Chapter 02

Unit & Measurement

Practice Section-01

Q.1 The value of Gravitational constant G in MKS system is 6.67×10^{-11} N-m^2/kg^2. What will be its value in CGS system ?

(1) $6.67 \times 10^{8}\ \frac{cm^3}{g} s^2$ (2) $6.67 \times 10^{9}\ \frac{cm^3}{g} s^2$

(3) $6.67 \times 10^{11}\ \frac{cm^3}{g} s^2$ (4) $6.67 \times 10^{-8}\ \frac{cm^3}{g} s^2$

Q.2 Match the type of unit (column A) with its corresponding example (column B)

Column-(A)	Column-(B)
(a) Base unit	(i) m/s^2
(b) Derived SI unit	(ii) hp
(c) Improper unit	(iii) kg-wt
(d) Practical unit	(iv) rad
(e) Supplementary unit	(v) kg

(1) a $\rightarrow$ (v), b $\rightarrow$ (i), c $\rightarrow$ (iii), d $\rightarrow$ (ii), e $\rightarrow$ (iv)

(2) a $\rightarrow$ (v), b $\rightarrow$ (ii), c $\rightarrow$ (iv), d $\rightarrow$ (i), e $\rightarrow$ (iii)

(3) a $\rightarrow$ (v), b $\rightarrow$ (ii), c $\rightarrow$ (i), d $\rightarrow$ (iii), e $\rightarrow$ (iv)

(4) a $\rightarrow$ (i), b $\rightarrow$ (ii), c $\rightarrow$ (iii), d $\rightarrow$ (iv), e $\rightarrow$ (v)

Q.3 Derive an expression for time period (t) of a simple pendulum which may depend upon : mass of bob (M), length of pendulum (ℓ) and acceleration due to gravity (g)

(1) $t = K\sqrt{\frac{a}{g}}$ (2) $t = K\sqrt{\frac{v}{g}}$ (3) $t = K\sqrt{\frac{\ell}{g}}$ (4) $t = K\sqrt{\frac{2\ell}{g}}$

Q.4 Find the dimensions of the following quantities:

(i) Temperature (ii) Kinetic energy (iii) Pressure (iv) Angular speed

Q.5 Find the dimensions of Planck's constant (h).

(1) $H^{-1}L^{-2}T^{-3}$ (2) $M^{-2}L^{1}T^{2}$ (3) $[M^{1}L^{2}T^{-1}]$ (4) $[M^{0}L^{2}T^{-1}]$

Q.6 Centripetal force (F) on a body of mass (m) moving with uniform speed (v) in a circle of radius (r) depends upon m, v and r. Derive a formula for the centripetal force using theory of dimensions.

(1) $F = K\frac{mr^2}{v}$ (2) $F = K\frac{mv^2}{r}$ (3) $F = K\frac{mv}{r}$ (4) F = mvr

Q.7 If $\frac{\alpha}{t^2} = Fv + \frac{\beta}{x^2}$.

Find dimension formula for [α] and [β] (here t = time, F = force, v = velocity, x = distance)

(1) $\alpha = M^1L^2T^{-1}$, $\beta = M^1L^4T^{-3}$ (2) $\alpha = M^2L^1T^2$, $\beta = M^2L^4T^{-3}$

(3) $\alpha = M^3L^2T^1$, $\alpha = M^1L^2T^{-2}$ (4) $\alpha = M^2L^2T^2$, $\beta = M^2L^2T^2$

Q.8 Write the formula of plank's constant

(1) $\frac{E}{f}$ (2) $\frac{E}{a}$ (3) $\frac{E}{t}$ (4) $\frac{E}{P}$

Q.9 Write the dimensional formula of strain

(1) $[M^1L^2T^0]$ (2) $[M^1L^0T^0]$ (3) $[M^{-1}L^{-1}T^{-1}]$ (4) $[M^0L^0T^0]$

Q.10 Write the formula of rotational kinetic energy

(1) $\frac{1}{2}I\omega^2$ (2) $\frac{1}{2}Iv^2$ (3) $\frac{1}{2}\ell\omega^2$ (4) $\frac{\omega^2}{2I}$

Note: The final absolute error in this type of questions is taken to be equal to the least count of the measuring instrument.

Practice Section-02

Q.1 Give the number of significant figures in the following:
(a) 0.165 (b) 4.0026 (c) 0.0256 (d) 201
(e) 0.050 (f) 2.653×10^4 (g) 6.02×10^{23} (h) 0.0006032

Q.2 From the point of view of significant figures which of the following statement are correct ?
(i) 10.2 cm + 8 cm = 18.2 cm (ii) 2.53 m – 1.2 m = 1.33 m
(iii) 4.2 m × 1.4 m = 5.88 m^2 (iv) 3.6 m / 1.75 sec = 2.1 m/s
(1) (i) & (iv) only (2) (ii) & (iii) only (3) (iv) only (4) (ii) & (iv) only

Q.3 Calculate area enclosed by a circle of diameter 1.06 m to correct number of significant figures.
(1) 0.882 m^2 (2) 0.44 m^2 (3) 0.22 m^2 (4) 0.11 m^2

Q.4 Two rods have lengths measured as (1.8 ± 0.2) m and (2.3 ± 0.1)m. Calculate their combined length with error limits.
(1) (4.1 ± 0.3) m (2) (0.2 ± 0.1) m (3) (0.4 ± 0.4) m (4) (0.6 ± 0.6) m

Q.5 Measure of two quantities along with the precision of respective measuring instruments is :
A = 2.5 m/s ± 0.5 m/s B = 0.10s ± 0.01 s
The value of AB will be
(1) (0.25 ± 0.08)m (2) (0.25 ± 0.5)m (3) (0.25 ± 0.05)m (4) (0.25 ± 0.135)m

Q.6 The radius of a sphere is measured to be (2.1 ± 0.5) cm. Calculate its surface area with absolute error limits.
(1) (52.2 ± 26.2) cm^2 (2) (55.4 ± 26.4) m^2 (3) (55.4 ± 26.4) cm^2 (4) (52.4 ± 2) cm^2

Q.7 A physical quantity x is calculated from the relation $x = a^3b^2 / \sqrt{cd}$. Calculate percentage error in x, if a, b, c and d are measured respectively with an error of 1%, 3%, 4% and 2%.
(1) ± 13 % (2) ± 12 % (3) ± 10 % (4) ± 8 %

Q.8 An object covers (16.0 ± 0.4) m distance in (4.0 ± 0.2)s. Find out its speed.
(1) (4.0 ± 0.2) m/s (2) (4.0 ± 0.3) m/s (3) (0.2 ± 0.7) m/s (4) Zero

Q.9 One centimeter on the main scale of vernier calipers is divided into ten equal parts. If 20 divisions of vernier scale coincide with 19 small divisions of the main scale then what will be the least count of the callipers.
(1) 0.005 cm (2) 0.006 cm (3) 0.007 cm (4) 0.0023 cm

Q.10 If the number of divisions on the circular scale is 100 and number of full rotations given to screw is 8 and distance moved by the screw is 4 mm, then what will be least count of the screw gauge ?
(1) 0.002 mm (2) 0.004 mm (3) 0.005 mm (4) 0.008 mm

ANSWER KEY

PRACTICE SECTION -01

Que.	1	2	3	5	6	7	8	9	10
Ans.	4	1	3	3	2	1	1	4	1

Q.4 (a) $[M^0L^0T^0K^1]$ (b) $[ML^2T^{-2}]$ (c) $[M\,L^{-1}\,T^{-2}]$ (d) $[M^0L^0T^{-1}]$

PRACTICE SECTION -02

Que.	2	3	4	5	6	7	8	9	10
Ans.	3	1	1	1	3	2	2	1	3

Q. 1 (a) 3, (b) 5, (c) 3, (d) 3, (e) 2, (f) 4, (g) 3, (h) 4