Units and Dimensions

1. The dimensional formula for Areal Velocity is

1. $\left[M^0L^{-2}T^{-1}\right]$ 2. $\left[M^0L^{-2}T^1\right]$ 3. $\left[M^0L^2T^{-1}\right]$ 4. $\left[M^0L^2T^1\right]$

2. If P is the X-ray unit and Q is micron then P/Q is

1. 10^{-5} 2. 10^5 3. 10^7 4. 10^{-7}

3. [Jm^{-2}] is the unit of

1. Surface Tension 2. Viscosity
3. Strain Energy 4. Intensity of Energy

4. Linear Momentum and Angular Momentum have the same dimensions in

1. Mass and Length 2. Length and Time
3. Mass and Time 4. Mass, Length and Time

5. The angle subtended at the centre of a circle by an arc whose length is equal to the diameter of the circle is

1. Radian 2. 2 Radian
3. π Radian 4. $\pi/2$ Radian

6. The dimensions of (velocity)/radius are the same as that of

1) Planck's constant 2) Gravitational constant
3) Dielectric constant 4) Acceleration due to Gravity

7. The physical quantities not having same dimensions are

1) Torque and Work 2) Momentum and Planck's constant
3) Stress and Young's Modulus 4) Speed and $\left(\mu_0 \epsilon_o\right)^{-1/2}$

8. The dimensional formula of resistivity in terms of M, L, T and Q, where Q stands for the dimensions of charge is

1) $[ML^3T^{-1}Q^{-2}]$ 2) $[ML^3T^{-1}Q^{-1}]$ 3) $[ML^2T^{-1}Q^{-1}]$ 4) $[MLT^{-1}Q^{-1}]$

9. The dimensional formula for magnetic flux is

1) $[ML^2T^{-2}I^{-1}]$ 2) $[ML^2T^{-2}I^{-2}]$ 3) $[ML^{-2}T^{-2}I^{-1}]$ 4) $[ML^{-2}T^{-2}I^{-2}]$

10. If μ is the permeability and ϵ is the permittivity then $\frac{1}{\sqrt{\mu\epsilon}}$ is equal to

1. Speed of sound 2. Speed of light in vacuum
3. Speed of sound in medium 4. Speed of light in medium

11. $\frac{1}{\sqrt{\text{Capacitance} \times \text{Inductance}}}$ **has the same unit as**

1) Time 2) Velocity 3) Velocity gradient 4) None of the above

12. **$[M^1L^2T^{-3}A^{-2}]$ is the dimensional formula of**

1. Electric resistance
2. Capacity
3. Electric potential
4. Specific resistance

13. **If m is the mass, Q is the charge and B is the magnetic induction, *m/BQ* has the same dimensions as**

1. Frequency
2. Time
3. Velocity
4. Acceleration

14. **Consider the following two statements A and B and identify the correct answer.**

A) The size (u) of the unit of physical quantity and its numerical magnitude (n) are related to each other by the relation nu = constant.

B) The choice of mass, length and time as fundamental quantities is not unique.

1) A is true but B is false
2) B is true but A is false
3) Both A and B are true
4) Both A and B are false

15. **Consider the following two statements A and B and identify the correct answer**

A) The MKS system is a coherent system of units

B) In SI, joule is the unit for all forms of energy

1) A is true but B is false
2) B is true but A is false
3) Both A and B are true
4) Both A and B are false

16. **With usual notation, the following equation, said to give the distance covered in the n^{th} second i.e., is** $S_n = u + a\frac{(2n-1)}{2}$

1) Numerically correct only
2) Dimensionally correct only
3) Both dimensionally and numerically correct
4) Neither numerically nor dimensionally corrects

17. The pair of quantities having neither units nor dimensions is

1) Plane angle and Specific gravity

2) Magnetic permeability and Relative Permittivity

3) Coefficient of friction and Coefficient of restitution

4) Linear momentum and Angular momentum

18. The physical quantity which has dimensional formula as that of $\frac{\text{Energy}}{\text{mass} \times \text{length}}$ is

1) Force 2) Power 3) Pressure 4) Acceleration

19. Out of the following the correct order of dimensions of mass increases is

a) Velocity b) Power c) Gravitational Constant

1) a, b, c 2) c, a, b 3) a, c, b 4) b, c, a

20. The correct order in which the dimensions of time decreases in the following physical quantities.

a) Power b) Modulus of elasticity

c) Moment of inertia d) Angular momentum

1) a, b, d, c 2) c, d, a, b 3) a, c, d, b 4) c, d, b, a

21. (A): Plane angle has unit but no dimensional formula.

(B): All dimensions less quantities are unit less.

1) Both A & B are true 2) Both A & B are false

3) Only A is true 4) Only B is true

22. (A): The correctness of an equation is verified using the principle of homogeneity.

(B): All units less quantities are dimensional less.

1) Both A & B are true 2) Both A & B are false

3) Only A is true 4) Only B is true

23. (A): The value of dimensionless constants or proportionality constants cannot be found by dimensional methods.

(B): The equations containing trigonometrical, exponential and logarithmic functions cannot be analyzed by dimensional methods.

1) Both A & B are true 2) Both A & B are false

3) Only A is true 4) only B is true

24. **The pair of physical quantities not having the same dimensional formula are (1993E)**

1. Acceleration, Gravitational field strength
2. Torque, Angular momentum
3. Pressure, Modulus of elasticity
4. All the above

25. **A pair of physical quantities having the same dimensional formula is**

1. Momentum and Impulse
2. Momentum and Energy
3. Energy and Pressure
4. Force and Power

26. **A pair of physical quantities having the same dimensional formula is**

1. Force and Work
2. Work and Energy
3. Force and Torque
4. Work and Power

27. **The pair of physical quantities having the same dimensional formula is**

1. Angular momentum and Torque
2. Torque and Strain energy
3. Entropy and Power
4. Power and Angular momentum

28. **If the dimensions of velocity, acceleration and length are yz^{-1}, yz^{-2} and xy respectively, the dimensions of the coefficient of friction is**

(1) $x^0y^0z^0$ (2) $x^{-1}y^0z^0$ (3) $x^1y^0z^0$ (4) $x^{-1}y^{-1}z^0$

29. **Poise is the unit of**

(1) Torque (2) Viscosity (3) Surface Tension (4) Moment of Inertia

30. **Surface tension has the same dimensional formula as that of**

(1) Spring constant (2) Compliance (3) Viscosity (4) Entropy

31. **A spherical body of mass m and radius r is allowed to fall in a medium of viscosity η. The time in which the velocity of the body increases from zero to 0.63 times the terminal velocity (v) is called time constant (τ). Dimensionally can be represented by**

(1) $\frac{mr^2}{6\pi\eta}$ (2) $\frac{6\pi mr\eta}{g^2}$ (3) $\frac{m}{6\pi\eta rv}$ (4) none of these

32. **Which of the following have the same dimensions?**

(1) Planck's constant and Gas constant (2) Latent heat and Gravitational potential

(3) Work and Power (4) Impulse and Torque

33. **The dimensional formula of λ from equation $N = N_0e^{-\lambda t}$ where N is the number of atoms remaining after a time t of a radioactive decay is**

(1) $M^0L^0T^0$ (2) M^0L^0T (3) $M^0L^0T^{-1}$ (4) MLT

34. Electron volt is the unit of

(1) Energy (2) Potential difference (3) Charge (4) Potential gradient

35. Assume that the mass m of the largest stone that can be moved by a flowing river depends upon the velocity v of water, its density and acceleration due to gravity g. Then m is proportional to

(1) v^2 (2) v^4 (3) v^6 (4) v^8

36. The dimensions of resistance x capacitance are same as for

(1) Frequency (2) Energy (3) Time Period (4) Current

37. The dimensional formula for Planck's constant is

(1) $M^1L^{-1}T^{-2}$ (2) ML^2T^{-1} (3) $ML^{-1}T^{-1}$ (4) MLT^{-1}

38. The dimensional formula for E/B, where E is intensity of electric field and B is magnetic induction, is as same as that of

(1) Velocity (2) Force (3) Pressure Head (4) Entropy

39. (A): Electric current is a scalar.

(R): All fundamental physical quantities are scalar.

1. A and R are correct and R is correct explanation of A.
2. A and R are correct and R is correct not correct explanation A.
3. A is true and R is false.
4. A is false and R is true.

40. (A): The equation y=x+t can not be true where x, y are the distances and t is time.

(R): Quantities with different dimensions cannot be added.

1. A and R are correct and R is correct explanation of A.
2. A and R are correct and R is correct not correct explanation A.
3. A is true and R is false.
4. A is false and R is true.

41. A: Surface tension and spring constant have the same dimensions.

R: Both are equivalent to force per unit length.

1. A and R are correct and R is correct explanation of A.
2. A and R are correct and R is correct not correct explanation A.
3. A is true and R is false.
4. A is false and R is true.

42. (A): Elastic strain is a dimensionless quantity.

(R): The ratio of two similar physical quantities is dimensionless.

(1) A is true, R is true and R is the correct explanation of A.

(2) A is true, R is true but R is not the correct explanation of A.

(3) A is true, R is false.

(4) Both A and R are false.

43. (A): If e is charge, h the plank's constant, and c the velocity of light, then the quantity e^2/hc is a number.

(R): The dimensions of e^2 are the same as those of the product hc.

(1) A is true, R is true and R is the correct explanation of A.

(2) A is true, R is true but R is not the correct explanation of A.

(3) A is true, R is false.

(4) Both A and R are false.

44. (A): If u_1 and u_2 are units and n_1, n_2 are their numerical values in two different systems then $n_1 > n_2 \Rightarrow u_1 < u_2$.

(R): The numerical value of physical quantity is inversely proportional to unit.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).

(2) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

45. (A): The value of 'G' can not be derived by dimensional method.

(R): The value of proportionality constants can not be derived by dimensional method.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).

(2) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

46. **(A): In mechanics, we treat length, mass and time as the three basic or fundamental quantities.**

(R): Length, mass and time cannot be obtained from one another.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).

(2) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

47. **(A): When the unit of measurement of a quantity is changed, its numerical value changes.**

(R): Smaller the unit of measurement smaller is its numerical value.

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).

(2) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

48. **Match the following:**

a) Same negative	**e) Pressure, Dimensions of mass Rydberg constant**
b) Same negative	**f) Magnetic induction dimensions of length field, potential**
c) Same dimensions	**g) Capacity, Universal of time gravitational constant**
d) Same dimensions	**h) Energy density of current Surface tension**

1) a - g b - e c - h d - f

2) a - g b - h c - e d - f

3) a - e b - f c - g d - h

4) a - f b - e c - h d - g

49. **Match the following.**

a) Planck's constant	**e)** $ML^{-1}T^{-2}$
b) Gravitational constant	**f)** $ML^{-1}T^{-1}$
c) Bulk modulus	**g)** $ML^{2}T^{-1}$
d) Coefficient of viscosity	**h)** $M^{-1}L^{3}T^{-2}$

1) a - h; b - g; c - f; d - e

2) a - f; b - e; c - g; d - h

3) a - g; b - f; c - e; d - h

4) a - g; b - h; c - e; d - f

50. Match the following.

a) Pa s	**e) $L^2T^{-2}K^{-1}$**
b) NmK^{-1}	**f) $MLT^{-3}K^{-1}$**
c) $Jkg^{-1}K^{-1}$	**g) $ML^{-1}T^{-1}$**
d) $Wm^{-1}K^{-1}$	**h) $ML^2T^{-2}K^{-1}$**

1) a - h; b - g; c - e; d - f

2) a - g; b - f; c - h; d - e

3) a - g; b - e; c - h; d - f

4) a - g; b - h; c - e; d - f

51. Match the following.

a) Electron volt	**e) 746 W**
b) KWH	**f) 10^{-15} m**
c) Horse power	**g) 36×10^5 J**
d) Fermi	**h) 1.6×10^{-19}J**

(1) a-h, b-g, c-e, d-f (2) a-h, b-f, c-g, d-e

(3) a-g, b-h, c-e, d-f (4) a-h, b-g, c-f, d-e

52. Match the following.

a) Pressure	**e) $ML^2T^{-2}I^{-1}$**
b) Latent heat	**f) $M^0L^0T^{-1}$**
c) Velocity gradient	**g) $ML^{-1}T^{-2}$**
d) Magnetic flux	**h) $M^0L^2T^{-2}$**

(1) a-h, b-f, c-g, d-e (2) a-g, b-h, c-e, d-f

(3) a-g, b-h, c-f, d-e (4) a-f, b-g, c-e, d-h

53. Match the following.

a) Surface tension — **e) Gas constant**

b) Specific heat — **f) Areal velocity**

c) Latent heat — **g) Spring constant**

d) Kinematic viscosity — **h) Gravitational potential**

(1) a-e, b-g, c-h, d-f (2) a-f, b-h, c-g, d-e

(3) a-g, b-f, c-h, d-e (4) a-g, b-e, c-h, d-f

54. Match the following.

a) Same negative dimensions of mass — **e) Pressure, Rydberg constant**

b) Same negative dimensions of length — **f) Magnetic induction field, Potential**

c) Same dimensions of time — **g) Capacity, Universal gravitational constant**

d) Same dimensions of current — **h) Energy density, Surface tension**

(1) a-g, b-e, c-h, d-f (2) a-g, b-h, c-c, d-f

(3) a-e, b-f, c-g, d-h (4) a-f, b-e, c-h, d-g

55. A force of 40N acts on a body. If the units of mass and length are doubled and the unit of time is tripled, then the force in the new system becomes

1) 90 N 2) 90 new units 3) $\frac{160}{9}$ new units 4) $\frac{160}{9}$N

56. If the unit of power is million erg/minute, the unit of force is 1000 dyne and the unit of length is 5/3 cm then the unit of time is (in second)

1) 10 2) 1 3) 1/10 4) 1/100

57. If J is the angular momentum and E is the kinetic energy, then $\frac{J^2}{E}$ has the dimensions of

1) Moment of Inertia 2) Power 3) Angular velocity 4) Impulse

58. If the unit of mass is kg, the unit of length is β metre and the unit of time is 'γ' second, the magnitude of calorie in the new system is (1 Cal = 4.2 J)

1) 4.2 $\alpha^2\beta^2\gamma^2$ new units 2) 4.2 $\alpha^{-1}\beta^{-2}\gamma^2$ new units

3) $\alpha^{-1}\beta^{-2}\gamma^2$ New units 4) $\frac{1}{4.2}\alpha^{-1}\beta^{-2}\gamma^2$ new units

59. **The number of particles crossing unit area perpendicular to x-axis in unit time is given by $n = \frac{-D(n_2 - n_1)}{x_2 - x_1}$ where n_1 and n_2 are number of particles per unit volume for the value of x meant to x_1 and x_2. The dimensions of D are**

1) $M^{\circ}L\,T^{3}$ 2) $M^{\circ}L^{2}\,T^{-4}$ 3) $M^{\circ}L\,T^{-2}$ 4) $M^{\circ}L^{2}\,T^{-1}$

60. **Dimensional formula of the product of the two physical quantities P and Q is $ML^{2}T^{-2}$, the dimensional formula of P/Q is MT^{-2}. P and Q respectively are**

1) Force, Velocity 2) Momentum, Displacement
3) Force, Displacement 4) Work, Velocity

61. **If $\log\eta = \frac{A}{B}$ (Bx+C) is dimensionally true, then (here h is the coefficient of viscosity and x is the distance)**

1) C is dimensionless constant 2) B has dimensions of -1 in length
3) The dimensional formula of A is $ML^{-2}T^{-1}$ 4) All the above are true.

62. **The Vander Waals equation for a gas is $\left(P + \frac{a}{V^2}\right)$ (V – b) = nRT where P, V, R, T and n represent the pressure, volume, universal gas constant, absolute temperature and number of moles of a gas respectively. a and b are constants. The ratio b/a will have the following dimensional formula**

1) $M^{-1}L^{-2}T^{2}$ 2) $M^{-1}L^{-1}T^{-1}$ 3) $ML^{2}T^{2}$ 4) MLT^{-2}

63. **A quantity X is given by $\epsilon_0 L \frac{\Delta V}{\Delta t}$ where ϵ_0 is the permittivity of free space, L is a length ΔV is a potential difference and Δt is a time interval. The dimensional formula for X is the same as that of**

1) Resistance 2) Charge 3) Voltage 4) Current

64. **If velocity of light C, universal gravitational constant G and Planck's constant h are the fundamental quantities in a system of measurement, then the dimensional formula for mass is**

1) $C^{\frac{1}{2}}\,G^{\frac{-1}{2}}\,h^{\frac{1}{2}}$ 2) $C^{\frac{1}{2}}\,G^{\frac{1}{2}}\,h^{\frac{1}{2}}$ 3) $C^{\frac{3}{2}}\,G^{\frac{-1}{2}}\,h^{\frac{1}{2}}$ 4) $C^{\frac{1}{2}}\,G^{\frac{3}{2}}\,h^{\frac{1}{2}}$

65. Bernoulli's Equation is given by $P+\frac{1}{2}\rho v^2+\rho gh=constant$**. The quantity $v^2/2$ has the same units as that of**

(1) Force (2) Impulse (3) Strain (4) Pressure

66. The time period of a small liquid drop of density 'd', radius 'r' and surface tension 'S' is

1) $T=k\sqrt{\left(\frac{d}{Sr^3}\right)}$ 2) $T=k\sqrt{\left(\frac{dr^3}{S}\right)}$ 3) $T=k\sqrt{\left(\frac{dS}{r^3}\right)}$ 4) $T=\sqrt{\left(\frac{Sr^3}{d}\right)}$

67. If P represents radiation pressure, C represents speed of light and Q represents radiation energy striking unit area per second, then non zero integers x, y and z, such that $P^x.Q^y.C^z$ is dimensionless are

1) x = 1, y = 1, z = -1 2) x = 1, y = -1, z = 1 3) x = -1, y = 1, z = 1 4) x = 1, y = 1, z = 1

68. If K represents kinetic energy, V velocity and T time, and these are chosen as the fundamental units then, the units of surface tension will be:

1) $KV^{-2}T^{-2}$ 2) $KV^{-1}T^{-2}$ 3) $K^2V^{-1}T^{-3}$ 4) $KV^{-2}T^{-1}$

69. A certain body of mass M moves under the action of a conservative force with potential energy V given by $V=\frac{Kx}{x^2+a^2}(x\rightarrow distance, a\rightarrow amplitude)$ **in this equation the units of K will be equal to that of:**

1) Power 2) Couple 3) Joule-metre 4) all are true

70. Which one of the following formulae is dimensionally correct?

1) $h=\frac{2\rho g\cos\theta}{2Tr}$ 2) $h=\frac{2T\cos\theta}{r\rho g}$ 3) $h=\frac{2Trg\rho}{\cos\theta}$ 4) $h=\frac{2Tr}{\rho g\cos\theta}$

71. A solid cylinder rolls down an inclined plane without slipping. The velocity of the cylinder at the bottom of the plane, if the height of the plane is h, is given by:

1) $\frac{3gh}{4}$ 2) $\sqrt{\left(\frac{4g}{h}\right)}$ 3) $\sqrt{\left(\frac{2g}{h}\right)}$ 4) $\sqrt{\left(\frac{4gh}{3}\right)}$

72. Given that $y = a\cos\left(\frac{t}{p} - qx\right)$, where t is time in seconds and x is distance in metre. Which of the following statements is true?

1) The unit of x is same as that of 'q'

2) The unit of x is same as that of 'p'

3) The unit of t is the same as that of 'q'

4) The unit of t is the same as that of 'p'

73. For the equation $F \propto A^x V^y D^z$ F is force, A is area, V is the velocity and D is the density with the dimensional analysis gives the following results:

1) x=1, y=2,z=1 2) x=2,y=1, z=1 3) x=1,y=1,z=2 4) x=0,y=1,z=1

74. The dimensions of $\frac{1}{\epsilon_0} \times \frac{e^2}{hc}$

1) $[A^2L^{-3}T^4M^{-4}]$ 2) $[A^{-2}T^{-4}L^3M]$ 3) $[A^0M^0L^0T^0]$ 4) $[AT^2L^{-3}M^{-1}]$

75. The viscosity 'η' of a gas is determined by its density 'd', molecular velocity 'c' and its mean free path l, then $\frac{\eta}{dcl}$ has the dimensional formula

1) MLT^{-2} 2) MLT^{-1} 3) $M^0L^0T^0$ 4) $M^0L^0T^{-1}$

76. In a particular system, the units of length, mass and time are chosen to be 10cm 10gm and 0.1sec respectively the unit of force in this system will be equivalent to

1) 0.1N 2) 1N 3) 10N 4) 100N

77. Pressure gradient $\frac{dp}{dx}$ is rate of change of pressure with distance. What are the dimensions of $\frac{dp}{dx}$?

1) $ML^{-1}T^{-1}$ 2) $ML^{-2}T^{-2}$ 3) $ML^{-1}T^{-2}$ 4) $ML^{-2}T^{-1}$

78. To determine the Young's modulus of a wire, the formula is $Y = \frac{F}{A} \times \frac{L}{\Delta L}$; where L = length, $A =$ area of cross-section of the wire, $\Delta L =$ change in length of the wire when stretched with a force F. The conversion factor to change it from CGS to MKS system is

1) 1 2) 1 3) 0.1 4) 0.01

Key

(1) 3	(2)4	(3)1	(4)3	(5)2	(6)4	(7)2	(8)1	(9)1	(10)4
(11)3	(12)1	(13)2	(14)3	(15)1	(16)3	(17)3	(18)4	(19)2	(20)4
(21)3	(22)1	(23)1	(24)1	(25)1	(26)2	(27)2	(28)1	(29)2	(30)1
(31)4	(32)2	(33)3	(34)1	(35)3	(36)3	(37)2	(38)1	(39)2	(40)2
(41)1	(42)1	(43)1	(44)1	(45)1	(46)1	(47)3	(48)1	(49)4	(50)4
(51)1	(52)3	(53)4	(54)1	(55)2	(56)3	(57)4	(58)2	(59)4	(60)3
(61)4	(62)1	(63)4	(64)1	(65) 4	(66) 2	(67) 2	(68) 1	(69) 3	(70) 2
(71)4	(72) 4	(73) 1	(74) 3	(75)3	(76)1	(77)3	(78) 3		

Hints

55. $n_1u_1 = n_2u_2$

$$40\left(\frac{ML}{T^2}\right) = n_2 = \frac{2M2L}{(3T)^2}$$

$$40\left(\frac{ML}{T^2}\right) = \frac{4}{9}n_2\left(\frac{ML}{T^2}\right)$$

$$40 = \frac{4}{9}n_2$$

$n_2 = 90$ new units

56. $P = \frac{FL}{T} \Rightarrow T = \frac{FL}{P}$

$T = \frac{1000}{10^6} x \frac{5}{3} x\ 60 = \frac{1}{10} sec$

57. $\frac{J^2}{E} = \frac{(ML^2T^{-2})}{ML^2T^{-2}} = ML^2$

58. $n_1U_1 = n_2U_2$

$4.2\ J = n_2\left(\frac{\alpha \beta^2}{\gamma^2}\right) J$

$4.2 \alpha^{-1}\beta^{-2}\gamma^2 = n_2$

59. $n = \frac{1}{Area \times time} = L^{-2}T^{-1}$

$(x_2 - x_1) = L$

$(n_2 - n_2) = \frac{1}{L^3}$

$\therefore D = \left(\frac{x_2 - x_1}{n_2 - n_1}\right).n$

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

60. $P.Q = ML^2T^{-2}$

$\frac{P}{Q} = MT^{-2}$

$P^2 = M^2L^2T^{-4}$

$P = MLT^{-2}$

$Q = L$

61. $\eta = \frac{A}{B} log\,(Bx + C)$

C $\rightarrow$ Dimension less

$B = L^{-1}$

$\frac{A}{B} = \eta$

A = η.B = $ML^{-1}T^{-1}L^{-1}$

A = $ML^{-2}\ T^{-1}$

62. $\left(p+\frac{a}{v^2}\right)(v-b)=RT$

a = $pv^2 = ML^{-1}\ T^{-2}\ L^6$

a = ML^5T^{-2}

b = L^3

$$\frac{b}{a}=\frac{L^3}{ML^5T^{-2}}=M^{-1}L^{-2}T^2$$

63. $x=\epsilon_0\ L.\frac{\Delta V}{\Delta T}$

$= M^{-1}L^{-3}T^4I^2\ \frac{L.ML^2T^{-3}I^{-1}}{T}$ I (current)

64. $M\propto C^xG^yh^z$

$M\propto(LT^{-1})^x(M^{-1}L^3T^{-2})^y(ML^2T^{-1})^Z$

-y + z = 1

x + 3y + 2z = 0

-x - 2y - z = 0

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

$M=C^{1/2}.G^{-1/2}.h^{1/2}$

66. Let $T\propto d^xr^ys^z$ (or) T = k. $d^x\ r^y\ s^z$.

Writing dimensions on both the sides and comparing powers of T, M, L, we get

$M^0L^0T = [ML^{-3}]^x\ [L]^y\ [MT^{-2}]^z = M^{x+z}\ L^{-3x+y}\ T^{-2z}$

z = -1/2, x = 1/2, y = 3/2

$$\therefore T=k\sqrt{\frac{dr^3}{s}}$$

67. $[P^xQ^yC^z) = [M^0L^0T^0]$.

$$\therefore [M^0L^0T^0] = [ML^{-1}T^{-2}]^x\left[\frac{ML^2T^{-2}}{L^2\times T}\right]^y[LT^{-1}]^z$$

$M^0L^0T^0 = M^{(x+y)}\ L^{(-x+z)}\ T^{(-2x-3y-z)}$

Trying the options, the correct answer is x = 1,

y = -1, z = 1.

75. Dimensional formula of η = $ML^{-1}T^{-1}$

Dimensional formula of d = ML^{-3}

Dimensional formula of c = LT^{-1}

Dimensional formula of l = L

On substituting these, $\frac{\eta}{dcl}$ has the dimensional formula $[M^0L^0T^0]$

76. n_1 C.G.S units = n_2 new units

$n_1[M_1L_1T_1^{-2}] = n_2\ [M_2L_2T_2^{-2}]$

$$n_1 = n_2\left[\frac{M_2}{M_1}\right]\left[\frac{L_2}{L_1}\right]\left[\frac{T_2}{T_1}\right]^{-2}$$

$$\Rightarrow \frac{n_1}{n_2} = \frac{10gm}{gm} + \frac{10cm}{cm} + \frac{\sec^2}{y_{100}\sec^2}$$

$n_1 = 10^4 n_2$

From equation (1)

$10^4 n_2$ dyne = n_2

1new unit = 0.1N

77. $Dimensions\ \ of\ \frac{dp}{dx} = \frac{\dim ensions\ of\ \ p}{\dim ension\, of\ \ x} = \frac{ML^{-1}T^{-2}}{L}$

78. $Y = \frac{F}{A}.\frac{L}{\Delta L} = \frac{dyne}{cm^2} = \frac{10^{-5}N}{10^{-4}m^2} = 0.1N/m^2$