PHYSICS

Physical World, Units & Measurements

Speed TEST 1

Chapter-wise

No. of Questions	Maximum Marks	Time
45	**180**	**1 Hour**

GENERAL INSTRUCTIONS

- This test contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solutions provided at the end of this book.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

1. The density of material in CGS system of units is $4 g/cm^3$. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be

(a) 0.4 unit (b) 40 unit
(c) 400 unit (d) 0.04 unit

2. The time period of a body under S.H.M. is represented by: $T = P^a D^b S^c$ where P is pressure, D is density and S is surface tension, then values of a, b and c are

(a) $-\frac{3}{2}, \frac{1}{2}, 1$ (b) $-1, -2, 3$
(c) $\frac{1}{2}, -\frac{3}{2}, -\frac{1}{2}$ (d) $1, 2, \frac{1}{3}$

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

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

4. Young's modulus of a material has the same unit as that of

(a) pressure (b) strain
(c) compressibility (d) force

5. Of the following quantities, which one has dimensions different from the remaining three?

(a) Energy per unit volume
(b) Force per unit area
(c) Product of voltage and charge per unit volume
(d) Angular momentum

6. The pressure on a square plate is measured by measuring the force on the plate and length of the sides of the plate by using the formula $P = \frac{F}{\ell^2}$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then the maximum error in the measurement of pressure is

(a) 1% (b) 2% (c) 8% (d) 10%

RESPONSE GRID	
	1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ
	6. ⓐⓑⓒⓓ

Space for Rough Work

7. The siemen is the SI unit of
(a) resistivity (b) resistance
(c) conductivity (d) conductance

8. An object is moving through the liquid. The viscous damping force acting on it is proportional to the velocity. Then dimensions of constant of proportionality are
(a) $[ML^{-1}T^{-1}]$ (b) $[MLT^{-1}]$
(c) $[M^0LT^{-1}]$ (d) $[ML^0T^{-1}]$

9. The least count of a stop watch is 0.2 second. The time of 20 oscillations of a pendulum is measured to be 25 second. The percentage error in the measurement of time will be
(a) 8% (b) 1.8% (c) 0.8% (d) 0.1%

10. Weber is the unit of
(a) magnetic susceptibility
(b) intensity of magnetisation
(c) magnetic flux
(d) magnetic permeability

11. The physical quantity which has the dimensional formula $[M^1T^{-3}]$ is
(a) surface tension (b) solar constant
(c) density (d) compressibility

12. The dimensions of Wien's constant are
(a) $[ML^0TK]$ (b) $[M^0LT^0K]$
(c) $[M^0L^0TK]$ (d) $[MLTK]$

13. If the capacitance of a nanocapacitor is measured in terms of a unit 'u' made by combining the electric charge 'e', Bohr radius 'a_0', Planck's constant 'h' and speed of light 'c' then
(a) $u = \frac{e^2h}{a_0}$ (b) $u = \frac{hc}{e^2a_0}$
(c) $u = \frac{e^2c}{ha_0}$ (d) $u = \frac{e^2a_0}{hc}$

14. The dimensions of $\frac{1}{\epsilon_0}\frac{e^2}{hc}$ are
(a) $M^{-1}L^{-3}T^4A^2$ (b) $ML^3T^{-4}A^{-2}$
(c) $M^0L^0T^0A^0$ (d) $M^{-1}L^{-3}T^2A$

15. The density of a cube is measured by measuring its mass and length of its sides. If the maximum error in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of density will be
(a) 7% (b) 9% (c) 12% (d) 13%

16. Which is different from others by units ?
(a) Phase difference (b) Mechanical equivalent
(c) Loudness of sound (d) Poisson's ratio

17. A quantity X is given by $\varepsilon_0 L\frac{\Delta V}{\Delta t}$ where ϵ_0 is the permittivity of the free space, L is a length, DV is a potential difference and Dt is a time interval. The dimensional formula for X is the same as that of
(a) resistance (b) charge
(c) voltage (d) current

18. If the error in the measurement of the volume of sphere is 6%, then the error in the measurement of its surface area will be
(a) 2% (b) 3% (c) 4% (d) 7.5%

19. If velocity (V), force (F) and energy (E) are taken as fundamental units, then dimensional formula for mass will be
(a) $V^{-2}F^0E$ (b) V^0FE^2 (c) $VF^{-2}E^0$ (d) $V^{-2}F^0E$

20. Multiply 107.88 by 0.610 and express the result with correct number of significant figures.
(a) 65.8068 (b) 65.807 (c) 65.81 (d) 65.8

21. Which of the following is a dimensional constant?
(a) Refractive index (b) Poissons ratio
(c) Strain (d) Gravitational constant

22. If E, m, J and G represent energy, mass, angular momentum and gravitational constant respectively, then the dimensional formula of EJ^2/m^5G^2 is same as that of the
(a) angle (b) length (c) mass (d) time

23. The refractive index of water measured by the relation $m = \frac{\text{real depth}}{\text{apparent depth}}$ is found to have values of 1.34, 1.38, 1.32 and 1.36; the mean value of refractive index with percentage error is
(a) $1.35 \pm 1.48\%$ (b) $1.35 \pm 0\%$
(c) $1.36 \pm 6\%$ (d) $1.36 \pm 0\%$

RESPONSE GRID					
	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ
	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ
	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ
	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ			

Space for Rough Work

24. If e is the charge, V the potential difference, T the temperature, then the units of $\frac{eV}{T}$ are the same as that of

(a) Planck's constant (b) Stefan's constant
(c) Boltzmann's constant (d) gravitational constant

25. The dimensions of mobility are

(a) $M^{-2}T^{2}A$ (b) $M^{-1}T^{2}A$
(c) $M^{-2}T^{3}A$ (d) $M^{-1}T^{3}A$

26. Two quantities A and B have different dimensions which mathematical operation given below is physically meaningful?

(a) A/B (b) A + B (c) A – B (d) A = B

27. The velocity of water waves (v) may depend on their wavelength l, the density of water r and the acceleration due to gravity, g. The method of dimensions gives the relation between these quantities is

(a) v (b) $v^2 \propto g\lambda$
(c) $v^2 \propto g\lambda^2$ (d) $v^2 \propto g^{-1}\lambda^2$

28. The physical quantities not having same dimensions are

(a) torque and work
(b) momentum and Planck's constant
(c) stress and Young's modulus
(d) speed and $(m_0e_0)^{-1/2}$

29. A physical quantity of the dimensions of length that can be formed out of c, G and $\frac{e^2}{4\pi\varepsilon_0}$ is [c is velocity of light, G is universal constant of gravitation and e is charge]

(a) $c^2\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$ (b) $\frac{1}{c^2}\left[\frac{e^2}{G4\pi\varepsilon_0}\right]^{1/2}$

(c) $\frac{1}{c}G\frac{e^2}{4\pi\varepsilon_0}$ (d) $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

30. The unit of impulse is the same as that of

(a) energy (b) power
(c) momentum (d) velocity

31. If Q denote the charge on the plate of a capacitor of capacitance C then the dimensional formula for $\frac{Q^2}{C}$ is

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

32. The mass of the liquid flowing per second per unit area of cross-section of the tube is proportional to (pressure difference across the ends)^n and (average velocity of the liquid)^m. Which of the following relations between m and n is correct?

(a) m = n (b) m = – n (c) $m^2 = n$ (d) $m = -n^2$

33. The Richardson equation is given by $I = AT^2e^{-B/kT}$. The dimensional formula for AB^2 is same as that for

(a) IT^2 (b) kT (c) Ik^2 (d) Ik^2/T

34. Turpentine oil is flowing through a capillary tube of length ℓ and radius r. The pressure difference between the two ends of the tube is p. The viscosity of oil is given by : $\eta = \frac{p(r^2 - x^2)}{4v\ell}$. Here v is velocity of oil at a distance x from the axis of the tube. From this relation, the dimensional formula of η is

(a) $[ML^{-1}T^{-1}]$ (b) $[MLT^{-1}]$

(c) $[ML^2T^{-2}]$ (d) $[M^0L^0T^0]$

35. Given that y = $A\sin\left[\left(\frac{2\pi}{\lambda}(ct - x)\right)\right]$, where y and x are measured in metre. Which of the following statements is true?

(a) The unit of λ is same as that of x and A
(b) The unit of λ is same as that of x but not of A
(c) The unit of c is same as that of $\frac{2\pi}{\lambda}$
(d) The unit of (ct – x) is same as that of $\frac{2\pi}{\lambda}$

36. If L = 2.331 cm, B = 2.1 cm, then L + B =

(a) 4.431 cm (b) 4.43 cm (c) 4.4 cm (d) 4 cm

37. In the relation $x = \cos(\omega t + kx)$, the dimension(s) of ω is/are

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

RESPONSE GRID					
	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ
	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ	31. ⓐⓑⓒⓓ	32. ⓐⓑⓒⓓ	33. ⓐⓑⓒⓓ
	34. ⓐⓑⓒⓓ	35. ⓐⓑⓒⓓ	36. ⓐⓑⓒⓓ	37. ⓐⓑⓒⓓ	

Space for Rough Work

38. In a vernier callipers, ten smallest divisions of the vernier scale are equal to nine smallest division on the main scale. If the smallest division on the main scale is half millimeter, then the vernier constant is

(a) 0.5 mm (b) 0.1 mm (c) 0.05 mm (d) 0.005 mm

39. Which two of the following five physical parameters have the same dimensions?

(A) Energy density (B) Refractive index
(C) Dielectric constant (D) Young's modulus
(E) Magnetic field

(a) (B) and (D) (b) (C) and (E)
(c) (A) and (D) (d) (A) and (E)

40. In the eqn. $\left(P + \frac{a}{V^2}\right)(V - b) = \text{constant}$, the unit of a is

(a) dyne cm^5 (b) dyne cm^4
(c) dyne/cm^3 (d) dyne cm^2

41. The dimensions of Reynold's constant are

(a) $[M^0L^0T^0]$ (b) $[ML^{-1}T^{-1}]$
(c) $[ML^{-1}T^{-2}]$ (d) $[ML^{-2}T^{-2}]$

42. Which of the following do not have the same dimensional formula as the velocity?

Given that m_0 = permeability of free space, e_0 = permittivity of free space, n = frequency, l = wavelength, P = pressure, r = density, w = angular frequency, k = wave number,

(a) $1/\sqrt{\mu_0 \varepsilon_0}$ (b) n l (c) $\sqrt{P/\rho}$ (d) ωk

43. Unit of magnetic moment is

(a) ampere–$metre^2$ (b) ampere–metre
(c) weber–$metre^2$ (d) weber/metre

44. An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L. In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be:

(a) 1.7% (b) 2.7% (c) 4.4% (d) 2.27%

45. The dimensional formula for magnetic flux is

(a) $[ML^2T^{-2}A^{-1}]$ (b) $[ML^3T^{-2}A^{-2}]$
(c) $[M^0L^{-2}T^2A^{-2}]$ (d) $[ML^2T^{-1}A^2]$

RESPONSE GRID	
	38. ⓐⓑⓒⓓ 39. ⓐⓑⓒⓓ 40. ⓐⓑⓒⓓ 41. ⓐⓑⓒⓓ 42. ⓐⓑⓒⓓ
	43. ⓐⓑⓒⓓ 44. ⓐⓑⓒⓓ 45. ⓐⓑⓒⓓ

PHYSICS CHAPTERWISE SPEED TEST-1			
Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	50	Qualifying Score	70
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

HINTS & SOLUTIONS (PHYSICS – Chapter-wise Tests)

Speed Test-1

1. **(b)** In CGS system,

$$d = 4\frac{g}{cm^3}$$

The unit of mass is 100g and unit of length is 10 cm, so

$$\text{density} = \frac{4\left(\frac{100g}{100}\right)}{\left(\frac{10}{10}cm\right)^3}$$

$$= \frac{\left(\frac{4}{100}\right)}{\left(\frac{1}{10}\right)^3}\frac{(100g)}{(10cm)^3}$$

$$= \frac{4}{100}\times(10)^3\cdot\frac{100g}{(10cm)^3}$$

= 40 unit

2. **(a)** $T = P^a D^b S^c$

$M^0L^0T^1 = (ML^{-1}T^{-2})^a(ML^{-3})^b(MT^{-2})^c$

$= M^{a+b+c}L^{-a-3b}T^{-2a-2c}$

Applying principle of homogeneity

$a + b + c = 0;\ -a - 3b = 0;\ -2a - 2c = 1$

on solving, we get $a = -3/2$, $b = 1/2$, $c = 1$

3. **(a)** Number of significant figures in 23.023 = 5

Number of significant figures in 0.0003 = 1

Number of significant figures in $2.1 \times 10^{-3} = 2$

4. **(a)** $Y = \frac{\text{Stress}}{\text{Strain}} = \frac{\text{Force / Area}}{\text{Dimensionless}} \Rightarrow Y = \text{Pressure.}$

5. **(d)** For angular momentum, the dimensional formula is $[ML^2T^{-1}]$. For other three, it is $[ML^2T^{-2}]$.

6. **(c)** $\frac{\Delta P}{P}\times 100 = \frac{\Delta F}{F}\times 100 + 2\frac{\Delta\ell}{\ell}\times 100 = 4\% + 2\times 2\%$

$= 8\%$

7. **(d)** Conductance,

$$G = \frac{1}{\text{resistance}} = \text{mho}(\Omega^{-1}) \text{ or siemen (S)}$$

8. **(d)** $F \propto v \Rightarrow F = kv \Rightarrow [k] = \left[\frac{F}{v}\right] = \left[\frac{MLT^{-2}}{LT^{-1}}\right] = [ML^0T^{-1}]$

9. **(c)** $\frac{0.2}{25}\times 100 = 0.8\,\%$

10. **(c)** Weber is the unit of magnetic flux in S.I. system.

1 Wb(S.I unit) = 10^8 maxwell

11. **(b)** Solar constant = energy/area/time

$$= \frac{ML^2T^{-2}}{L^2T} = [M^1T^{-3}].$$

12. **(b)** $b = \lambda_m T = LK = [M^0 L^1 T^0 K^1]$

13. **(d)** Let unit 'u' related with e, a_0, h and c as follows.

$[u] = [e]^a [a_0]^b [h]^c [C]^d$

Using dimensional method,

$[M^{-1}L^{-2}T^{+4}A^{+2}] = [A^1T^1]^a[L]^b[ML2T^{-1}]^c[LT^{-1}]^d$

$[M^{-1}L^{-2}T^{+4}A^{+2}] = [M^c L^{b+2c+d} T^{a-c-d} A^a]$

$a = 2,\ b = 1,\ c = -1,\ d = -1$

$$\therefore\quad u = \frac{e^2 a_0}{hc}$$

14. **(c)** From $F = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}$

$$\therefore\quad \frac{e^2}{\varepsilon_0} = 4\pi F r^2 \text{ (dimensionally)}$$

$$\frac{e^2}{\varepsilon_0 hc} = \frac{4\pi Fr^2}{hc} = \frac{(MLT^{-2})L^2}{ML^2T^{-1}[LT^{-1}]} = [M^0L^0T^0A^0],$$

$\frac{e^2}{\varepsilon_0 hc}$ is called fine structure constant & has value $\frac{1}{137}$.

15. **(d)** $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

$$\rho = \frac{M}{L^3} \qquad \therefore\ \frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + 3\frac{\Delta L}{L}$$

% error in density = % error in Mass + 3 (% error in length]

= 4 + 3(3) = 13%

16. **(d)** Poisson's ratio is a unitless quantity.

17. **(d)** Dimensionally $\varepsilon_0 L$ = Capacitance (c)

$$\therefore\ \varepsilon_0 L\frac{\Delta V}{\Delta t} = \frac{C\Delta V}{\Delta t} = \frac{q}{\Delta t} = I$$

18. **(c)** $\frac{\Delta V}{V} = 3\frac{\Delta r}{r}$ or $6\% = 3\frac{\Delta r}{r}$ or $\frac{\Delta r}{r} = 2\%$

Now surface area $s = 4\pi r^2$ or $\log s = \log 4\pi + 2\log r$

$$\therefore\quad \frac{\Delta s}{s} = 2\frac{\Delta r}{r} = 2\times 2\% = 4\%.$$

19. **(d)** Let $(M) = V^a F^b E^c$

Putting the dimensions of V, F and E, we have

$(M) = (LT^{-1})^a \times (MLT^{-2})^b \times (ML^2T^{-2})^c$

or $\quad M^1 = M^{b+c} L^{a+b+2c} T^{-a-2b-2c}$

Equating the powers of dimensions, we have

$b + c = 1$
$a + b + 2c = 0; \quad -a - 2b - 2c = 0$
which give $a = -2$, $b = 0$ and $c = 1$.
Therefore $(M) = (V^{-2} F^0 E)$.

20. **(d)** Number of significant figures in multiplication is three, corresponding to the minimum number
$107.88 \times 0.610 = 65.8068 = 65.8$

21. **(d)** A quantity which has dimensions and a constant value is called dimensional constant. Therefore, gravitational constant (G) is a dimensional constant.

22. **(a)** $\frac{[ML^2T^{-2}][ML^2T^{-1}]^2}{[M^5][M^{-1}L^3T^{-2}]^2} = [M^0L^0T^0]$ = angle.

23. **(a)** The mean value of refractive index,

$$\mu = \frac{1.34 + 1.38 + 1.32 + 1.36}{4} = 1.35$$

and

$$\Delta\mu = \frac{|(1.35 - 1.34)| + |(1.35 - 1.38)| + |(1.35 - 1.32)| + |(1.35 - 1.36)|}{4}$$

$$= 0.02$$

Thus $\frac{\Delta\mu}{\mu} \times 100 = \frac{0.02}{1.35} \times 100 = 1.48$

24. **(c)** $\frac{eV}{T} = \frac{W}{T} = \frac{PV}{T} = R$

and $\frac{R}{N}$ = Boltzmann constant.

25. **(b)** Mobility $\mu = \frac{\text{drift velocity}}{\text{electric field}} \frac{V_d}{E} = \frac{(ms^{-1})}{(Vm^{-1})} = \frac{m^2 s^{-3}}{V}$

$$\left(\because \text{ Volt} = V = \frac{\text{joule(J)}}{\text{coulomb(C)}}\right)$$

$$= \frac{m^2 s^{-1} C}{J} = \frac{m^2 s^{-1} As}{kg m^2 s^{-2}} [\text{Coulomb}, c = As]$$

$$= kg^{-1} s^2 A = M^{-1} T^2 A$$

26. **(a)**

27. **(b)** $v = k \lambda^a \rho^b g^c$

$$[M^0 LT^{-1}] = L^a (ML^{-3})^b (LT^{-2})^c$$
$$= M^b L^{a-3b+c} T^{-2c}$$

$\therefore \; b = 0; a - 3b + c = 1$

$-2c = -1 \Rightarrow c = 1/2 \qquad \therefore \; a = \frac{1}{2}$

$v \propto \lambda^{1/2} \rho^0 g^{1/2}$ or $v^2 \propto \lambda g$

28. **(b)** $[\text{momentum}] = [M][L][T^{-1}] = [MLT^{-1}]$

Planck's constant $= \frac{E}{\nu} = \frac{[M][LT^{-1}]^2}{T^{-1}} = ML^2T^{-1}$

29. **(d)** Let dimensions of length is related as,

$$L = [c]^x [G]^y \left[\frac{e^2}{4\pi\varepsilon_0}\right]^z$$

$$\frac{e^2}{4\pi\varepsilon_0} = ML^3T^{-2}$$

$L = [LT^{-1}]^x [M^{-1}L^3T^{-2}]^y [ML^3T^{-2}]^z$

$[L] = [L^{x+3y+3z} M^{-y+z} T^{-x-2y-2z}]$

Comparing both sides

$-y + z = 0 \Rightarrow y = z$ ...(i)

$x + 3y + 3z = 1$ ...(ii)

$-x - 4z = 0 \quad (\because y = z)$ ...(iii)

From (i), (ii) & (iii)

$z = y = \frac{1}{2}, \; x = -2$

Hence, $L = c^{-2}\left[G \cdot \frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

30. **(c)** Impulse = change in momentum

31. **(c)** We know that $\frac{Q^2}{2C}$ is energy of capacitor so it represent the dimension of energy = $[ML^2T^{-2}]$.

32. **(b)** Let $M = p^n v^m$

$$ML^{-2} T^{-1} = (ML^{-1} T^{-2})^n (LT^{-1})^m$$
$$= M^n L^{-n+m} T^{-2n-m}$$

$\therefore \; n = 1; -n + m = -2$

$\therefore \; m = -2 + n = -2 + 1 = -1 \qquad \therefore \; m = -n$

33. **(c)** $I = AT^2 e^{-B/kT}$

Dimensions of $A = I/T^2$; Dimensions of $B = kT$

($\because$ power of exponential is dimensionless)

$$AB^2 = \frac{I}{T^2}(kT)^2 = Ik^2$$

34. **(a)** $\eta = \frac{p(r^2 - x^2)}{4vl} = \frac{[ML^{-1}T^{-2}][L^2]}{[LT^{-1}][L]} = [ML^{-1}T^{-1}]$

35. **(a)** The unit of λ, x and A are the same

36. **(c)** $L + B = 2.331 + 2.1 \cong 4.4$ cm

Since minimum significant figure is 2.

37. **(c)** Given, $x = \cos(\omega t + kx)$

$(\omega t + kx)$ is an angle and hence it is a dimension less quantity.

$[(\omega t + kx)] = [M^0L^0T^0]$

or $[\omega t] = [M^0L^0T^0]$

$$[\omega] = \frac{[M^0L^0T^0]}{[T]} = [M^0L^0T^{-1}]$$

38. **(c)** $10\text{ VD} = 9\text{MD}, 1\text{VD} = \frac{9}{10}\text{MD}$

Vernier constant = 1 MD − 1 VD

$$= \left(1 - \frac{9}{10}\right)\text{MD} = \frac{1}{10}\text{MD} = \frac{1}{10} \times \frac{1}{2} = 0.05\text{ mm}$$

39. **(c)** $[\text{Energy density}] = \frac{[\text{Work done}]}{[\text{Volume}]}$

$$= \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$

$[\text{Young's Modulus}] = \left[\frac{F}{A} \times \frac{l}{\Delta l}\right]$

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

40. **(b)** As $\frac{a}{V^2} = P$

$\therefore\ a = PV^2 = \frac{\text{dyne}}{\text{cm}^2}(\text{cm}^3)^2 = \text{dyne cm}^4$

41. **(a)** Reyonld's constant is a pure number, hence it has no dimensions.

42. **(d)** $\omega k = \frac{1}{T} \times \frac{1}{L} = [L^{-1}\,T^{-1}]$

The dimensions of the quantities in a, b, c are of velocity $[LT^{-1}]$

43. **(a)** M = Pole strength × length

= amp – metre × metre = amp – metre^2

44. **(b)** According to the question.

$t = (90 \pm 1)$ or, $\frac{\Delta t}{t} = \frac{1}{90}$

$l = (20 \pm 0.1)$ or, $\frac{\Delta l}{l} = \frac{0.1}{20}$

$\frac{\Delta g}{g}\% = ?$

As we know,

$$t = 2\pi\sqrt{\frac{l}{g}}$$

$$\Rightarrow \quad g = \frac{4\pi^2 l}{t^2}$$

or, $\frac{\Delta g}{g} = \pm\left(\frac{\Delta l}{l} + 2\frac{\Delta t}{t}\right)$

$$= \left(\frac{0.1}{20} + 2 \times \frac{1}{90}\right)$$

$$= 0.027$$

$\therefore \quad \frac{\Delta g}{g}\% = 2.7\%$

45. **(a)** Dimension of magnetic flux

= Dimension of voltage × Dimension of time

$= [ML^2T^{-3}A^{-1}]\,[T] = [ML^2T^{-2}A^{-1}]$

$\because \text{Voltage} = \frac{\text{work}}{\text{charge}}$