

Video Solution on Website:-

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Video Solution on YouTube:-

<https://youtu.be/MiEe5jAe5w4>

Written Solution on Website:-

<https://physicsaholics.com/note/notesDetailis/49>

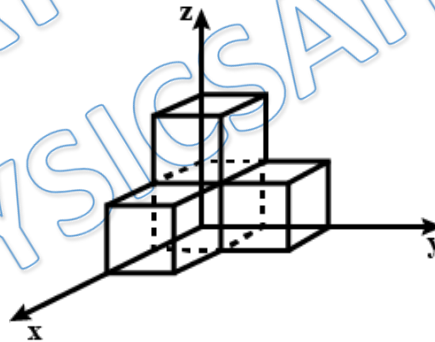
Q 1. Calculate the center of mass of a non-uniform rod whose linear mass density (λ) varies as $\lambda = \frac{\lambda_0}{L} x^2$, where λ_0 is a constant, L is the length of the rod and x distance is measured from one end of the rod

- (a) $\frac{L}{4}$ (b) $\frac{L}{2}$
 (c) $\frac{3L}{4}$ (d) $\frac{L}{3}$

Q 2. A non-uniform thin rod of length l lies along the axis with one end at the origin. It has a linear mass density $\lambda = \lambda_0 \left(1 + \frac{x}{l}\right)$. Find the center of mass of the rod

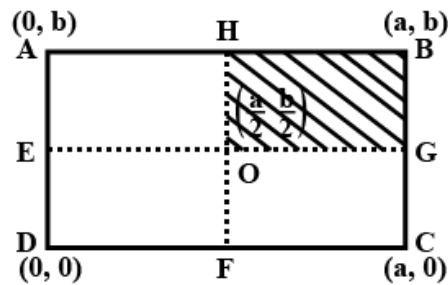
- (a) $\frac{2l}{9}$ (b) $\frac{5l}{9}$
 (c) $\frac{2l}{5}$ (d) $\frac{3l}{7}$

Q 3. Find the center of mass (x, y, z) of the following structure of four identical cubes if the length of each side of a cube is 1 unit



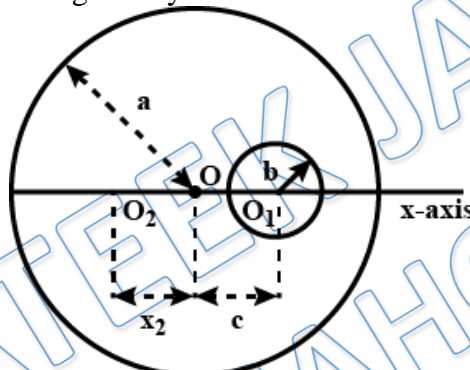
- (a) $\left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$
 (c) $\left(\frac{3}{4}, \frac{3}{4}, \frac{3}{4}\right)$ (d) $\left(\frac{1}{2}, \frac{3}{4}, \frac{1}{2}\right)$

Q 4. A uniform rectangular thin sheet ABCD of mass M has length a and breadth b, as shown in the figure. If the shaded portion HBGO is cut-off, the coordinates of the center of mass of the remaining portion will be :-



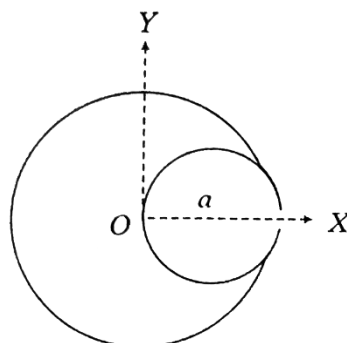
- (a) $\left(\frac{2a}{3}, \frac{2b}{3}\right)$ (b) $\left(\frac{5a}{3}, \frac{5b}{3}\right)$
 (c) $\left(\frac{3a}{4}, \frac{3b}{4}\right)$ (d) $\left(\frac{5a}{12}, \frac{5b}{12}\right)$

Q 5. A uniform circular disc of radius a is taken. A circular portion of radius b has been removed from it as shown in the figure. If the center of hole is at a distance c from the center of the disc, the distance x_2 of the center of mass of the remaining part from the initial center of mass O is given by



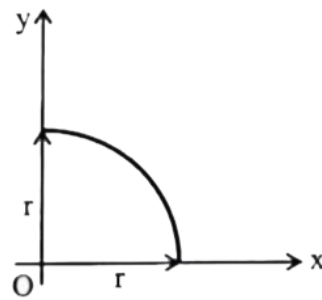
- (a) $\frac{\pi b^2}{a^2 - c^2}$ (b) $\frac{cb^2}{a^2 - b^2}$
 (c) $\frac{\pi c^2}{a^2 - b^2}$ (d) $\frac{ca^2}{c^2 - b^2}$

Q 6. Find the position of center of mass of the uniform lamina shown in figure, if small disc of radius $\frac{a}{2}$ is cut from disc of radius a . (Consider point 'O' as origin)



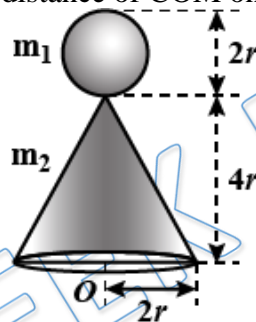
- (a) $(0, 0)$ (b) $\left(0, -\frac{a}{6}\right)$
 (c) $\left(-\frac{a}{6}, -\frac{a}{6}\right)$ (d) $\left(-\frac{a}{6}, 0\right)$

Q 7. The coordinates of the center of mass of the following uniform quarter circular arc are



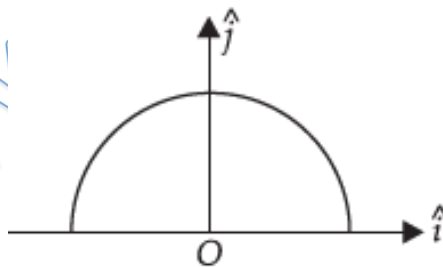
- (a) $\left(\frac{r}{2}, \frac{r}{2}\right)$ (b) $\left(\frac{2r}{3}, \frac{2r}{3}\right)$
 (c) $\left(\frac{2r}{\pi}, \frac{2r}{\pi}\right)$ (d) none of these

Q 8. A solid cone and a sphere is shown in the figure. The density of material of cone is $1/12$ times that of the sphere. The distance of COM on the line of symmetry from O is:



- (a) $4r$ (b) $3r$
 (c) $2r$ (d) $5r$

Q 9. Find the center of mass of uniform semi-circular ring of radius R

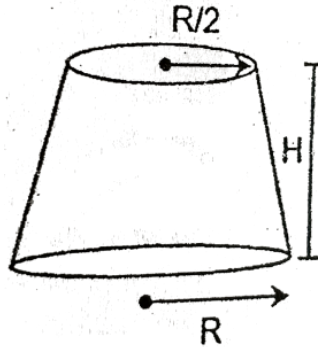


- (a) $\left(0, \frac{r}{2}\right)$ (b) $\left(0, \frac{r}{\pi}\right)$
 (c) $\left(0, \frac{2r}{\pi}\right)$ (d) $\left(0, \frac{2r}{3}\right)$

Q 10. A thin uniform wire is bent to form the two equal sides AB and AC of triangle ABC, where $AB=AC=5$ cm. The third side BC, of length 6cm, is made from uniform wire of same cross-section and twice the density of the first. The distance of the center of mass from A is

- (a) $\frac{23}{11}$ cm (b) $\frac{34}{9}$ cm
 (c) $\frac{12}{11}$ cm (d) $\frac{34}{11}$ cm

Q 11. A frustum of a uniform solid cone has base radius R and height H as shown. Radius of top surface is $R/2$. If height of center of mass of frustum is $\frac{11H}{4n}$ from base then n will be



- (a) 2 (b) 3
(c) 7 (d) 9

Q 12. Two spheres of mass M and $7M$ are connected by a rod whose mass is negligible, and the distance between the centers of each sphere is d . How far from the center of the $7M$ sphere is the Center of Mass for this object?

- (a) $\frac{d}{8}$ (b) $\frac{d}{7}$
(c) $\frac{d}{2}$ (d) $\frac{2d}{7}$

Answer Key

Q.1 c	Q.2 b	Q.3 c	Q.4 d	Q.5 b
Q.6 d	Q.7 c	Q.8 a	Q.9 c	Q.10 d
Q.11 c	Q.12 a			