Physicsaholics

DPP – 1 & 2 (COM)

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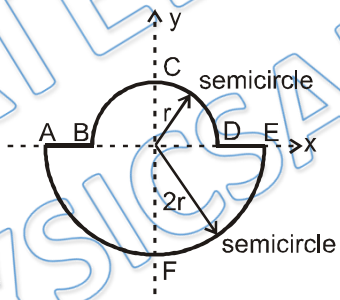
Q 1. Centre of mass is a point
(a) Which is geometric center of a body
(b) From which distance of particles are same
(c) Which moves exactly as motion described by newton's second law.
(d) Which represents average position of all masses of system.

Q 2. Two semicircular rings of linear mass densities λ and 2λ and of radius 'R' each are joined to form a complete ring. The distance of the center of the mass of complete ring from its geometrical centre is :
(a) $\frac{3R}{8\pi}$ (b) $\frac{2R}{3\pi}$ (c) $\frac{3R}{4\pi}$ (d) none of these

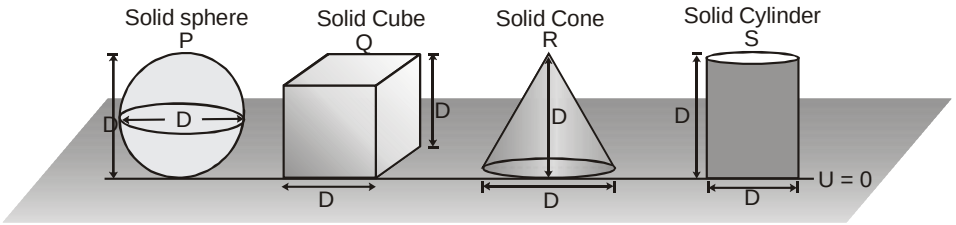
Q 3. A uniform thin rod is bent in the form of closed loop ABCDEFA as shown in the figure. The x-coordinate of the centre of mass of the system is



(a) $\frac{2r}{\pi}$ (b) $-\frac{6r}{3\pi+2}$ (c) $-\frac{2r}{\pi}$ (d) Zero

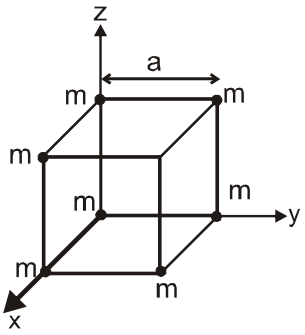
Q 4. Three identical metal balls each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed, when centres of three balls are joined. The centre of the mass of system is located in:
(a) horizontal surface
(b) centre of one of the balls
(c) line joining centres of any two balls
(d) point of intersection of the medians of equilateral triangle

Q 5. Assuming potential energy 'U' at ground level to be zero. All objects are made up of same material. U_P = Potential energy of solid sphere U_Q = Potential energy of solid cube U_R = Potential energy of solid cone U_S = Potential energy of solid cylinder



(a) $U_S > U_P$ (b) $U_Q > U_S$ (c) $U_P > U_Q$ (d) $U_P > U_S$

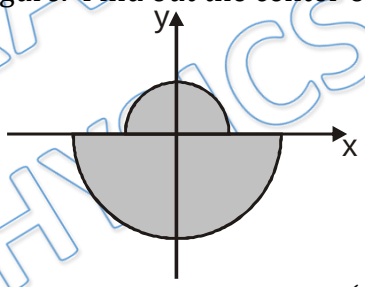
Q 6. Seven particles, each of mass m are placed at the seven corners of a cube of side 'a', but one corner is vacant, as shown in figure. The co–ordinates of the centre of mass of the system is :



(a) $\left(\frac{2a}{7}, \frac{2a}{7}, \frac{2a}{7}\right)$ (b) $\left(\frac{3a}{7}, \frac{3a}{7}, \frac{3a}{7}\right)$

(c) $\left(\frac{a}{3}, \frac{a}{3}, \frac{a}{3}\right)$ (d) $\left(\frac{5a}{11}, \frac{5a}{11}, \frac{5a}{11}\right)$

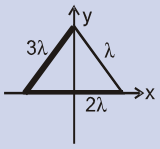
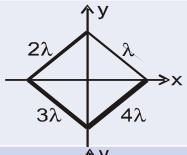
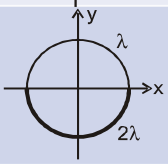
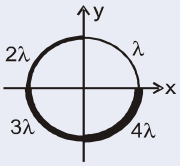
Q 7. Two semicircular discs made of same material having radius r and 2r are placed as shown in figure. Find out the center of mass of structure.



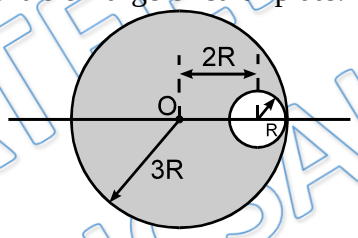
(a) $\left(0, \frac{-28r}{5\pi}\right)$ (b) $\left(0, \frac{-28r}{15\pi}\right)$

(c) $\left(0, \frac{-9r}{5\pi}\right)$ (d) $\left(0, \frac{-9r}{15\pi}\right)$

Q 8. In each situation of column-I a mass distribution is given and information regarding x and y-coordinate of centre of mass is given in column-II. Match the figures in column-I with corresponding information of centre of mass in column-II.

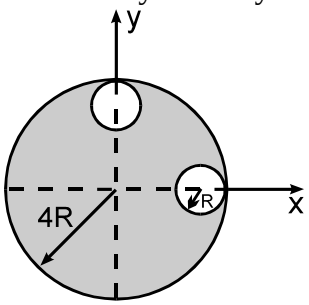
Column-I			Column-II	
(A)	An equilateral triangular wire frame is made using three thin uniform rods of mass per unit lengths λ, 2λ and 3λ as shown		(p)	$x_{cm} \geq 0$
(B)	A square frame is made using four thin uniform rods of mass per unit length lengths λ, 2λ, 3λ and 4λ as shown		(q)	$y_{cm} \geq 0$
(C)	A circular wire frame is made of two uniform semicircular wires of same radius and of mass per unit length λ and 2λ as shown		(r)	$x_{cm} < 0$
(D)	A circular wire frame is made of four uniform quarter circular wires of same radius and mass per unit length λ, 2λ, 3λ and 4λ as shown		(s)	$y_{cm} < 0$

Q 9. In the figure shown find out the distance of centre of mass of a system of a uniform circular plate of radius 3 R from O in which a hole of radius R is cut whose centre is at 2R distance from centre of large circular plate.



(a) R/4 (b) R/5 (c) R/2 (d) none of these

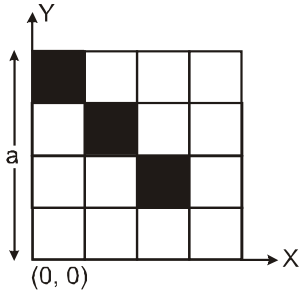
Q 10. From the uniform disc of radius 4 R two small disc of radius R are cut off. The centre of mass of the new structure will be : (Centre of lower circular cavity lies on x-axis and centre of upper circular cavity lies on y-axis)



(a) $\hat{\imath}\frac{R}{5} + \hat{\jmath}\frac{R}{5}$ (b) $-\hat{\imath}\frac{R}{5} + \hat{\jmath}\frac{R}{5}$

(c) $-\hat{\imath}\frac{R}{5} - \hat{\jmath}\frac{R}{5}$ (d) $-\frac{3R}{14}(\hat{\imath} + \hat{\jmath})$

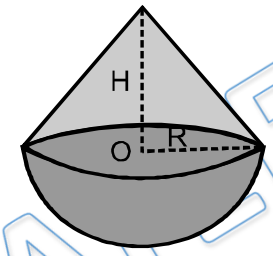
Q 11. From a uniform square plate the shaded portions are removed as shown in figure. The coordinates of centre of mass of the remaining plate are x, y. Axes and origin are shown in figure.



(a) $x < \frac{a}{2}, y < \frac{a}{2}$ (b) $x > \frac{a}{2}, y < \frac{a}{2}$

(c) $x < \frac{a}{2}, y > \frac{a}{2}$ (d) $x > \frac{a}{2}, y > \frac{a}{2}$

Q 12. A homogenous body consists of right circular conical portion attached to a hemispherical portion of radius R = $\sqrt{3}$ m. Determine the height H of cone if the centre of gravity of the composite body coincides with the center O of the circular base of the cone.

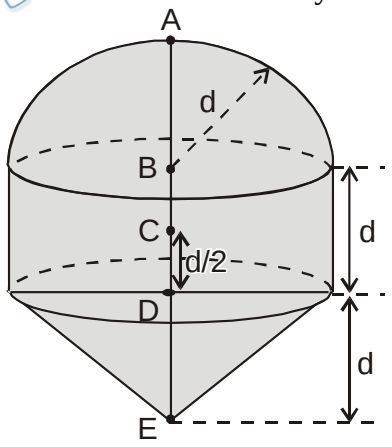


(a) 1m (b) 2m

(c) 3m (d) 4m

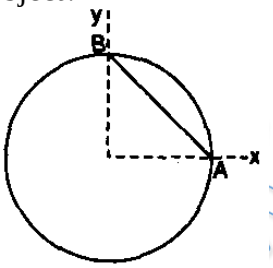
Q 13. Match the following

Following is a solid object formed by three parts which are a solid hemisphere, solid cyllinder and a solid cone. The material of the object is uniform and all the above parts are made up of the same material. The dimensions of the objects are indicated in the figure. The points A,B,C,D,E lie on the common axis of the system as shown in the figure. Point C is the centre of the cylinder.



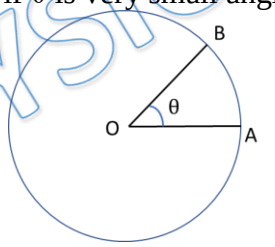
Column I	Column II
(A) Centre of mass of the whole system lies on segment	(p) AB
(B) Centre of mass of the system of only hemisphere and cylinder lies on segment	(q) BC
(C) Centre of mass of the system of only cone and cyllinder lies on segment	(r) CD
(D) Centre of mass of the system of only hemisphere and cone lies on segment	(s) DE

Q 14. An object comprises of a uniform ring of radius R and its uniform chord AB (not necessarily made of the same material) as shown. Which of the following cannot be the centre of mass of the object?



(a) (R/3, R/3)
(b) (R/ $\sqrt{2}$, R/$\sqrt{2}$)
(c) (R/4, R/4)
(d) None of the above

Q 15. Section AOB is cut from a uniform circular plate of radius R. find distance of centre of mass of AOB from O if θ is very small angle?



(a) R
(b) R/2
(c) 2R/3
(d) R/3

Q 16. A uniform solid sphere of radius R is divided into four equal parts. Distance of centre of mass of one part from centre of complete sphere is

(a) 3R/8
(b) $3\sqrt{2}$ R/8
(c) 3R/4
(d) R/4

Q 17. Mark correct statements
(a) If all particles of a system are lying in a plane centre of mass of system must be in same plane.

(b) If all particles of a system are lying in a spherical volume centre of mass of system must be in that spherical volume.
(c) If all particles of a system are lying in a cubical volume centre of mass of system must be in that cubical volume.
(d) There must be some mass at position of centre of mass

Answer Key

Q.1 c, d	**Q.2 b**	**Q.3 d**	**Q.4 d**	**Q.5 a, b**
Q.6 b	**Q.7 b**	**Q.8 (A) q,r (B) p,s (C) p,s (D) p,s**	**Q.9 a**	**Q.10 d**
Q.11 b,	**Q.12 c**	**Q.13 (A) q (B) q (C) r (D) q**	**Q.14 b**	**Q.15 c**
Q.16 b	**Q.17 a, b, c**			