PHYSICS

NEET

CRASH COURSE

UNITS DIMENSION, VECTOR & BASIC MATHS

SMART ACHIEVERS

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UNITS DIMENSION, VECTOR & BASIC MATHS

Q.1 In a particular system the units of length, mass and time are chosen to be 10 cm, 10 g and 0.1 s respectively. The unit of force in this system will be equal to
(1) 0.1 N (2) 1 N (3) 10 N (4) 100 N

Q.2 A force F is given by $F = at + bt^2$, where 't' is time. The dimension of a and b are respectively :
(1) $[M\,L\,T^{-3}]$ and $[M\,L\,T^{-4}]$ (2) $[M\,L\,T^{-4}]$ and $[M\,L\,T^{-3}]$
(3) $[M\,L\,T^{-1}]$ and $[M\,L\,T^{-2}]$ (4) $[M\,L\,T^{-2}]$ and $[M\,L\,T^{0}]$

Q.3 Velocity of a body is given as $c = \alpha t^2 + \beta t + \gamma$. Here α, β and γ are constants. c is velocity in S.I. and t is time in S.I. Then unit of
(1) γ is m s^{-1} (2) α is m s^{-1}
(3) β is m s^{-1} (4) α, β and γ is same

Q.4 A dimensionless quantity
(1) Never has a unit (2) Always has unit
(3) May have a unit (4) Does not exist

Q.5 $0.4\hat{i} + 0.8\hat{j} + c\hat{k}$ represents a unit vector when c is
(1) – 0.2 (2) $\sqrt{0.2}$ (3) $\sqrt{0.8}$ (4) 0

Q.6 Angular momentum is
(1) A scalar (2) A polar vector (3) An axial vector (4) None of these

Q.7 Two forces, each of magnitude F have a resultant of the same magnitude F. The angle between the two forces is
(1) 45° (2) 120° (3) 150° (4) 60°

Q.8 The magnitude of vector $\vec{A}, \vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A} + \vec{B} = \vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is
(1) 0 (2) π (3) $\pi/2$ (4) $\pi/4$

Q.9 A particle has displacement of 12 m towards east and 5 m towards north then 6 m vertically upward. The sum of these displacements is
(1) 12 (2) 10.04 m (3) 14.31 m (4) None of these

Q.10 Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously $\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}$, $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move
(1) In x - y plane (2) In y - z plane (3) In x - z plane (4) Along x -axis

Q.11 Given that $\vec{A}+\vec{B}=\vec{C}$ and that $\vec{C}$ is $\perp$ to $\vec{A}$. Further if $|\vec{A}|=|\vec{C}|$, then what is the angle between $\vec{A}$ and $\vec{B}$

(1) $\frac{\pi}{4}$ radian (2) $\frac{\pi}{2}$ radian (3) $\frac{3\pi}{4}$ radian (4) π radian

Q.12 Two vectors $\vec{A}$ and $\vec{B}$ are at right angles to each other, then

(1) $\vec{A}+\vec{B}=0$ (2) $\vec{A}-\vec{B}=0$ (3) $\vec{A}\times\vec{B}=0$ (4) $\vec{A}.\vec{B}=0$

Q.13 The angles which a vector $\hat{i}+\hat{j}+\sqrt{2}\,\hat{k}$ makes with X, Y and Z axes respectively are

(1) 60°, 60°, 60° (2) 45°, 45°, 45° (3) 60°, 60°, 45° (4) 45°, 45°, 60°

Q.14 The method of dimensional analysis can be used to derive which of the following relations ?

(1) $N_0\, e^{-\lambda t}$ (2) $A\sin(\omega t+kx)$

(3) $\frac{1}{2}mv^2+\frac{1}{2}I\omega^2$ (4) None of the above

Q.15 Mechanical force = $\frac{a}{b^3+\text{volumetric density}}$. Then a and b have dimensions

(1) $[MLT^{-2}]$, $\left[M^{\frac{1}{2}}L^{-1}\right]$ (2) $[M^2L^{-2}T^{-2}]$, $\left[M^{\frac{1}{3}}L^{-1}\right]$

(3) $[ML^{-2}T^{-2}]$, $\left[M^{\frac{1}{3}}L^{-\frac{1}{2}}\right]$ (4) $[M^3L^{-2}T^{-2}]$, $[M^3L^{-1}]$

Q.16 If A is amplitude and x distance then in a relation for K.E. = $\frac{\beta x}{A^2+x^2}$ the dimension of β are that of

(1) force (2) energy (3) distance × work (4) power

Q.17 Find the odd one out

(a) $\sqrt{\omega/r}$, where ω is angular frequency and r is radius

(b) $\sqrt{F/\gamma}$, where F is force and γ is linear density

(c) $\sqrt{P/\rho}$, where P is pressure and ρ is density

(d) $\sqrt{E/m}$, where E is energy and m is mass

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

Q.18 From the dimensional consideration, which of the following equation is correct

(1) $T = 2\pi\sqrt{\frac{R^3}{GM}}$ (2) $T = 2\pi\sqrt{\frac{GM}{R^3}}$

(3) $T = 2\pi\sqrt{\frac{GM}{R^2}}$ (4) $T = 2\pi\sqrt{\frac{R^2}{GM}}$

Q.19 A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity. After some time the velocity of the ball attains a constant value known as terminal velocity v_T. The terminal velocity depends on (i) m, the mass of the ball. (ii) η coefficient of viscosity (iii) r and (iv) acceleration due to gravity g. then which of the following relations is dimensionally correct

(1) $v_T \propto \frac{mg}{\eta r}$ (2) $v_T \propto \frac{\eta r}{mg}$ (3) $v_T \propto \eta rmg$ (4) $v_T \propto \frac{mgr}{\eta}$

Q.20 100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\pi/50$ with the preceding force. What is the resultant of the forces

(1) 1000 N (2) 500 N (3) 250 N (4) Zero

Q.21 At what angle must the two forces of magnitude (x + y) and (x - y) act so that the resultant may be $\sqrt{(x^2+y^2)}$

(1) $\cos^{-1}\left(-\frac{x^2+y^2}{2(x^2-y^2)}\right)$ (2) $\cos^{-1}\left(-\frac{2(x^2-y^2)}{x^2+y^2}\right)$

(3) $\cos^{-1}\left(-\frac{x^2+y^2}{x^2-y^2}\right)$ (4) $\cos^{-1}\left(-\frac{x^2-y^2}{x^2+y^2}\right)$

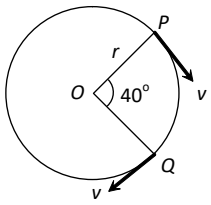
Q.22 A particle is moving on a circular path of radius r with uniform velocity v. The change in velocity when the particle moves from P to Q is $(\angle POQ = 40°)$

(1) $2v\cos 40°$

(2) $2v\sin 40°$

(3) $2v\sin 20°$

(4) $2v\cos 20°$



Q.23 A particle moves in the x-y plane under the action of a force $\vec{F}$ such that the value of its liner momentum $(\vec{P})$ at anytime t is $P_x = 2\cos t, P_y = 2\sin t$. The angle θ between $\vec{F}$ and $\vec{P}$ at a given time t. will be

(1) $\theta = 0°$ (2) $\theta = 30°$ (3) $\theta = 90°$ (4) $\theta = 180°$

Q.24 The value of $(\vec{A}+\vec{B})\times(\vec{A}-\vec{B})$ is

(1) 0 (2) $A^2 - B^2$ (3) $\vec{B}\times\vec{A}$ (4) $2(\vec{B}\times\vec{A})$

Q.25 If vectors P, Q and R have magnitude 5, 12 and 13 units and $\vec{P}+\vec{Q}=\vec{R}$, the angle between Q and R is

(1) $\cos^{-1}\frac{5}{12}$ (2) $\cos^{-1}\frac{5}{13}$ (3) $\cos^{-1}\frac{12}{13}$ (4) $\cos^{-1}\frac{7}{13}$

Q.26 Let $\vec{A}=\cos\theta\hat{i}+A\sin\theta\hat{j}$ be any vector. Another vector $\vec{B}$ which is normal to A is

(1) $B\cos\theta\hat{i}+B\sin\theta\hat{j}$ (2B) $B\sin\theta\hat{i}+B\cos\theta\hat{j}$

(3) $B\sin\theta\hat{i}-B\cos\theta\hat{j}$ (4) $B\cos\theta\hat{i}-B\sin\theta\hat{j}$

Q.27 If $|\vec{A}-\vec{B}|=|\vec{A}|=|\vec{B}|$, the angle between $\vec{A}$ and $\vec{B}$ is

(1) 60° (2) 0° (3) 120° (4) 90°

Q.28 The angle between vectors $(\vec{A}\times\vec{B})$ and $(\vec{B}\times\vec{A})$ is

(1) Zero (2) π (3) $\pi/4$ (4) $\pi/2$

Q.29 Consider a vector $\vec{F}=4\hat{i}-3\hat{j}$. Another vector that is perpendicular to $\vec{F}$ is

(1) $4\hat{i}+3\hat{j}$ (2) $6\hat{i}$ (3) $7\hat{k}$ (4) $3\hat{i}-4\hat{j}$

Q.30 Out of the following which pair of quantities do not have same dimensions-

(1) Planck's constant and angular momentum. (2) Work and torque.

(3) Impulse and momentum. (4) Torque and moment of inertia

Q.31 A particle of masss m is suspended by a spring if frequency of its oscilation is $n = cm^xk^y$ here c is a constant then the value of x and y are -

(1) $x=\frac{1}{2}, y=\frac{1}{2}$ (2) $x=-\frac{1}{2}, y=-\frac{1}{2}$ (3) $x=-\frac{1}{2}, y=\frac{1}{2}$ (4) $x=\frac{1}{2}, y=-\frac{1}{2}$

Q.32 The unit of $\frac{1}{\lambda}\sqrt{\frac{T}{m}}$ is the same as that of (where T is tension and m is mass/length) -

(1) Frequency (2) Time period (3) Wave-length (4) Wave number

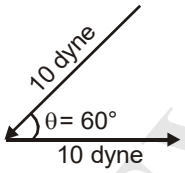
Q.33 In a relation $F = a\sin k_1x + b\sin k_2t$, F, x and t denote the force, distance and time respectively. Units of k_1 and k_2 are respectively as –

(1) Metre, sec (2) Metre^{-1}, sec^{-1} (3) Metre^{-1}, sec (4) Metre, sec^{-1}

Q.34 How many minimum number of vectors in different planes can be added to give zero resultant:-
(1) 2 (2) 3 (3) 4 (4) 5

Q.35 What is the maximum number of rectangular components into which a vector can be split in its own plane?
(1) 2 (2) 3 (3) 4 (4) Infinite

Q.36 Two forces, each numerically equal to 10 dyne are acting as shown in the following figure. Their resultant is :



(1) 10 dyne (2) 20 dyne (3) $10\sqrt{3}$ dyne (4) 5 dyne

Q.37 Let $\vec{A} = \hat{i}ACos\theta + \hat{j}ASin\theta$, be any vector. Another vector $\vec{B}$ which is normal to $\vec{A}$ is :
(1) $\hat{i}BCos\theta + \hat{j}BSin\theta$ (2) $\hat{i}BSin\theta + \hat{j}BCos\theta$
(3) $\hat{i}BSin\theta - \hat{j}BCos\theta$ (4) $\hat{i}ACos\theta - \hat{j}ASin\theta$

Q.38 The Bernoulli's equation is given by

$p + \frac{1}{2}\rho v^2 + h\rho g = k$

Where p = pressure, ρ = density, v = speed, h = height of the liquid column, g = acceleration due to gravity and k is constant. The dimensional formula for k is same as that for :
(1) Velocity gradient (2) Pressure gradient
(3) Modulus of elasticity (4) Thrust

Q.39 The equation of a wave is given by $Y = A\sin\omega\left(\frac{x}{v} - k\right)$ where ω is the angular velocity and υ is the linear velocity. The dimension of k is
(1) LT (2) T (3) T^{-1} (4) T^2

Q.40 An experiment measures quantities a, b and c, and X is calculated from $X = ab^2/c^3$. If the percentage error in a, b and c are ± 1%, ± 3% and ± 2% respectively, the percentage error in X will be –
(1) ± 13% (2) ± 7% (3) ± 4% (4) ± 1%

Q.41 Zero error of an instrument introduces
(1) Systematic errors (2) Random errors (3) Both (4) None

Q.42 What is the fractional error in g calculated from $T = 2\pi\sqrt{l/g}$? Given that fractional errors in T and $2\overline{)21}$ are ± x and ± y respectively.
(1) x + y (2) x – y (3) 2x + y (4) 2x – y

Q.43 The period of oscillation of a simple pendulum in the experiment is recorded as 2.63s, 2.56s, 2.42s, 2.71s and 2.80s respectively. The average absolute error is
(1) 0.1s (2) 0.11s (3) 0.01s (4) 1.0s

Q.44 The resistance is $R = \frac{V}{I}$ where $V = 100 \pm 5$ Volts and $I = 10 \pm 0.2$ amperes. What is the total error in R?
(1) 5 % (2) 7 % (3) 5.2 % (4) $\left(\frac{5}{2}\right)$ %

Q.45 In a vernier calliper, N divisions of vernier scale coincide with (N – 1) divisions of main scale (in which 1 division represents 1mm). The least count of the instrument in cm. should be
(1) N (2) N – 1 (3) $\frac{1}{10N}$ (4) $\frac{1}{N-1}$

Q.46 The length of a cylinder is measured with a metre rod having least count 0.1 cm. Its diameter is measured with vernier callipers having least count 0.01 cm. Given the length is 5.0 cm. and radius is 2.00 cm. The percentage error in the calculated value of volume will be –
(1) 2% (2) 1% (3) 3% (4) 4%

Q.47 A vernier callipers has 20 divisions on the vernier scale which coincide with 19 divisions on the main scale. The least count of the instrument is 0.1 mm. The main scale divisions are of
(1) 0.5 mm (2) 1 mm (3) 2 mm (4) 1/4 mm

Q.48 One centimetre on the main scale of vernier callipers is divided into ten equal parts. If 10 divisions of vernier scale coincide with 8 small divisions of the main scale, the least count of the callipers is
(1) 0.01 cm (2) 0.02 cm (3) 0.05 cm (4) 0.005 cm

Q.49 While measuring acceleration due to gravity by a simple pendulum a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value of the time period. His percentage error in the measurement of the value of g will be -
(1) 2 % (2) 4 % (3) 7 % (4) 10 %

Q.50 A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is –
(1) 5.3 cm (2) 5.32 cm (3) 5.320 cm (4) 5.3200 cm

Direction for Assertion & Reason Questions

A. If both Assertion & Reason are True and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are True but Reason is not a correct explanation of the Assertion

C. If Assertion is True but the Reason is False.

D. If both Assertion and Reason are False.

Q.51 **Assertion:** The equation $y = 2x + t$ cannot be true if x & y are distance and t is time.
Reason : Quantities with different dimensions cannot be added.
(1) A (2) B (3) C (4) D

Q.52 **Assertion :** Pressure has the dimensions of energy density.

Reason : Energy density $= \frac{\text{energy}}{\text{volume}} = \frac{[ML^2T^{-2}]}{[L^3]} = [ML^{-1}T^{-2}] =$ pressure.

(1) A (2) B (3) C (4) D

Q.53 **Assertion :** If the initial and final position coincide, the displacement is a null vector.
Reason : A physical quantity can not be called a vector, if its magnitude is zero.
(1) 1 (2) 2 (3) C (4) 4

Q.54 **Assertion :** If the rectangular components of a force are 24 N and 7 N, then the magnitude of the force can be 25 N.

Reason : If $\left|\vec{A}\right| = \left|\vec{B}\right| = 1$ then $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A}.\vec{B}\right|^2 = 1$

(1) A (2) B (3) C (4) D

Q.55 **Assertion :** The angle between the two vectors $\left(\hat{i} + \hat{j}\right)$ and $\left(\hat{j} + \hat{k}\right)$ is $\frac{\pi}{3}$ radian.

Reason : Angle between two vectors $\vec{A}$ and $\vec{B}$ is given by $\theta = \cos^{-1}\left(\frac{\vec{A}.\vec{B}}{AB}\right)$.

(1) A (2) B (3) C (4) D

Q.56 **Assertion :** The dot product of one vector with another vector may be a scalar or a vector.
Reason : If the product of two vectors is a vector quantity, then product is called a cross product.
(1) A (2) B (3) C (4) D

Q.57 **Assertion :** The direction of a zero (null) vector is indeterminate.
Reason : We can have $\vec{A} \times \vec{B} = \vec{A}.\vec{B}$ with $\vec{A} \neq \vec{0}$ and $\vec{B} \neq \vec{0}$.
(1) A (2) B (3) C (4) D

Q.58 **Assertion :** If the rectangular components of a force are 24N and 7N, then the magnitude of the force is 25N.

Reason : If $\left|\vec{A}\right| = \left|\vec{B}\right| = 1$ then $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A}.\vec{B}\right|^2 = 1$

(1) A (2) B (3) C (4) D

Q.59 **Assertion** : If three vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ satisfy the relation $\vec{A}.\vec{B} = 0$ & $\vec{A}.\vec{C} = 0$ then the vector $\vec{A}$ may be parallel to $\vec{B} \times \vec{C}$.

Reason : If $\vec{A} + \vec{B} = \vec{R}$ and $A + B = R$, then angle between $\vec{A}$ and $\vec{B}$ is zero.
(1) A (2) B (3) C (4) D

Q.60 **Assertion :** If position vector is given by $\vec{r} = \sin t\,\hat{i} + \cos t\,\hat{j} - 7t\,\hat{k}$, then magnitude of acceleration $|\vec{a}| = 1$.

Reason : The angles which the vector $\vec{A} = A_1\hat{i} + A_2\hat{j} + A_3\hat{k}$ makes with the co-ordinate axes are given by $\cos\alpha = \frac{A_1}{A}$, $\cos\beta = \frac{A_2}{A}$ & $\cos\gamma = \frac{A_3}{A}$.

(1) A (2) B (3) C (4) D

Q.61 **Assertion :** If x and y are the distances along x and y axes respectively then the dimensions of $\frac{d^3y}{dx^3}$ is $M^0L^{-2}T^0$

Reason : Dimensions of $\int_a^b y\,dx$ is $M^0L^2T^0$

(1) A (2) B (3) C (4) D

Q.62 **Assertion :** The equation y = 2x + t cannot be true if x & y are distances and t is time.
Reason : Quantities with different dimensions cannot be added or subtracted.
(1) A (2) B (3) C (4) D

ANSWER KEY

Q.1	1	Q.2	1	Q.3	1	Q.4	3	Q.5	2
Q.6	3	Q.7	2	Q.8	3	Q.9	3	Q.10	2
Q.11	3	Q.12	4	Q.13	3	Q.14	4	Q.15	2
Q.16	3	Q.17	1	Q.18	1	Q.19	1	Q.20	4
Q.21	1	Q.22	3	Q.23	3	Q.24	4	Q.25	3
Q.26	3	Q.27	1	Q.28	2	Q.29	3	Q.30	4
Q.31	3	Q.32	1	Q.33	2	Q.34	3	Q.35	1
Q.36	1	Q.37	3	Q.38	1	Q.39	2	Q.40	1
Q.41	1	Q.42	3	Q.43	2	Q.44	2	Q.45	3
Q.46	3	Q.47	3	Q.48	2	Q.49	3	Q.50	3
Q.51	1	Q.52	1	Q.53	3	Q.54	2	Q.55	1
Q.56	2	Q.57	3	Q.58	2	Q.59	2	Q.60	2
Q.61	3	Q.62	4						