INDIAN SCHOOL AL WADI AL KABIR

Class: XI	DEPARTMENT OF SCIENCE 2025– 2026 SUBJECT: PHYSICS	Date: 23/04/2025
Worksheet: 01	TOPIC: UNITS AND MEASUREMENTS	Note: A4 FILE FORMAT
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

MCQ TYPE QUESTIONS

1.The velocity of a body is given by the equation: $\upsilon = (b/t) + ct^2 + dt^3$. The dimensional formula for b is

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

2. Suppose a quantity y can be the dimensionally represented in terms M, L and T, that is $[y] = [M^aL^bT^c]$. The quantity mass;

(a) may be represented in terms of L, T and y if a = 0

(b) may be represented in terms of L, T and y if a≠ 0.

(c) can always be dimensionally represented in terms of L, T and y.

(d) can never be dimensionally represented in terms of L, T and y.

3. if I is the moment of inertia and ω the angular velocity, what is the dimensional formula of rotational kinetic energy ½ $I\omega^2$.

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

4. if $Y = a+bt+ct^2$, where y is in meter and t in second, then the unit of c is

(a)m (b) s^{-2} (c)ms^{-1} (d) ms^{-2}

5. The dimensional formula $[ML^2T^{-2}]$ represents

(a) momentum (b) moment of force

(c) acceleration (d) force.

6. g cm s^{-2} stands for the unit of

(a) Energy (b) force (c) momentum (d) acceleration

7. The dimensional formula for PV, where P is pressure and V is volume is the same as that of

(a) work (b) power (c) Elastic modulus (d) Pressure.

8. The quantity having dimensions -2 in the time is

(a) force (b) pressure (c) gravitational constant (d) all of these

9. in the equation $[P+(a/V^2)]$ (V-b) = RT, the S.I unit of a is

(a) Nm^2 (b) Nm^4 (c) Nm^{-3} (d) Nm^{-2}

10. The physical quantities of which one is a vector and the other is a scalar, having same dimensions are

(a) moment and momentum (b) power and pressure
(c) impulse and momentum (d) torque and work.

11. Given that r = m^2 sinpt, where t represents time, the unit of m is N, then the unit of r is
(a) N (b) N^2 (c) Ns (d) N^2s

12. linear momentum and Angular momentum have the same dimensions in
(a) Mass and length (b) Length and time
(c) Mass and time (d) mass, length and time.

13. The dimensional formula of velocity gradient is
(a) $[M^0L^0T^{-1}]$ (b) $[MLT^{-1}]$ (c) $[ML^0T^{-1}]$ (d) $[M^0LT^{-2}]$

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

15. The dimensionless quantity
(a) does not exist (b) always has a unit
(c)never has a unit (d) may have a unit.

<u>Assertion and Reason type Questions:</u>

A. Both the assertion and the reason are true, and the reason is the correct explanation of the assertion.

B. Both the assertion and the reason are true, but the reason is not the correct explanation of the assertion.

C. The assertion is true, but the reason is false.

D. The assertion is false, but the reason is true.

16. Assertion: In any physically valid equation, the dimensions of the quantities on both sides must be identical.

Reason: Dimensional analysis serves as a tool to verify the algebraic consistency of equations by ensuring that only quantities of the same "kind" are added or equated.

17. Assertion: Units such as the kilogram, meter, and second are classified as base units in the SI system.

Reason: Derived units like the newton and the joule cannot be expressed in terms of these base units.

18. Assertion: Every derived unit in physics can be expressed in terms of the seven SI base units.

Reason: Because all physical quantities are fundamentally related, derived units are formed by algebraically combining base units through multiplication or division.

<u>SHORT ANSWER TYPE QUESTIONS (2/3 MARKS): -</u>

19. Give an example of
(a) a physical quantity which has a unit but no dimensions.
(b) a physical quantity which has neither unit nor dimensions. (c) a constant which has a unit.
(d) a constant which has no unit.

20. The displacement of a progressive wave is represented by y = Asin (ωt – kx), where x is distance and t is time. Write the dimensional formula of (i) ω and (ii) k.

21. Find the dimensions of Planck's constant *h* from the equation *E* = *hυ* where *E* is the energy and *υ* is the frequency.

22. Suppose the acceleration due to gravity at a place is 10 m/s^2. Find its value in cm/(minute)^2.

23. The average speed of a snail is 0.020 miles/hour and that of a leopard is 70 miles/hour. Convert these speeds in SI units.

LONG ANSWER TYPE QUESTIONS (5 MARKS): -

24. Taking force, length and time to be the fundamental quantities find the dimensions of (a) density, (b) pressure, (c) momentum and (d) energy.

25. Test if the following equations are dimensionally correct.

$$\text{(a) } h = \frac{2\,S\cos\theta}{\rho r g}, \qquad \text{(b) } v = \sqrt{\frac{P}{\rho}},$$

$$\text{(c) } V = \frac{\pi P r^4 t}{8\,\eta\, l}, \qquad \text{(d) } \nu = \frac{1}{2\pi}\sqrt{\frac{mgl}{I}}$$

where *h* = height, *S* = surface tension, *ρ* = density, *P* = pressure, *V* = volume, *η* = coefficient of viscosity, *ν* = frequency and *I* = moment of inertia.

26. Young's modulus of steel is 19 x 10^{10} N/m^2. Express it in dyne/cm^2. Here dyne is the CGS unit of force.

Answer Key; -

1. (a), 2. (b), 3. (c), 4. (d), 5. (b), 6. (b), 7. (a), 8. (d), 9. (b), 10. (d), 11. (b), 12. (c), 13. (a), 14. (c), 15. (d), 16.A, 17. C,18. A.

19. -(a) angle, (b) strain, refractive index etc. (co-efficient of friction or spring constant).

20. (i) [T^{-1}], (ii) [L^{-1}].

21. E = hν where E = energy and ν = frequency.

$$h = \frac{E}{\nu} = \frac{[ML^2T^{-2}]}{[T^{-1}]}[ML^2T^{-1}]$$

22. $$g = 10\,\frac{\text{metre}}{\text{sec}^2} = 36 \times 10^5 \text{ cm/min}^2$$

23. The average speed of a snail is 0.02 mile/hr

Converting to S.I. units, $\frac{0.02 \times 1.6 \times 1000}{3600}$ m/sec [1 mile = 1.6 km = 1600 m] = 0.0089 ms^{-1}

The average speed of leopard = 70 miles/hr

In SI units = 70 miles/hour = $\frac{70 \times 1.6 \times 1000}{3600}$ = 31 m/s

24. Taking force, length and time as fundamental quantity

a) Density = $\frac{m}{V} = \frac{(\text{force/acceleration})}{\text{Volume}} = \frac{[F/LT^{-2}]}{[L^2]} = \frac{F}{L^4T^{-2}} = [FL^{-4}T^2]$

b) Pressure = F/A = F/L^2 = $[FL^{-2}]$

c) Momentum = mv (Force / acceleration) × Velocity = $[F / LT^{-2}] \times [LT^{-1}] = [FT]$

d) Energy = $\frac{1}{2}mv^2 = \frac{\text{Force}}{\text{acceleration}} \times (\text{velocity})^2$

$$= \left[\frac{F}{LT^{-2}}\right] \times [LT^{-1}]^2 = \left[\frac{F}{LT^{-2}}\right] \times [L^2T^{-2}] = [FL]$$

25. a) $h = \frac{2S\cos\theta}{\rho rg}$

LHS = [L]

Surface tension = S = F/l = $\frac{MLT^{-2}}{L} = [MT^{-2}]$

Density = ρ = M/V = $[ML^{-3}T^0]$

Radius = r = [L], g = $[LT^{-2}]$

RHS = $\frac{2S\cos\theta}{\rho rg} = \frac{[MT^{-2}]}{[ML^{-3}T^0][L][LT^{-2}]} = [M^0L^1T^0] = [L]$

LHS = RHS

So, the relation is correct

b) $v = \sqrt{\frac{p}{\rho}}$ where v = velocity

LHS = Dimension of v = $[LT^{-1}]$

Dimension of p = F/A = $[ML^{-1}T^{-2}]$

Dimension of ρ = m/V = $[ML^{-3}]$

RHS = $\sqrt{\frac{p}{\rho}} = \sqrt{\frac{[ML^{-1}T^{-2}]}{[ML^{-3}]}} = [L^2T^{-2}]^{1/2} = [LT^{-1}]$

So, the relation is correct.

c) $V = (\pi pr^4t) / (8\eta l)$

LHS = Dimension of V = $[L^3]$

Dimension of p = $[ML^{-1}T^{-2}]$, $r^4 = [L^4]$, t = [T]

Coefficient of viscosity = $[ML^{-1}T^{-1}]$

RHS = $\frac{\pi pr^4t}{8\eta l} = \frac{[ML^{-1}T^{-2}][L^4][T]}{[ML^{-1}T^{-1}][L]}$

So, the relation is correct.

d) $v = \frac{1}{2\pi}\sqrt{(mgl/I)}$

LHS = dimension of v = $[T^{-1}]$

RHS = $\sqrt{(mgl/I)} = \sqrt{\frac{[M][LT^{-2}][L]}{[ML^2]}} = [T^{-1}]$

LHS = RHS

So, the relation is correct.

26. This suggests that it has dimensions of $\frac{Force}{(distance)^2}$

Thus, $[Y] = \frac{[F]}{L^2} = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$.

N/m^2 is in SI units.

So, $1\ N/m^2 = (1\ kg)(1\ m)^{-1}(1\ s)^{-2}$

and $1\ dyne/cm^2 = (1\ g)(1\ cm)^{-1}(1\ s)^{-2}$

so, $\frac{1\ N/m^2}{1\ dyne/cm^2} = \left(\frac{1\ kg}{1\ g}\right)\left(\frac{1\ m}{1\ cm}\right)^{-1}\left(\frac{1\ s}{1\ s}\right)^{-2}$

$= 1000 \times \frac{1}{100} \times 1 = 10$

or, $1\ N/m^2 = 10\ dyne/cm^2$

or, $19 \times 10^{10}\ N/m^2 = 19 \times 10^{11}\ dyne/cm^2$.

Prepared by:	*Checked by:*
Mr. Randhir Gupta	*HoD Science*