DPP No. 15

SYLLABUS : UNIT & DIMENSIONS & MEASUREMENT ERROR AND EXPERIMENTS

1. Which of the following sets can't enter into the list of fundamental quantities 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

2. A dimensionless quantity

(A) never has a unit (B) always has a unit (C) may have a unit (D) does not exist

3. Which pair of following quantities has dimensions different from each other.

(A) Impulse and linear momentum (B) Plank's constant and angular momentum

(C) Moment of inertia and moment of force (D) Young's modulus and pressure

4. The velocity of water waves 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) $v^2 = k\lambda^{-1} g^{-1} \rho^{-1}$ (B) $v^2 = k g \lambda$ (C) $v^2 = k g \lambda \rho$ (D) $v^2 = k \lambda^3 g^{-1} \rho^{-1}$

where k is a dimensionless constant

5. The value of $G = 6.67 \times 10^{-11}$ N m^2 $(kg)^{-2}$. Its numerical value in CGS system will be :

(A) 6.67×10^{-8} (B) 6.67×10^{-6} (C) 6.67 (D) 6.67×10^{-5}

6. Force applied by water stream depends on density of water (ρ), velocity of the stream (v) and cross–sectional area of the stream (A). The expression of the force can be

(A) ρAv (B) ρAv^2 (C) $\rho^2 Av$ (D) $\rho A^2 v$

7. If unit of length and time is doubled, the numerical value of 'g' (acceleration due to gravity) will be :

(A) doubled (B) halved (C) four times (D) remain same

8. Force F is given in terms of time t and distance x by

$$F = A \sin C t + B \cos D x$$

Then the dimensions of $\frac{A}{B}$ and $\frac{C}{D}$ are given by

(A) MLT^{-2}, $M^0L^0T^{-1}$ (B) MLT^{-2}, $M^0L^{-1}T^0$ (C) $M^0L^0T^0$, $M^0L^1T^{-1}$ (D) $M^0L^1T^{-1}$, $M^0L^0T^0$

9. What are the dimensions of electrical resistance?

(A) $ML^2 T^{-2} A^2$ (B) $ML^2 T^{-3} A^{-2}$ (C) $ML^2 T^{-3} A^2$ (D) $ML^2 T^{-2} A^{-2}$

10. $\int \frac{x\,dx}{\sqrt{2ax - x^2}} = a^n \sin^{-1}\left[\frac{x}{a} - 1\right]$. The value of n is :

(A) 0 (B) –1 (C) 1 (D) none of these

You may use dimensional analysis to solve the problem.

11. An unknown quantity "α" is expressed as $\alpha = \frac{2ma}{\beta} \log\left(1 + \frac{2\beta\ell}{ma}\right)$

where m = mass, a = acceleration, ℓ = length

The unit of α should be

(A) meter (B) m/s (C) m/s^2 (D) s^{-1}

12. Choose the correct statement(s):

(A) All quantities may be represented dimensionally in terms of the base quantities.

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

(C) The dimension of a base quantity in other base quantities is always zero.

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

13. Choose the correct statement(s) :

(A) A dimensionally correct equation may be correct.

(B) A dimensionally correct equation may be incorrect.

(C) A dimensionally incorrect equation may be correct.

(D) A dimensionally incorrect equation must be incorrect.

14. A parameter α is given by $\alpha = \frac{h}{\sigma\theta^4}$

(here σ = Stefan's constant, h = Planck's constant , θ = absolute temperature) then

(A) Dimension of 'α' will be $L^2 T^2$

(B) Unit of 'α' may be $m^2 s^2$

(C) Unit of 'α' may be $\frac{(\text{Weber})(\Omega)^2(\text{Farad})^2}{(\text{Tesla})}$

(D) Dimension of 'α' will be equal to dimension of $\left(\frac{Ri}{\phi_m}\right)$ where R = gas constant, i = Electrical current, ϕ_m = magnetic flux

15. Which of the following units denotes the dimensions ML^2/Q^2, where Q denotes the electric charge?

(A) H/m^2 (B) Weber (Wb) (C) Wb/m^2 (D) Henry (H)

16. 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) $MLT^{-1}C^{-1}$

17. Let $[\in_0]$ denote the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = time and A = electric current, then :

(A) $[\in_0] = [M^{-1} L^{-3} T^2 A]$ (B) $[\in_0] = [M^{-1} L^{-3} T^4 A^2]$

(C) $[\in_0] = [M^{-1} L^2 T^{-1} A^{-2}]$ (D) $[\in_0] = [M^{-1} L^2 T^{-1} A]$

18. The density of a material in SI units is 128 kgm^{-3}. In certain units in which the units of length is 25 cm and the unit of mass is 50 g, the numerical value of density of the material is :

(A) 410 (B) 40 (C) 640 (D) 16

19. If speed (V), acceleration (A) and force (F) are considered as fundamental units, the dimension of Young's modulus will be :

(A) $V^{-4}A^2F$ (B) $V^{-2}A^2F^{-2}$ (C) $V^{-4}A^{-2}F$ (D) $V^{-2}A^2F^2$

20. Let ℓ, r, c and v represent inductance, resistance, capacitance and voltage, respectively. The dimension of $\frac{\ell}{rcv}$ in SI units will be :

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

21. Amount of solar energy received on the earth's surface per unit area per unit time is defined a solar constant. Dimension of solar constant is

(A) ML^2T^{-2} (B) MLT^{-2} (C) $M^2L^0T^{-1}$ (D) ML^0T^{-3}

22. The workdone by a gas molecule in an isolated system is given by, $W = \alpha\beta^2 e^{-\frac{x^2}{\alpha kT}}$, where x is the displacement, k is the Boltzmann constant and T is the temperature, α and β are constants. Then the dimension of β will be :

(A) $[M\ L^2\ T^{-2}]$ (B) $[M\ L\ T^{-2}]$ (C) $[M^2\ L\ T^2]$ (D) $[M^0\ L\ T^0]$

ANSWER KEY

1.	(B)	**2.**	(C)	**3.**	(C)	**4.**	(B)	**5.**	(A)
6.	(B)	**7.**	(A)	**8.**	(C)	**9.**	(B)	**10.**	(C)
11.	(A)	**12.**	(ABC)	**13.**	(ABD)	**14.**	(ABC)	**15.**	(D)
16.	(B)	**17.**	(B)	**18.**	(B)	**19.**	(A)	**20.**	(D)
21.	(D)	**22.**	(B)						