B)
Q20	(A)	Q50	(D)
Q21	(A)	Q51	(D)
Q22	(D)	Q52	(B)
Q23	(C)	Q53	(B)
Q24	(C)	Q54	(C)
Q25	(C)	Q55	(C)
Q26	(B)	Q56	(B)
Q27	(A)	Q57	(B)
Q28	(C)	Q58	(D)
Q29	(D)	Q59	(B)
Q30	(C)	Q60	(A)

Hints & Solutions

Q1 Text Solution:

(C)

A measurement having more number of decimal places is the one with the most precision.

So, 20.01 g is most precise.

Q2 Text Solution:

(B)

Most accurate reading is the one having minimum error.

So, 6 - 6.28 = 0.28 cm

6.5 - 6.28 = 0.22 cm

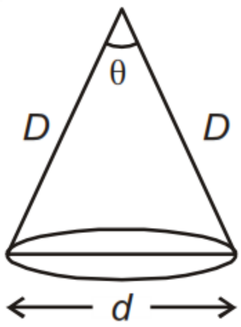
5.99 - 6.28 = 0.29 cm

6.0 - 6.28 = 0.28 cm

So, second reading is most accurate.

Q3 Text Solution:

(C)



$$\theta = \frac{Arc\ length}{Radius}$$

$$\theta = \frac{d}{D}$$

$$\Rightarrow d = D\theta$$

Q4 Text Solution:

$$\frac{dv}{dt} = At - Bv$$

$$\left[\frac{dv}{dt}\right] = [At] = [Bv]$$

$$\left[L^1T^{-2}\right] = [At];$$

$$\left[L^1T^{-2}\right] = [B]\quad\left[L^1T^{-1}\right]$$

$$[A] = \left[L^1T^{-3}\right] \text{ and } [B] = \left[T^{-1}\right]$$

Q5 Text Solution:

(D)

A pure number has infinite number of significant figures.

Q6 Text Solution:

(B)

m_1 = 20.23 g ± 0.01 g

m_2 = (5.75 ± 0.01) g

m_1 - m_2 = [(20.23 - 5.75) ± 0.02] g

Δm = (14.48 ± 0.02) g

Q7 Text Solution:

(B)

Volume of cylinder $V = \pi r^2 l$

Percentage error in volume

$$\frac{\Delta V}{V} \times 100 = \frac{2\Delta r}{r} \times 100 + \frac{\Delta l}{l} \times 100$$

$$= \left(2 \times \frac{0.01}{2.0} \times 100 + \frac{0.1}{5.0} \times 100\right)$$

$$= (1+2)\% = 3\%$$

Q8 Text Solution:

(D)

4.700 $\Rightarrow$ Four significant figures.

Also, 470.0 m $\Rightarrow$ four significant figures.

Q9 Text Solution:

(A)

$$\mathrm{F} \propto \mathrm{V^a}\rho^{\mathrm{b}}\mathrm{g^c}$$

$$\mathrm{F} = \left[\mathrm{L^3}\right]^{\mathrm{a}}\left[\mathrm{ML^{-3}}\right]^{\mathrm{b}}\left[\mathrm{LT^{-2}}\right]^{\mathrm{c}}$$

$$\left[\mathrm{MLT^{-2}}\right] = \mathrm{F} = \left[\mathrm{M^bL^{3a-3b+c}T^{-2c}}\right]$$

On compairing,

$$b = 1,\quad -2c = -2$$

$$\Rightarrow c = 1$$

$$3a - 3b + c = 1$$

$$\Rightarrow 3a - 3 + 1 = 1$$

$$\Rightarrow 3a - 2 = 1$$

$$\Rightarrow 3a = 3 \Rightarrow a = 1$$

So, on putting all these values,

$$F = V\rho g$$

Q10 Text Solution:

(B)

Dimensional formula of power =

$$\frac{W}{t} = \frac{ML^2T^{-2}}{T} = \left[ML^2T^{-3}\right]$$

Current $\rightarrow$[A]

$$V = \frac{W}{q} = \frac{ML^2T^{-2}}{AT} = \left[ML^2T^{-3}A^{-1}\right]$$

$$E = \left[ML^2T^{-2}\right]$$

So,

$$R = \frac{E}{I^2 t} = \frac{ML^2T^{-2}}{A^2T} \Rightarrow [ML^2T^{-3}A^{-2}]$$

$$\text{and } V = IR \Rightarrow R = \frac{ML^2T^{-3}A^{-1}}{A}$$

$$= [ML^2T^{-3}A^{-2}]$$

So, (B) is the correct formula.

Q11 Text Solution:

(B)

$$Pitch = \frac{dis\tan ce\ moved\ on\ circular\ scale}{No.\ of\ rotations} =$$

$$\frac{2}{4}mm$$

$$= \frac{1}{2}mm = \frac{1}{20}cm$$

$$L.C. = \frac{Pitch}{100} = \frac{1}{2000}cm = 0.0005cm$$

Q12 Text Solution:

(B)

$$Q = m^a s^b \theta^c$$

$$[ML^2T^{-2}] = [M^a][L^{2b}T^{-2b}K^{-b}][K^c]$$

$$\Rightarrow a = 1, \quad 2b = 2 \Rightarrow b = 1$$

$$-b + c = 0$$

$$\Rightarrow b = c \Rightarrow c = 1$$

$$Q = ms\Delta T$$

$$\Rightarrow s = \frac{Q}{m\Delta T}$$

Q13 Text Solution:

(B)

The critical velocity of the liquid flowing through a tube is expressed as

$V_c \propto \eta^x \rho^y r^z$

$Coefficient\ of\ vis\cos ity\ of\ liquid,$

$\eta = [ML^{-1}T^{-1}]$

The density of the liquid,$\rho = [ML^{-3}]$

Radius of tube $r = [L]$

Critical velocity of the liquid $v_c = [M^0L^1T^{-1}]$

$\Rightarrow [M^0L^1T^{-1}]$

$= [ML^{-1}T^{-1}]^x [ML^{-3}]^y [L]^z$

$[M^0L^1T^{-1}] = [M^{x+y}L^{-x-3y+z}T^{-x}]$

Comparing exponents of M,L and L, we get

$x + y = 0, -x - 3y + z = 1, -x = -1$

$\Rightarrow z = -1, x = 1, y = -1$

Q14 Text Solution:

(B)

$$\frac{h}{I} = \frac{ML^2T^{-1}}{ML^2} \Rightarrow [T^{-1}] \rightarrow Frequency$$

Q15 Text Solution:

(B)

For pressure, $[ML^{-1}T^{-2}]$

a = 1, b = -1, c = -2

Q16 Text Solution:

(C)

$\frac{d^2y}{dx^2}$ will have dimension of $\frac{y}{x^2}$

y → pressure, x → velocity gradient

$$x \rightarrow \frac{V}{L} \Rightarrow \frac{LT^{-1}}{L} \Rightarrow T^{-1}$$

$$\frac{y}{x^2} = \frac{ML^{-1}T^{-2}}{T^{-2}} \Rightarrow [ML^{-1}]$$

Q17 Text Solution:

(B)

$G = [E^a d^b P^c]$

$[M^{-1}L^3T^{-2}] = [ML^2T^{-2}]^a [ML^{-3}]^b [ML^2T^{-3}]^C$

a + b + c = -1

2a - 3b + 2c = 3

-2a - 3c = -2 ⇒ 2a + 3c = 2

On solving,

a = -2

b = -1

c = 2

So, $G= [E^{-2}d^{-1}P^2]$

Q18 Text Solution:

(A)

$$y = x^2 \cos^2 2\pi \left(\frac{\beta\gamma}{\alpha}\right)$$

The argument of a trigonometric ratio is always dimensionless.

$$\frac{\beta\gamma}{\alpha} = [M^0L^0T^0]\ or\ \beta\gamma = \alpha \Rightarrow \gamma = \frac{T^{-1}}{L^{-1}T}$$

$$\Rightarrow [LT^{-2}]$$

and $y = x^2 \Rightarrow [L^2]$

$$\alpha = s^{-1} \Rightarrow [T^{-1}], \beta = [LT^{-1}]^{-1}$$

$$\Rightarrow [L^{-1}T]$$

$$y = m^2\ ,\ \gamma = ms^{-2}$$

Q19 Text Solution:

(A)

(i) $L.C. = MSD - VSD = 0.05 - \frac{2.45}{50}$

=0.001 cm

(ii) L.C.= 0.01 mm = 0.001 cm

Q20 Text Solution:

(A)

The given equation can be written as, Pat = b – x^2

Now, $[Pat]$ = [b] = [x^2] or [b] = [x^2] = [$M^0L^2T^0$]

And

$$[a]=\frac{[x^2]}{[Pt]}=\frac{[L^2]}{[ML^2T^{-3}][T]}=[M^{-1}L^0T^2]$$

Q21 Text Solution:

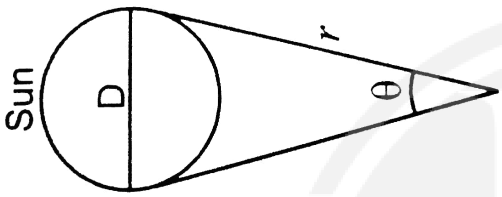
(A)

Given, Sun's Angular Diameter (θ) = 1920''

Distance (d) of sun from Earth =

$1.496\times10^{11}\ m$

Find the Diameter of the Sun.(D)



We Know,

$1'' = \left(\frac{1}{3600}\right)\times\frac{\pi}{180}\ rad$

$Angular\ Distance\ (\theta) = 1920\times\left(\frac{1}{3600}\right)$

$\times\frac{\pi}{180}\ rad$

$= 0.0093\ rad$

Now for telescope,

$\tan(\theta) = \frac{D}{r}$

$(\theta\ is\ very\ small\ for\ very\ large\ distant$

$objects\ like - Planets)$

$0.0093 = \frac{D}{1.496\times10^{11}}$

$D = 1.39\times10^9\ m$

Diameter of sun is 'D' = $1.39\times10^9\ m$

Q22 Text Solution:

(D)

- Boltzmann Constant (k):[$ML^2T^{-2}K^{-1}$]
- Coefficient of Viscosity (q): [$MT^{-1}T^{-1}$]
- Planck Constant (h): [ML^2T^{-1}]
- Thermal Conductivity (K): [$MLT^{-3}K^{-1}$]

Q23 Text Solution:

(C)

Pitch of screw gauge,

P= least count $\times$ no. of divisions

Least count of screw gauge = 0.01 mm (given)

Total number of circular divisions = 50

$P = 0.01\times50\ mm,\ P = 0.5\ mm$

Q24 Text Solution:

(C)

According to the question, the formula for the physical quantity , X is

$X = \frac{A^2B^{(1/2)}}{C^{(1/3)}D^3}$

Maximum percentage error in the measurement of the physical quantity (X) can be calculated as,

$\left(\frac{dX}{X}\right)\times100$

$= \left[\left(2\frac{dA}{A}+\frac{1}{2}\frac{dB}{B}+\frac{1}{3}\frac{dC}{C}+3\frac{dD}{D}\right)\times100\right]$

$= (2\times1)+\left(\frac{1}{2}\times2\right)+\left(\frac{1}{3}\times3\right)+(3\times4)$

$= 16\%$

Q25 Text Solution:

(C)

As given in the question,

$n\ V.S.D = \left(n-1\right)M.S.D$

$V.S.D = \frac{(n-1)\ M.S.D}{n}$

least count = Main Scale division-Vernier Scale Division

$LC = 1\ MSD - 1\ VSD = 1\ MSD$

$-\frac{(n-1)}{n}MSD = \frac{1}{n}MSD$

As per the question, there are n divisions per cm,

$\frac{1}{n}\times\frac{1}{n}cm = \frac{1}{n^2}cm$

Q26 Text Solution:

(B)

Let distance travelled = h

Acceleration due to gravity =g

Initial velocity = u

Time= t

From second equation of motion,

$h = ut+\frac{1}{2}gt^2$

as body is rest initially, therefore u = 0

$h = \frac{1}{2}gt^2$

$g = \frac{2h}{t^2}$

For error to be maximum we have the following relation,

$\left(\frac{\Delta g}{g}\times100\right)_{\max}\% = \left[\left(\frac{\Delta h}{h}\times100\right)+2\right.$

$\left.\times\left(\frac{\Delta t}{t}\times100\right)\right]\%$

$\therefore\left[\left(\frac{\Delta g}{g}\times 100\right)_{\max}\right]\% = e_1 + 2e_2$

Q27 Text Solution:

(A)

From the principle of dimensional homogeneity $[\alpha t]$ = dimensionless

$\therefore [\alpha] = \left[\frac{1}{t}\right] = \left[T^{-1}\right]$

Similarly

$\left[x\right] = \frac{[v_0]}{[\alpha]} \therefore [v_0] = \left[x\right]\left[\alpha\right]$

$= \left[L\right]\ \left[T^{-1}\right] = \left[LT^{-1}\right]$

Q28 Text Solution:

(C)

The dimension of resistance, R is

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

The dimension of capacitance, C is =

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

$\left[RC\right] = \left[M^1\ L^2\ T^{-3}A^{-2}\right]$ = [T]

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

Product of unit of Resistance, R and capacitance, C comes out to be unit of time ,i.e., second

So dimensions of RC = time.

Q29 Text Solution:

(D)

(a) $\frac{Energy}{volume} = \frac{E}{v}$

$\frac{E}{v} = \frac{\left[ML^2T^{-2}\right]}{\left[L^3\right]} = \left[ML^{-1}T^{-2}\right]$

(b) $\frac{Force}{Area} = \frac{F}{A}$

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

(c) $\frac{Voltage\times\ ch\arg e}{volume} = \frac{V_q}{v}$

$\frac{V_q}{v} = \frac{\left[ML^2T^{-3}A^{-1}\right]}{\left[L^3\right]} = \left[ML^{-1}T^{-2}\right]$

(d) Angular momentum $L = \left[ML^2T^{-1}\right]$

Dimensional formula of angular momentum is $\left[ML^2T^{-1}\right]$ and the other three have dimensional formula $= \left[ML^{-1}T^{-2}\right]$

Therefore the dimensional formula of angular momentum is not as same as that of the other three physical quantities.

Q30 Text Solution:

(C)

$x = a + b = (14 \pm 0.14)$

$\Rightarrow \%\ \text{error}\ = \frac{0.14}{14}\times 100 = 1\%$

$y = a - b = (2 \pm 0.14)$

$\Rightarrow \%\ \text{error}\ = \frac{0.14}{2}\times 100 = 7\%$

$z = ab = (48 \pm 0.96)$

$\Rightarrow \%\ \text{error}\ = \frac{0.96}{48}\times 100 = 2\%$

Therefore, order of $\%$ error is $x < z < y$

Q31 Text Solution:

P = *mv*

$x\,\text{kg}\ \frac{\text{m}}{\text{s}} = \frac{1\,(10\,\text{kg})(10\,\text{m})}{1\,\text{minute}}$

$\Rightarrow x\ \text{kg}\ \frac{\text{m}}{\text{s}} = \frac{100}{60}\ \frac{\text{kg m}}{\text{s}}$

$\Rightarrow x = \frac{5}{3}$

Q32 Text Solution:

$n = \frac{1}{2l}\sqrt{\frac{T}{m}}$

$m = \frac{I}{4l^2n^2}$

$m \propto \frac{T}{l^2n^2}$

So, dimensions of *m*,

$= \frac{\left[MLT^{-2}\right]}{\left[L^2T^{-2}\right]}$

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

Q33 Text Solution:

(1)

$\frac{\Delta X}{X} = \frac{\Delta a}{a} + \frac{2\Delta b}{b} + \frac{3\Delta c}{c}$

% error in X is 13%

Q34 Text Solution:

$R_{eq} = \frac{R_1R_2}{R_1+R_2} = \frac{50}{15} = 3.33$

$\frac{\Delta R_{eq}}{R_{eq}} = R_{eq}\left(\frac{\Delta R_1}{{R_1}^2} + \frac{\Delta R_2}{{R_2}^2}\right)$

$= 3.33\left(\frac{0.2}{25} + \frac{0.1}{100}\right)$

Error = 3%

Q35 Text Solution:

$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{mg}{A}$

m = density × volume

$m \propto \text{Volume}$

$m \propto \left[L^3\right]$

$A = \left[L^2\right]$

So, stress $\propto L$

If length increases by a factor of q, stress also increases by a factor of q.

Q36 Text Solution:

In 0.0021<u>0</u>2<u>0</u>, the underlined zeroes only are significant as this number is less than 1.

Q37 Text Solution:

Only 1.02 has 3 significant figures.

Q38 Text Solution:

$$[\mathrm{P}] = \left[\frac{\text{Energy}}{\text{Time}}\right]$$

$$= \frac{[\mathrm{ML^2\,T^{-2}}]}{[\mathrm{T}]} = \left[\mathrm{ML^2\,T^{-3}}\right]$$

Q39 Text Solution:

As power of exponent is dimensionless,

$[v_0] = [v] = [LT^{-1}]$

and $[at] = [M^0L^0T^0]$

$\therefore\ [av_0] = [LT^{-1}T^{-1}]$

$= [LT^{-2}]$

Q40 Text Solution:

Thickness = (outer radii – inner radii)

= [(4.23 – 3.87) $\pm$ (0.01 + 0.01)]

=[0.36 $\pm$ 0.02]cm [$\because$ Errors are always added]

Q41 Text Solution:

Speed $= \frac{12.0}{4.0} = 3.0$

$s = \frac{d}{t}$

$\frac{\Delta s}{s} = \frac{\Delta d}{d} + \frac{\Delta t}{t}$

$\Rightarrow \Delta s = s\left(\frac{\Delta d}{d} + \frac{\Delta t}{t}\right)$

$\Delta s = 3\left(\frac{0.2}{12} + \frac{0.1}{4}\right) = 3\left(\frac{0.2+0.3}{12}\right)$

$\Delta s = \frac{0.5}{4} = 0.125$ rounded off to 0.1

Q42 Text Solution:

$1' = \left(\frac{1}{60}\right)^\circ = \frac{1}{60} \times \frac{\pi}{180}$ rad = 2.91×10^{-4} rad

Q43 Text Solution:

A reading that is imprecise but accurate is option D) as the maximum number of readings are close to the true value but many readings are much smaller and greater than the true value which averages to the true value.

Q44 Text Solution:

All four statement are correct.

Q45 Text Solution:

$g = 10\,\mathrm{m/s^2} = 10\,\mathrm{LT^{-2}}$

$L' = 1000\,\mathrm{m} = 10^3\,L$

$T' = 3600\,\mathrm{s} = 3600\,\mathrm{T}$

Now, $n_1u_1 = n_2u_2$

$10\,\mathrm{LT^{-2}} = n_2L'T'^{-2}$

$10\,\mathrm{LT^{-2}} = n_2\left(10^3L\right)(3600T)^{-2}$

$\therefore n_2 = \frac{10}{10^3} \times (3600)^2$

$= \frac{36\times36\times10^4}{10^2}$

$n_2 = 129600$

Q46 Text Solution:

Both A and R are correct and R is correct explanation of A.

Q47 Text Solution:

$[\mathrm{Bt}] = [\mathrm{M^0L^0T^0}]$

$[\mathrm{B}] = [\mathrm{T^{-1}}]$

$\left[\frac{A}{B}\right] = [L]$

$\Rightarrow [A] = [LT^{-1}]$

Q48 Text Solution:

When rounding, if the digit to be dropped is '5', and the preceding digit is odd, the preceding digit is increased by 1.

So, the correct answer is 15.8.

Q49 Text Solution:

$T \propto p^a d^b E^c$

M^0L^0T'

$= [ML^{-1}T^{-2}]^a[ML^{-3}]^b[ML^2T^{-2}]^c$

$M^0L^0T' = M^{a+b+c}L^{-a-3b+2c}T^{-2a-2c}$

$\therefore a + b + c = 0,\ -a - 3b + 2c = 0;$

$-2a - 2c = 1$

On solving, $a = \frac{-5}{6}, b = \frac{1}{2}$ and $c = \frac{1}{3}$

Q50 Text Solution:

Length, $\mathrm{l} = (10 \pm 0.1)\mathrm{mm}$

radius, r = (2 + 0.1)mm

Now, Volume = $\pi r^2 \mathrm{l}$

$= \frac{22}{7} \times 2^2 \times 10^{-2} \times 10$

$= 1.26\ \mathrm{cm^3}$

Now, $\frac{\Delta V}{V} = 2.\frac{\Delta r}{r} + \frac{\Delta \mathrm{l}}{\mathrm{l}}$

$= 2 \times \frac{0.1}{2} + \frac{0.1}{10} = 0.11$

$\Delta V = 0.11 \times 1.26$
$= 0.14\,\text{cm}^3$
And, surface area = $A = 2\pi rl$
$\frac{\Delta A}{A} = \frac{\Delta r}{r} + \frac{\Delta l}{l}$
$= \frac{0.1}{2} + \frac{0.1}{10} = 0.06$
$d = 2r$. Relative error in diameter is same as that in radius
So, only options (1) and (2) are correct.

Q51 Text Solution:

$[M] = F^a V^b T^c$
$\Rightarrow \left[M^1\right] = \left[MLT^{-2}\right]^a \left[LT^{-1}\right]^b [T]^c$
$\Rightarrow \left[M^1\right] = \left[M^a L^{a+b} T^{-2a-b+c}\right]$
$\therefore a = 1$
$a + b = 0 \Rightarrow b = -1$
$-2a - b + c = 0$
$\Rightarrow -2 + 1 + c = 0 \text{ or } c = 1$
$[M] = \left[FV^{-1}T\right]$

Q52 Text Solution:

If student measures 3.50 cm, it means that there is an uncertainly of order 0.01 cm.
$1\,\text{MSD} = \frac{1}{10}\text{cm}$ and 9 MSD = 10 VSD
LC of vernier caliper = 1MSD –1VSD
$= \frac{1}{10}\left(1 - \frac{9}{10}\right) = \frac{1}{100}\text{cm} = 0.01\,\text{cm}$

Q53 Text Solution:

In a screw gauge,
Least count =
$= \frac{\text{Measure of 1 main scale division (MSD)}}{\text{Number of division on circular scale}}$
Here, minimum value to be measured/least count is $5\mu\text{m}$
$= 5 \times 10^{-6}\,\text{m}$
$5 \times 10^{-6} = \frac{1 \times 10^{-3}}{N}$
or $N = \frac{10^{-3}}{5 \times 10^{-6}} = \frac{1000}{5}$
= 200 divisions

Q54 Text Solution:

Dimensionally incorrect equations are always incorrect.

Q55 Text Solution:

$\Delta\theta = \Delta\theta_1 + \Delta\theta_2 = 0.2^\circ\,\text{C}$
$\theta_m = 70.0^\circ\,\text{C}$

Q56 Text Solution:

Thickness = M.S Reading + Circular Scale Reading (L.C.)
Here, $\text{L.C} = \frac{0.1}{50} = 0.002\,\text{cm}$ per division
So, 2.124 cm is the correct answer.

Q57 Text Solution:

The argument of log must be dimensionless
$\therefore \log\frac{A}{B}$ is not possible.

Q58 Text Solution:

Random error $\propto \frac{1}{\text{no. of observations}}$
$\frac{E'}{E} = \frac{100}{400}$
$\therefore E' = \frac{1}{4}E$

Q59 Text Solution:

$\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$
$= \frac{5}{100} + \frac{0.2}{10}$
$= \frac{7}{100}$
$\therefore \frac{\Delta R}{R}\% = 7\%$

Q60 Text Solution:

$y = a\sin(bt - cx)$
cx and $bt \rightarrow$ dimensionless
$[bt] = [M^0 L^0 T^0]$
$b = [T^{-1}]$
$[cx] = [M^0 L^0 T^0]$
$c = [L^{-1}]$
$\therefore \frac{b}{c} = \frac{L}{T} \Rightarrow$ same as wave velocity