1. Which of the following is not the name of a physical quantity
(a) Kilogram (b) Impulse (c) Energy (d) Ensity

2. Density of liquid is 15.7 g/cm^3. Its value in the international system of units is-
(a) 15.7 kg/m^3 (b) 157 kg/m^3
(c) 1570 kg/m^3 (d) 15700 kg/m^3

3. Given that force (F) is given $F = Pt^{-1} + Qt$. Here t is time. The unit of P is same as that of -
(a) Displacement (b) Velocity
(c) Acceleration (d) Momentum

4. f 1 g cm s^{-1} = x newton-second, then the number x is equal to
(a) 1×10^{-1} (b) 3.6×10^{-3} (c) 1×10^{-5} (d) 6×10^{-4}

5. Energy per unit volume represents -
(a) Pressure (b) Force (c) Thrust (d) Work

6. If the units of M and L are increased three times, then the unit of energy will be increased by -
(a) 3 times (b) 6 times (c) 27 times (d) 81 times

7. In a particular system, the unit of length, mass and time are chosen to be 10 cm, 10g and 0.1s respectively. The unit of force in this system will be equivalent to -
(a) 1/10 N (b) 1 N (c) 10 N (d) 100 N

8. A pressure of 10^6 dyne cm^{-2} is equivalent to -
(a) 10^5 N m^{-2} (b) 10^4 N m^{-2}
(c) 10^6 N m^{-2} (d) 10^7 N m^{-2}

9. Which of the following sets cannot enter into the list of fundamental quantities in any system of units?
(a) Length, time and mass (b) Mass, time and velocity
(c) Length, time and velocity (d) Length, mass and velocity

10. What is the unit of k in the relation $U = \frac{ky}{y^2 + a^2}$ where U represents the potential energy, y represents the displacement and a represents the maximum displacement i.e., amplitude ?
(a) m s^{-1} (b) m s (c) J m (d) J s^{-1}

11. Which of the following has the dimensions of pressure?
(a) $[ML^2T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[ML^{-1}T^{-1}]$ (d) $[ML^{-1}T^{-2}]$

12. Energy is given by $E = \frac{a - x}{bt}$ Where E is energy, x is distance and t is time. Dimensional formula of a and b are -
(a) $L, M^{-1}L^{-1}T$ (b) $ML^{-2}T, T$
(c) L, ML^2T^{-1} (d) LT^{-1}, ML^2T^{-1}

13. If force, length and time were the fundamental units, then the dimensional formula of mass would have been-
(a) $FL^{-1}T^2$ (b) FLT^{-2} (c) FLT^{-1} (d) F

14. The potential energy of a particle varies with distance x from a fixed origin as $U = \frac{A\sqrt{x}}{x + B}$ where A and B are constants. The dimensions of AB are -

(a) $ML^{5/2} T^{-2}$ (b) $^{1}L^{2}T^{-2}$
(c) $M^{3/2} L^{5/2} T^{-2}$ (d) $M^{1}L^{7/2}T^{-2}$

15. If energy (E), velocity (v) and force (F), be taken as fundamental quantities, then what are the dimensions of mass
(a) EV^{2} (b) EV^{-2} (c) FV^{-1} (d) FV^{-2}

16. $[ML^{2}T^{-3}A^{-2}]$ is the dimensional formula of -
(a) Electric resistance (b) Capacity
(c) Electric potential (d) Specific resistance

17. The dimensions of $\frac{e^2}{4\pi\varepsilon_0 hc}$, where e, ε_0, h and c are electronic charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively is -
(a) $[M^0 L^0 T^0]$ (b) $[M^1 L^0 T^0]$
(c) $[M^0 L^1 T^0]$ (d) $[M^0 L^0 T^1]$

18. The dimensional formula of thermal resistance is-
(a) $[M^{-1}L^{-2}T^{3}K]$ (b) $[ML^{2}T^{-2}K^{-1}]$
(c) $[ML^{2}T^{-3}K]$ (d) $S[ML^{2}T^{-2}K^{-2}]$

19. The energy E radiated per unit area per second by a black body at temperature T is given by $E = \sigma T^4$, where σ is the Stefan's constant. The dimensions of σ are -
(a) $MT^{2}K^{-2}$ (b) $MT^{-3}K^{-4}$ (c) $MT^{3}K^{-4}$ (d) $ML^{4}T^{-3}K^{-4}$

20. Dimensional formula for the linear momentum is-
(a) $[ML^{0}T^{-1}]$ (b) $[M^{0}LT^{-1}]$ (c) $[MLT^{-1}]$ (d) $[ML^{-1}T]$

21. The dimensional formula for ω in the relation y = A sin ωt is-
(a) $[M^{0}L^{0}T]$ (b) $[M^{0}L^{0}T^{-1}]$
(c) $[ML^{0}T^{0}]$ (d) $[M^{0}L^{-1}T^{-1}]$

22. Which of the following is dimensionless ?
(a) $\frac{v^2}{rg}$ (b) $\frac{v^2 g}{r}$ (c) $\frac{vg}{r}$ (d) v^2rg

23. Given : $X = (Gh/c^3)^{1/2}$, where G, h and c are gravitational constant, Planck's constant and the velocity of light respectively. Dimensions of X are the same as those of-
(a) Mass (b)Time (c) Length (d) Acceleration

24. If time T, acceleration A and force F are regarded as base units, then the dimensional formula of work is-
(a) [FA] (b) [FAT] (c) $[FAT^2]$ (d) $[FA^2T]$

25. If L and R are respectively the inductance and resistance, then the dimensions of $\frac{L}{R}$ will be-
(a) $M^0L^0T^{-1}$
(b) M^0LT^0
(c) M^0L^0T
(d) Cannot be represented in terms of M, L and T

26. Dimensions of one or more pairs are same. Identify the pairs-
(a) Torque and energy

(b) Angular momentum and work
(c) Energy and Young's modulus
(d) Light year and wavelength

27. A wave is represented by
y = a sin (At – Bx + C) where A, B, C are constants. The Dimensions of A, B, C are -
(a) T^{-1}, L, $M^0L^0T^0$ (b) T^{-1}, L^{-1}, $M^0L^0T^0$
(c) T, L, M (d) T^{-1}, L^{-1}, M^{-1}

28. Which of the following physical quantities has neither dimensions nor unit ?
(a) Angle (b) Luminous intensity
(c) Coefficient of friction (d) Current

29. You may not know integration. But using dimensional analysis you can check or prove results. In the integral $\int \frac{dx}{(2ax - x^2)^{1/2}}$ $= a^n \sin^{-1}\left(\frac{x}{a} - 1\right)$ the value of n should be –
(a) 1 (b) -1 (c) 0 (d) ½

30. If x = $\frac{a\sin\theta + b\cos\theta}{a+b}$, then –
(a) The dimension of a and x are same
(b)The dimension of b and x are same
(c) Both (a) and (b)
(d) x is dimensionless

1. (a)
Kilogram is the unit of a physical quantity. It is not the name of physical quantity.

2. (d)
density = $15.7\ \frac{gm}{cm^3} = 15.7\frac{(10^{-3}kg)}{(10^{-2}m)^3}$

3. (d)
Force = $\frac{P}{t}$
Dimension of P = dimension of (Force × time)

4. (c)
1 g cm s^{-1} = $1(10^{-3}$ kg$)(10^{-2}$ m$)$ s^{-1}
= 10^{-5} $kg\frac{m}{s}\times\frac{s}{s}$
= 10^{-5} N.s

5. (a)
$\frac{Energy}{Volume}$ = pressure

6. (c)
$E = M^1L^2T^{-2}$
M & L increased three times so E will increase 27 times

7. (a)
$n_1u_1 = n_1u_2$
Let 1 dyne = nu
Where u = new unit of force[F] = $[M^1L^1T^{-2}]$
1 gm. cm.s^{-2} = n.(10gm) . (10cm) . $(0.1s)^{-2}$
where 10 gm, 10 cm are 0.1 s are new units of mass, length and time respectively
solving the above relation we get n = 10^{-4}
i.e. 1 dyne = 10^{-4}u
or 10^{-5} newton = 10^{-4} u
or $u = \frac{1}{10}$ Newton

8. (a)
P = 10^6 dyne/cm^2
= $10^6 \times 10^{-5}$ N/$(10^{-2}$ m$)^2$
= 10^5 N/m^2

9. (C)Since velocity is derivable from length and time therefore it cannot be grouped with length and time as fundamental quantity.

10. (c)
$U = \frac{ky}{y^2 + a^2}$
$\Rightarrow M^1L^2T^{-2} = \frac{[k][L]}{L^2}$
$\Rightarrow [k] = [M^1L^2T^{-2}][L]$ = Joule × meter

11. (d)

$[M^1L^{-1}T^{-2}]$

12. (a)

$[a]=[x]$

$[a]=[L]$

And

$[E] = \frac{[a-x]}{[b][t]}$

$[b] = \frac{[a-x]}{[E][t]} = \frac{[L]}{[ML^2T^{-2}][T]}$

$=[M^{-1}L^{-1}T^{+1}]$

13. (a)

$Mass \propto F^a L^b T^c$

$M^1 L^0 T^0 = [M^1 L^1 T^{-2}]^a [L]^b [T]^c$ $M^1 L^0 T^0 = M^a L^{a+b} T^{-2a+c}$

so a = 1 a = 1a + b = 0 $\Rightarrow$ b = – 1

– 2a + c = 0 c = 2

14. (d)

$ML^2T^{-2} = \frac{[A]L^{1/2}}{L}$

$[A] = ML^{5/2}T^{-2}$

$[B] = L$

15. (b)

$\frac{1}{2}mv^2 = E$

16. (a)

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

17. (a)

$\frac{e^2}{4\pi\varepsilon_0 hc}$

$[\frac{kq^2}{r^2} = F \Rightarrow ke^2 = Fr^2$

Energy $E = \frac{hc}{\lambda} \Rightarrow hc = E\lambda]$

$\frac{Fr^2}{hc} = \frac{Fr^2}{E\lambda} = [M^0L^0T^0]$

18. (a)

$I = \frac{T_1 - T_2}{R} \Rightarrow R = \frac{T_1 - T_2}{I} = \frac{K}{\frac{ML^2T^{-2}}{T}}$

$= M^{-1}L^{-2}T^3K$

19. (b)

$E = \sigma T^4$, here E is energy per unit area per unit time.

20. (c)
momentum = mass × velocity

21. (b)
ωt = dimension less

dimension of ω = dimension of $\left(\frac{1}{t}\right)$

22. (a)
$\frac{v^2}{rg} = \frac{(L^1T^{-1})^2}{L^1 \times L^1T^{-2}}$ = dimension less.

23. (c)
$X = \left(\frac{Gh}{C^3}\right)^{1/2} = \left[\frac{M^{-1}L^3T^{-2} \times M^1L^2T^{-1}}{L^3T^{-3}}\right]^{1/2}$

24. (c)
$W = F \times \frac{\text{disp.}}{t^2} \times t^2$

$W = F \times A \times T^2$

25. (c)
L/R = Time constant

26. (d)
[Light year] = [Wavelength] = $[L]$

27. (b)
y = A sin (At –Bx +c)
At–Bx + c is dimension less
i.e. [At] = [Bx] = [C] = $[M^0L^0T^0]$
or [A] = $[T^{-1}]$
and [B] = $[L^{-1}]$
and [C] = $M^0L^0T^0$

28. (c)
Coeff. of friction = $\frac{\text{Applied force}}{\text{Normal reaction}}$

$= \frac{[MLT^{-2}]}{[MLT^{-2}]}$ = No dimensions

29. (c)
$\int \frac{dx}{(2ax - x^2)} = a^n \sin^{-1}\left[\frac{x}{a} - 1\right]$.

From R.H.S. dimension of [a] = [L],

Since $\left[\frac{x}{a}\right]$ should be dimensionless.

Dimension L.H.S. : $\frac{[L]}{[L]} = L^0$

Since dimension of $[2ax - x^2]^{1/2} = [L]$

& dimension of [dx] = L

Equating dimensions of L.H.S. & R.H.S. $L^0 = Ln$

n = 0

$L^0 = Ln$

n = 0

30. (d)

As x is a ratio.