Varun JEE Advanced (2026)

Physics

Center of Mass and Collision

DPP: 1

Time duration - 70 min

Q1 The center of mass of a body
(A) Lies always outside the body
(B) May lie within, outside or on the surface on the body
(C) Lies always inside the body
(D) Lies always on the surface of the body

Q2 The motion of the centre of mass depends on
(A) Total external force
(B) Total internal forces
(C) Sum of (1) and (2)
(D) None of these

Q3 The centre of mass of two particles lies on the line
(A) Joining the particles
(B) Perpendicular to the line joining the particles
(C) At any angle to this line
(D) None of these

Q4 If the resultant of all external forces is zero, the velocity of center of mass will be
(A) Zero
(B) Constant
(C) Either (1) or (2)
(D) Neither (1) nor (2)

Q5 Center of mass of the earth and the moon system lies
(A) Closer to the earth
(B) Closer to the moon
(C) At the mid-point of the line joining the earth and the moon
(D) Cannot be predicted

Q6 Two particles of mass m_1 and m_2 $(m_1 > m_2)$ attract each other with a force inversely proportional to the square of the distance between them. If the particles are initially held at rest and then released, the center of mass will
(A) move towards m_1
(B) Move towards m_2
(C) Remains at rest
(D) None of these

Q7 A shell following a parabolic path explodes somewhere in its flight. The centre of mass fragments will continue to move in
(A) Vertical direction
(B) Any direction
(C) Horizontal direction
(D) Same parabolic path

Q8 Consider a system of two particles having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the center of mass particles through a distance d, by what distance would the particle of mass m_2 move so as to keep the center of mass of particles at the original position?
(A) $\frac{m_2}{m_1}d$
(B) $\frac{m_1}{m_1+m_2}d$
(C) $\frac{m_1}{m_2}d$

(D) d

Q9 Three masses are placed on the x-axis : $300\ \text{g}$ at origin, $500\ \text{g}$ at $x = 40\ \text{cm}$ and $400\ \text{g}$ at $x = 70\ \text{cm}$. The distance of the center of mass from the origin is:
(A) $40\ \text{cm}$
(B) $45\ \text{cm}$
(C) $50\ \text{cm}$
(D) $30\ \text{cm}$

Q10 The centre of mass of three bodies each of mass $1\ \text{kg}$ located at the points $(0,0)(3,0)$ and $(0,4)$ in the XY plane is
(A) $\left(\frac{4}{3},1\right)$
(B) $\left(\frac{1}{3},\frac{2}{3}\right)$
(C) $\left(\frac{1}{2},\frac{1}{2}\right)$
(D) $\left(1,\frac{4}{3}\right)$

Q11 Four point masses $\text{P}, \text{Q}, \text{R}$ and S with respective masses $1\ \text{kg}, 1\ \text{kg}, 2\ \text{kg}$ and $2\ \text{kg}$ form the corners of a square of side a, the centre of mass of the system will be farthest from
(A) P only
(B) R and S
(C) R only
(D) P and Q

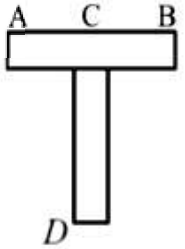
Q12 A rigid body consists of a $3\ \text{kg}$ mass located at $\vec{r}_1 = (2\hat{i} + 5\hat{j})m$ and a $2\ \text{kg}$ mass located at $\vec{r}_2 = (4\hat{i} + 2\hat{j})m$. The position of center of mass is
(A) $\left(\frac{14}{5}\hat{j} + \frac{19}{5}\hat{i}\right) m$
(B) $\left(\frac{14}{5}\hat{i} + \frac{19}{5}\hat{j}\right) m$
(C) $\left(\frac{17}{5}\hat{i} + \frac{14}{5}\hat{j}\right) m$
(D) 0

Q13 If three particles of mass $2\ \text{kg}, 1\ \text{kg}$ and $3\ \text{kg}$ and placed at corners of an equilateral triangle of perimeter $6\ \text{m}$ then the distance of centre of mass which is at origin of particles from $1\ \text{kg}$ mass is (approximately) (Assume $2\ \text{kg}$ on x-axis)
(A) $\sqrt{6}m$
(B) $\sqrt{2}m$
(C) $\frac{1}{\sqrt{2}}m$
(D) $2m$

Q14 Two blocks of masses $10\ \text{kg}$ and $30\ \text{kg}$ are placed along a vertical line. If the first blocks is raised through a height of $7\ \text{cm}$, then the distance through the second mass should be moved to raise the centre of mass of the system by $1\ \text{cm}$ is
(A) $1\ \text{cm}$ up
(B) $1\ \text{cm}$ down
(C) $2\ \text{cm}$ down
(D) $2\ \text{cm}$ up

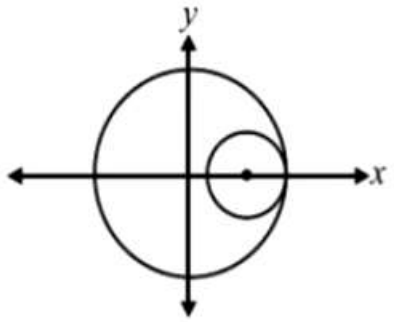
Q15 A uniform metre rod is bent at midpoint into L shape with the bent arms at 90° to each other. The distance of the center of mass from the bent point is
(A) $\frac{1}{4\sqrt{2}}m$
(B) $\frac{1}{2\sqrt{2}}m$
(C) $\frac{1}{\sqrt{2}}m$
(D) $\frac{1}{8\sqrt{2}}m$

Q16 Two identical thin uniform rods of length L each are joined to form T shape as shown in the figure. The distance of centre of mass from D is



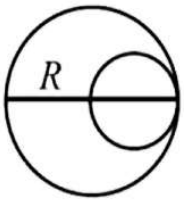
(A) 0
(B) $L/4$
(C) $\frac{3L}{4}$
(D) L

Q17 A circular disc of radius $20\ \text{cm}$ is cut from one edge of a larger circular disc of radius $50\ \text{cm}$. The shift of center of mass is



(A) $5.7\ \text{cm}$
(B) $-5.7\ \text{cm}$
(C) $3.2\ \text{cm}$
(D) $-3.2\ \text{cm}$

Q18 A uniformly sphere has radius R. A sphere of diameter R is cut from its edge as shown. Then the distance of centre of mass of remaining portion from the centre of mass of the original sphere is



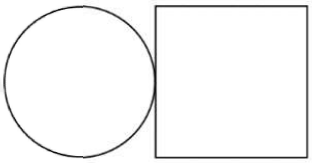
(A) $R/7$
(B) $R/14$
(C) $2R/7$
(D) $R/18$

Q19 The centre of mass of a non-uniform rod of length L whose mass per unit length $\lambda = \frac{Kx^2}{L}$, Where K is a constant and x is the distance from one end is:
(A) $3L/4$
(B) $L/8$
(C) K/L
(D) $\frac{3L}{5}$

Q20 Determine the location of COM of semi-circular ring of radius R, from the centre
(A) $4R/\pi$
(B) $\frac{3R}{2\pi}$
(C) $2R/\pi$
(D) $5R/2\pi$

Q21 Find the location of COM of semi-circular disc from its centre. (R is the radius)
(A) $\frac{2R}{\pi}$
(B) $\frac{4R}{\pi}$
(C) $\frac{2R}{3\pi}$
(D) $\frac{4R}{3\pi}$

Q22 A square plate and a circular plate made up of same material are placed touching each other on horizontal table. If the side length of square plate is equal to diameter of the circular plate then the centre of mass of the combination will be



(A) At their point of contact
(B) Inside the circular plate
(C) Inside the square plate
(D) Outside the combination

Q23 Four particles, each of mass $1\ \text{kg}$, are placed at the corners of square of side one meter in the XY plane. If the point of intersection of the diagonals of the square is taken as the origin, the co-ordinates of the centre of mass are:
(A) $(1, 1)$
(B) $(-1, 1)$
(C) $(1, -1)$
(D) $(0, 0)$

Q24 Two blocks of masses $10\ \text{kg}$ and $30\ \text{kg}$ are placed on X-axis the first mass is moved on the axis by a distance of $2\ \text{cm}$ right. By what distance should the second mass be moved to keep the position of centre of mass unchanged.
(A) $\frac{1}{3}\ \text{cm}$
(B) $\frac{2}{3}\ \text{cm}$

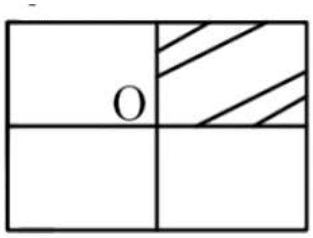
(C) $\frac{-1}{3}$ cm
(D) $\frac{-2}{3}$ cm

Q25 A thick straight wire of length πm is fixed at its midpoint and the bent in the form of a circle. The shift in its centre of mass is
(A) πm
(B) 0.5 m
(C) 2 m
(D) $\frac{\pi}{2}$ m

Q26 A uniform disc of radius R is put over another uniform disc of radius $2R$ of same thickness and density. The peripheries of the two discs touch each other. The position of their centre of mass is
(A) At $R/3$ from the centre of the bigger disc towards the centre of the smaller disc
(B) At $R/5$ from the centre of the bigger disc towards the centre of the smaller disc
(C) At $2R/5$ from the centre of the bigger disc towards the centre of the smaller disc
(D) At $2R/5$ from the centre of the smaller disc

Q27 A uniform thin rod of length 1 m and mass 3 kg is attached to a uniform thin circular disc of radius 30 cm and mass 1 kg at its centre perpendicular to its plane. The centre of mass of the combination from the centre of disc is
(A) 0.375 m
(B) 0.25 m
(C) 0.125 m
(D) 0.475 m

Q28 Figure shown a square plate of uniform thickness and side length $\sqrt{2}$ m. One fourth the plate is removed as indicated. The distance of centre of mass of the remaining portion from the centre of the original square plate is

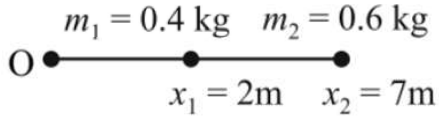


(A) $1/3$ m
(B) $1/2$ m
(C) $1/6$ m
(D) $1/8$ m

Q29 A uniform thin rod AB of length L has linear mass density $\mu(x) = a + \frac{bx}{L}$, where x, is measured from A. If the CM of the rod lies at a distance of $\left(\frac{7}{12}\right) L$ from A, then a and b are related as:
(A) $a = 2b$ (B) $2a = b$
(C) $a = b$ (D) $3a = 2b$

Q30 Distance of the centre of mass of a uniform cone of height h and base radius R from the vertex on the line of symmetry is
(A) $\frac{3h}{4}$
(B) $\frac{h}{4}$
(C) $\frac{h}{3}$
(D) $\frac{2h}{3}$

Q31 A system consists of two masses connected by a massless rod lies along x-axis. The distance of centre of mass from O is



(A) 2 m
(B) 3 m
(C) 5 m
(D) 7 m

Q32 Three identical spheres each of mass m and radius R are placed touching each other so that

their centres A, B and C lie on a straight line. The position of their centre of mass from centre of A is:

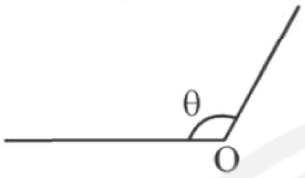
(A) $\frac{2R}{3}$

(B) $2\mathrm{R}$

(C) $\frac{5R}{3}$

(D) $\frac{4R}{3}$

Q33 A thin uniform rod of length L is bent at its mid point as shown in the figure. The distance of the centre of mass from the point O is



(A) $\frac{L}{2}\sin\frac{\theta}{2}$

(B) $\frac{L}{2}\cos\frac{\theta}{2}$

(C) $\frac{L}{4}\sin\frac{\theta}{2}$

(D) $\frac{L}{4}\cos\frac{\theta}{2}$

Q34 A uniform metre rod is bent into L shape with the bent arms at 90° to each other. The distance of the centre of mass from the bent point is

(A) $\frac{L}{4\sqrt{2}}m$

(B) $\frac{L}{2\sqrt{2}}m$

(C) $\frac{L}{\sqrt{2}}m$

(D) $\frac{L}{8\sqrt{2}}m$

Answer Key

Q1	(B)	Q18	(B)
Q2	(A)	Q19	(A)
Q3	(A)	Q20	(C)
Q4	(C)	Q21	(D)
Q5	(A)	Q22	(C)
Q6	(C)	Q23	(D)
Q7	(D)	Q24	(D)
Q8	(C)	Q25	(B)
Q9	(A)	Q26	(B)
Q10	(D)	Q27	(A)
Q11	(D)	Q28	(C)
Q12	(B)	Q29	(B)
Q13	(B)	Q30	(A)
Q14	(B)	Q31	(C)
Q15	(A)	Q32	(B)
Q16	(C)	Q33	(D)
Q17	(B)	Q34	(A)