STUDY mate
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Chapter End Test

Max. Mark : 25	Units and Dimensions	CLASS
Time : 45 Min.		XI

1. Light year is:
(a) Light emitted by the sun in one year.
(b) Time taken by light to travel from the sun to the earth.
(c) The distance travelled by light in one year, in free space.
(d) The time taken by earth to go round the sun once.

2. Unit of solid angle is:
(a) Newton (b) Radian
(c) Steradian (d) Pascal

3. Irrespective of the system of units followed, the condition to be satisfied is:
(a) $nu = 0$ (b) $n_1u_1 = n_2u_2$
(c) n/u = constant (d) $nu = 1$

4. $N\ kg^{-1}$ is the unit of:
(a) Velocity (b) Force
(c) Acceleration (d) None of these

5. The dimensions of pressure are:
(a) $[MLT^{-2}]$ (b) $[ML^{-1}T^{2}]$
(c) $[ML^{-1}T^{-2}]$ (d) $[MLT^{2}]$

6. The dimensions of torque are:
(a) $[ML^{2}T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[ML^{-1}T^{-2}]$ (d) $[ML^{-2}T^{-2}]$

7. Velocity of a particle depends upon t as $v = A + Bt + Ct^2$. It velocity is in m/s, the unit of A will be
(a) m/s (b) m/s^2
(c) m-s (d) m^2/s

8. The equation $y = A \sin(\omega t - kx)$, the dimensional formula of ω is (given x is distance and t is time)
(a) $[MLT^{-1}]$ (b) $[M^0LT^{-1}]$
(c) $[M^0L^0T^{-1}]$ (d) $[ML^0T^{-1}]$

9. Which of the following is dimensionally correct:
(a) Pressure = momentum per unit volume
(b) Pressure = momentum per unit volume per unit energy
(c) Pressure = energy per unit volume
(d) Pressure = energy per unit area

10. Which of the following is the most precise instrument for measuring length?
(a) Metre rod of least count 0.1 cm
(b) Vernier Callipers of least count 0.01 cm
(c) Screw gauge of least count 0.001 cm
(d) Metre scale of least count 1 cm.

11. The maximum error in the measurement of mass and length of a cube are 3% and 2% respectively. The maximum error in the measurement of its density will be:
(a) 3% (b) 6%
(c) 9% (d) 18%

12. A physical quantity Q is found to depend on observables x, y and z, obeying relation $Q = \frac{x^3y^2}{z}$. The percentage error in the measurements of x, y and z are 1%, 2% and 4% respectively. What is percentage error in the quantity?
(a) 4% (b) 3%
(c) 11% (d) 1%

13. The ratio of the dimensions of Planck constant and that of moment of inertia has the dimensions of

(a) angular momentum (b) time

(c) velocity (d) frequency

14. The respective number of significant figures for numbers 23.023, 0.0003 and 2.1×10^{-3} are

(a) 4, 4, 2 (b) 5, 1, 2

(c) 5, 1, 5 (d) 5, 5, 2

15. In the expression for Boyle's law, the product 'PV' has dimensions of

(a) force (b) impulse

(c) energy (d) momentum

16. $[M^1L^{-1}T^{-2}]$ is the dimensional formula for_____.

(a) joule constant (b) gravitational constant

(c) pressure (d) force

17. Dimensional equation CANNOT be used

(a) to check the correctness of a physical quantity.

(b) to derive the relation between different physical quantities.

(c) to find out constant of proportionality which may be pure number.

(d) to change from one system of units to another system.

18. The surface tension of a liquid is 10^8 dyne/cm. It is equivalent to

(a) 10^7 N/m (b) 10^6 N/m

(c) 10^5 N/m (d) 10^4 N/m

19. Which of the following set have different dimensions?

(a) Pressure, Young's modulus, stress (b) e.m.f, potential difference, electric potential

(c) Surface energy, work done, energy (d) dipole moment, electric flux, electric field

20. Two resistances $R_1 = 50 \pm 2$ ohm and $R_2 = 60 \pm 3$ ohm are connected in series, the equivalent resistance of the series combination is

(a) (110 ± 4) ohm (b) (110 ± 2) ohm

(c) (110 ± 5) ohm (d) (110 ± 6) ohm

21. Write the number of significant figures for the following: 1.0076, 1000, 0.00900, 2007. **[1]**

22. What is the percentage error in the surface area of a sphere, when the error in measuring its radius is ± 4%? **[1]**

23. A physical quantity Q is given by **[2]**

$$Q = \frac{A^2 \cdot B^{3/2}}{C^4 D^{1/2}}$$

The percentage error in A, B, C, D are 1%, 2%, 4%, 2% respectively. Find the percentage error in Q.

24. Calculate the focal length of a spherical mirror from the following data: **[3]**

Object distance u = (50 ± 0.5) cm, image distance v = (20 ± 0.2) cm.

25. The frequency of vibration (v) of a string depends upon length (l) of the string tension (T) in the string and mass per unit length (m) of the string. Using the method of dimension, derive a formula for the frequency of vibration of the string. **[3]**

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Hints/Solutions to Chapter End Test

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1.	(c)	**2.**	(c)	**3.**	(b)	**4.**	(c)	**5.**	(c)
6.	(a)	**7.**	(a)	**8.**	(c)	**9.**	(c)	**10.**	(c)
11.	(c)	**12.**	(c)	**13.**	(d)	**14.**	(b)	**15.**	(c)
16.	(c)	**17.**	(c)	**18.**	(c)	**19.**	(d)	**20.**	(c)

21. No. of significant figures in 1.0076 = 5 (1, 0, 0, 7, 6)

No. of significant figures in 1000 = 1 (1)

No. of significant figures in 0.009900 = 4 (9, 9, 0, 0)

No. of significant figures in 2007 = 4 (2, 0, 0, 7)

22. $A = 4\pi r^2$

$$\therefore \quad \frac{\Delta A}{A} = 2\frac{\Delta r}{r} = 2\times = (\pm 4\%) = 8\%$$

23. According to combination of error, we have

$$\left(\frac{\Delta Q}{Q}\times 100\right) = 2\left(\frac{\Delta A}{A}\times 100\right) + \frac{3}{2}\left(\frac{\Delta B}{B}\times 100\right) + 4\left(\frac{\Delta C}{C}\times 100\right) + \frac{1}{2}\left(\frac{\Delta D}{D}\times 100\right)$$

$$= 2\times 1 + \frac{3}{2}\times 2 + 4\times 4 + \frac{1}{2}\times 2$$

= 22%

24. $\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{20} + \frac{1}{50}$

$$f = \frac{uv}{u+v} = \frac{50+20}{50+20} = \frac{100}{7} \text{ cm}$$

$$\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} + \frac{\Delta(u+v)}{u+v}$$

$$= \frac{0.5}{50} + \frac{0.2}{20} + \frac{0.7}{70}$$

$$\Delta f = \left(\frac{3}{100}\right)\times\left(\frac{100}{7}\right) = 0.43 \text{ cm}$$

$f = (14 \pm 0.43)$ cm

25. Let

$v = k(l)^a\,(T)^b\,(m)^c$

$[T^{-1}] = [L]^a\,[MLT^{-2}]^b\,[ML^{-1}]^c$

$[T^{-1}] = [L]^{a+b-c}\,[M]^{b+c}\,[T]^{-2b}$

equating

$-2b = -1$ ..(i)

$b + c = 0$ ...(ii)

$a + b - c = 0$ ...(iii)

$$\Rightarrow \quad b = \frac{1}{2}$$

putting 'b' in (ii)

$$\Rightarrow \frac{1}{2} + c = 0$$

$$c = -\frac{1}{2}$$

Putting value of b and c in (iii)

$$a + \frac{1}{2} - \left(-\frac{1}{2}\right) = 0$$

$$a = -1$$

$$v = k(l)^{-1}(T)^{1/2}\ (m)^{-1/2}$$

$$\boxed{v = \frac{k}{l}\sqrt{\frac{T}{m}}}$$

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