UNIT AND DIMENSIONS & VECTORS

1. The vector projection of a vector $3\hat{i} + 4\hat{k}$ on y-axis is

(a) 5 (b) 4

(c) 3 (d) zero

2. Position of a particle in a rectangular co-ordinate system is (3, 1, 5). Then its position vector will be

(a) $3\hat{i}+5\hat{j}+2\hat{k}$ (b) $3\hat{i}+\hat{j}+5\hat{k}$

(c) $5\hat{i}+3\hat{j}+2\hat{k}$ (d) None of these

3. A force of 5 N acts on a particle along a direction making an angle of 60^o with vertical. Its vertical component will be

(a) 10 N (b) 3 N

(c) 4 N (d) 2.5 N

4. Two persons A and B are located in X-Y plane at the points (0, 0) and (0, 10), respectively. (The distances are measured in MKS units). At a time t = 0, they start moving simultaneously with velocities $\hat{\upsilon}_A = 2\hat{j}$ ms^{-1} and $\hat{\upsilon}_B = 2\hat{i}$ ms^{-1}, respectively. The time after which A and B are at their closest distance is

(a) 2.5 s (b) 4 s

(c) 1s (d) $\frac{10}{\sqrt{2}}$ s

5. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the x-axis an angle of

(a) 30^o

(b) 45^o

(c) 60^o

(d) 0^o

6. The component of vector A = $2\hat{i}+3\hat{j}$ along the vector $\hat{i}+\hat{j}$ is

(a) $\frac{5}{\sqrt{2}}$ (b) $10\sqrt{2}$

(c) $5\sqrt{2}$ (d) 5

7. The angle made by the vector A = $\hat{i}+\hat{j}$ with x-axis is

(a) 90^o (b) 45^o

(c) 22.5^o (d) 30^o

8. Angular momentum is

(a) A scalar

(b) A polar vector

(c) An axial vector

(d) None of these

9. If $\vec{P} = \vec{Q}$ then which of the following is NOT correct

(a) $\hat{P} = \hat{Q}$

(b) $|\vec{P}| = |\vec{Q}|$

(c) $P\hat{Q} = Q\hat{P}$

(d) $\vec{P}+\vec{Q} = \hat{P}+\hat{Q}$

10. If a unit vector is represented by $0.5\hat{i}+0.8\hat{j}+c\hat{k}$, then the value of 'c' is

(a) 1 (b) $\sqrt{0.11}$

(c) $\sqrt{0.01}$ (d) $\sqrt{0.39}$

11. There are two force vectors, one of 5 N and other of 12 N. At what angle the two vectors be added to get resultant vector of 17 N, 7N and 13 N respectively

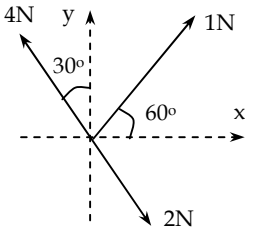
(a) 0^o, 180^a and 90^o

(b) 0^o, 90^o and 180^o

(c) 0^o, 90^o and 90^o

(d) 180^o, 0^o and 90^o

12. Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is



(a) $\frac{\sqrt{3}}{4}$ N (b) $\sqrt{3}$ N

(c) 0.5 N (d) 1.5 N

13. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e., $\vec{A}+\vec{B}+\vec{C}$

(a) Can be zero

(b) Cannot be zero

(c) Lies in the plane containing $\vec{A}+\vec{B}$

(d) Lies in the plane containing $\vec{C}$

14. y component of velocity is 20 and x component of velocity is 10. The direction of motion of the body with the horizontal at this instant is

(a) $\tan^{-1}(2)$

(b) $\tan^{-1}(1/2)$

(c) 45°

(d) 0°

15. The value of the sum of two vectors $\vec{A}$ and $\vec{B}$ with θ as the angle between them is

(a) $\sqrt{A^2+B^2+2AB\cos\theta}$

(b) $\sqrt{A^2-B^2+2AB\cos\theta}$

(c) $\sqrt{A^2+B^2-2AB\sin\theta}$

(d) $\sqrt{A^2+B^2+2AB\sin\theta}$

16. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{j}-4\hat{i}+a\hat{k}$. Then the value of a is

(a) –1 (b) $\frac{1}{2}$

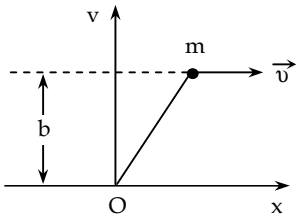
(c) $-\frac{1}{2}$ (d) 1

17. If $\hat{i},\hat{j}$ and $\hat{k}$ represent unit vector along the x, y and z-axis respectively, then the angle θ between the vectors $\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}$ is equal to

(a) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\sin^{-1}\left(\sqrt{\frac{2}{3}}\right)$

(c) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (d) 90°

18. If a particle of mass m is moving with constant velocity υ parallel to x-axis in x-y plane as shown in figure. Its angular momentum with respect to origin at any time t will be



(a) $m\upsilon b\hat{k}$ (b) $-m\upsilon b\hat{k}$

(c) $m\upsilon b\hat{i}$ (d) $m\upsilon\hat{i}$

19. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$. The angle between the two vectors is

(a) 75° (b) 45°

(c) 90° (d) 60°

20. How many minimum number of non-zero vectors in different planes can be added to give zero resultant

(a) 2 (b) 3

(c) 4 (d) 5

21. If a vector $\vec{P}$ makes angles α, β, and γ respectively with the X, Y and Z axes. Then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

(a) 0 (b) 1

(c) 2 (d) 3

22. Which of the following is not equal to watt

(a) joule/second

(b) ampere × volt

(c) (ampere)^2 × ohm

(d) ampere/volt

23. Which of the following is not represented in correct unit

(a) $\frac{\text{Stress}}{\text{Strain}} = N/m^2$

(b) Surface tension = N/m

(c) Energy = kg-m/sec

(d) Pressure = N/m^2

24. Match the following

(A) Capacitance	(i) Volt (ampere)$^{-1}$
(B) Magnetic induction	(ii) Volt-sec (ampere)$^{-1}$
(C) Inductance	(iii) Newton (ampere)$^{-1}$ (metre)$^{-1}$
(D) Resistance	(iv) Coulomb^2 (joule)$^{-1}$

(a) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(b) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(c) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(d) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

(e) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

25. Which of the following quantities has not been expressed in proper unit

(a) Torque	: Newton metre
(b) Stress	: Newton metre^{-1}
(c) Modulus of elasticity	: Newton metre^{-2}
(d) Power	: Newton metre sec^{-1}
(e) Surface tension	: Newton metre^{-2}

26. In S = a + bt + ct^2. S is measured in metre and t in second. The unit of c is

(a) None (b) m

(c) ms^{-1} (d) ms^{-2}

27. The unit of the coefficient of viscosity in S.I. system is

(a) m/kg-s (b) m-s/kg^2

(c) kg/m-s^2 (d) kg/m-s

28. Electron volt is a unit of

(a) Charge (b) Potential difference

(c) Momentum (d) Energy

29. Ampere – hour is a unit of

(a) Quantity of electricity

(b) Strength of electric current

(c) Power

(d) Energy

30. The unit of Planck's constant is

(a) Joule (b) Joule/s

(c) Joule/m (d) Joule-s

31. The units of modulus of rigidity are

(a) N-m (b) N/m

(c) N-m^2 (d) N/m^2

32. Match List – I with List – II and select the correct answer using the codes given below the lists

List – I	**List – II**
I. Joule	A. Henry × Ame/sec
II. Watt	B. Farad × volt
III. Volt	C. Coulomb × volt
IV. Coulomb	D. Oersted × cm
	E. Amp × Gauss
	F. Amp^2 × Ohm

Codes:

(a) I-A, II-F, III-E, IV-D

(b) I-C, II-F, III-A, IV-B

(c) I-C, II-F, III-A, IV-E

(d) I-B, II-F, III-A, IV-C

33. Select the pair whose dimensions are same
(a) Pressure and stress
(b) Stress and strain
(c) Pressure and force
(d) Power and force

34. $\frac{h}{2\pi}$ is the dimension of
(a) Velocity (b) Momentum
(c) Energy (d) Angular momentum

35. Dimensional formula for latent heat is:
(a) $M^0L^0T^{-2}$ (b) MLT^{-2}
(c) ML^2T^{-2} (d) ML^2T^{-1}

36. The dimensional formula for r.m.s. (root mean square) velocity is
(a) $M^0L^2T^{-1}$ (b) $M^0L^0T^{-2}$
(c) $M^0L^0T^{-1}$ (d) MLT^{-3}

37. Out of the following, the only pair that does not have identical dimensions is
(a) Angular momentum and Planck's constant
(b) Moment of inertia and moment of a force
(c) Work and torque
(d) Impulse and momentum

38. The equation of state of some gases can be expressed as $\left(P+\frac{a}{V^2}\right)(V-b)=RT$. Here P is the pressure, V is the volume, T is the absolute temperature and a, b, R are constants. The dimensions of 'a' are
(a) ML^5T^{-2} (b) $ML^{-1}T^{-2}$
(c) $M^0L^3T^0$ (d) $M^0L^6T^0$

39. 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 (ν) is called time constant (τ). Dimensionally τ can be represented by
(a) $\frac{mr^2}{6\pi\eta}$ (b) $\sqrt{\left(\frac{6\pi mr\eta}{g^2}\right)}$
(c) $\frac{m}{6\pi\eta r\nu}$ (d) None of the above

40. The frequency of vibration f of a mass m suspended from a spring constant K is given by a relation of this type, $f = Cm^xK^y$; where C is a dimensionless quantity. The value of x and y are
(a) $x=\frac{1}{2}, y=\frac{1}{2}$
(b) $x=-\frac{1}{2}, y=-\frac{1}{2}$
(c) $x=\frac{1}{2}, y=-\frac{1}{2}$
(d) $x=-\frac{1}{2}, y=\frac{1}{2}$

41. The velocity of water waves ν may depend upon 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) $\nu^2 \propto \lambda g^{-1}\rho^{-1}$
(b) $\nu^2 \propto g\lambda p$
(c) $\nu^2 \propto g\lambda$
(d) $\nu^2 \propto g^{-1}\lambda^{-2}$

42. The equation of a wave is given by
$Y = A\sin\omega\left(\frac{x}{\nu}-k\right)$
where ω is the angular velocity and ν is the linear velocity. The dimension of k is
(a) LT (b) T
(c) T^{-1} (d) T^2

43. The period of a body under SHM is represented by $T = P^aD^bS^c$; where P is pressure, D is density and S is surface tension. The value of a, b and c are
(a) $-\frac{3}{2}, \frac{1}{2}, 1$
(b) –1, –2, 3
(c) $\frac{1}{2}, -\frac{2}{3}, -\frac{1}{2}$
(d) $1, 2, \frac{1}{3}$

44. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity η. After some time the velocity of the ball attains a constant value known as terminal velocity v_T. The terminal velocity depends on (i) the mass of the ball m, (ii) η, (iii) r and (iv) acceleration due to gravity g. Which of the following relations is dimensionally correct

(a) $v_T \propto \frac{mg}{\eta r}$ (b) $v_T \propto \frac{\eta r}{mg}$

(c) $v_T \propto \eta r m g$ (d) $v_T \propto \frac{mgr}{\eta}$

45. The quantity $X = \frac{\varepsilon_0 LV}{t}$: ε_0 is permittivity of free space, L is length, V is potential difference and t is time. The dimensions of X are same as that of

(a) Resistance (b) Charge

(c) Voltage (d) Current

46. The Martians use force (F), acceleration (A) and time (T) as their fundamental physical quantities. The dimensions of length on Martians system are

(a) FT^2 (b) $F^{-1}T^2$

(c) $F^{-1}A^2T^{-1}$ (d) AT^2

47. The dimension of $\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$ is that of

(a) Velocity (b) Time

(c) Capacitance (d) Distance

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

(a) x = 1, y = 1, z = –1 (b) x = 1, y = –1, z = 1

(c) x = –1, y = 1, z = 1 (d) x = 1, y = 1, z = 1

49. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of the kinetic energy obtained by measuring mass and speed

(a) 11% (b) 8%

(c) 5% (d) 1%

50. The random error in the arithmetic mean of 100 observation is x; then random error in the arithmetic mean of 400 observations would be

(a) 4x (b) $\frac{1}{4}x$

(c) 2x (d) $\frac{1}{2}x$

ANSWERS KEY

1	D	**11**	A	**21**	C	**31**	D	**41**	C
2	B	**12**	C	**22**	D	**32**	B	**42**	B
3	D	**13**	B	**23**	C	**33**	A	**43**	A
4	A	**14**	A	**24**	B	**34**	D	**44**	A
5	C	**15**	A	**25**	E	**35**	A	**45**	D
6	A	**16**	B	**26**	D	**36**	A	**46**	D
7	B	**17**	A	**27**	D	**37**	B	**47**	A
8	C	**18**	B	**28**	D	**38**	A	**48**	B
9	D	**19**	C	**29**	A	**39**	D	**49**	B
10	B	**20**	C	**30**	D	**40**	D	**50**	B