1. A system consists of 3 particles each of mass m and located at (1, 1) (2, 2) (3, 3). The co-ordinates of the centre of mass are

(A) (6, 6) (B) (3, 3) (C) (2, 2) (D) (1, 1)

2. Two identical balls each of radius 10 cm are placed touching each other. The distance of their centre of mass from the point of contact is :

(A) zero (B) 5 cm (C) 10 cm (D) 15 cm

3. Four identical spheres each of radius 10 cm and mass 1 kg each are placed on a horizontal surface touching one another so that their centres are located at the corners of square of side 20 cm.

What is the distance of their centre of mass from centre of either sphere ?

(A) 5 cm (B) 10 cm (C) 20 cm (D) None of the above

4. Two atoms of the hydrogen are located at $\vec{r}_1$ and $\vec{r}_2$. Their centre of mass is at :

(A) $\frac{\vec{r}_1 - \vec{r}_2}{2}$ (B) $\frac{\vec{r}_1 + \vec{r}_2}{2}$ (C) $\vec{r}_1 - \vec{r}_2$ (D) $\vec{r}_1 + \vec{r}_2$

5. The separation between carbon and oxygen molecules in CO is 0.12 nm. What is the distance of the centre of mass from carbon atom ?

(A) 0.03 nm (B) 0.05 nm (C) 0.07 nm (D) 0.09 nm

6. Four identical spheres each of mass m are placed at the corners of square of side 2m. Taking the point of intersection of the diagonals as the origin, the co-ordinates of the centre of mass are :

(A) (0, 0) (B) (1, 1) (C) (–1, 1) (D)(1, –1)

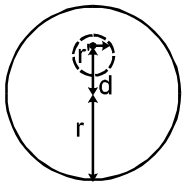
7. Three identical spheres each of mass M are placed at the corners of an equilateral triangle of side 2 m. Taking one of the corners as the origin, the position vector of the centre of mass is :

(A) $\hat{i} + \sqrt{3}\,\hat{j}$ (B) $\sqrt{3}\,\hat{i} + \hat{j}$ (C) $\hat{i} + \frac{\hat{j}}{\sqrt{3}}$ (D) $\frac{\hat{i}}{\sqrt{3}} + \hat{j}$

8. Three identical spheres each of mass M are placed at the corners of a right angled triangle with mutually perpendicular sides equal to 2m. Taking their point of intersection as the origin, the position vector of the centre of mass is :

(A) $\frac{2}{3}(\hat{i} + \hat{j})$ (B) $\frac{2}{3}(\hat{i} - \hat{j})$ (C) $\frac{1}{3}(\hat{i} + \hat{j})$ (D) $\frac{1}{3}(\hat{i} - \hat{j})$

9. A uniform circular of disc has radius r. A circular portion or radius r'. A circular portion of radius r' is removed from it. The centre of hole is at a distance d from the centre of disc. the position of centre of mass of the disc with hole is given by :



(A) $\frac{dr'}{(r - r')^2}$ (B) $\frac{dr'^2}{r - r'}$ (C) $-\frac{dr'^2}{r - r'}$ (D) $-\frac{dr'^2}{r^2 - r'^2}$

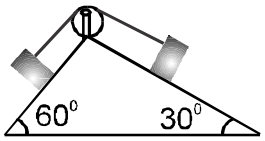
10. Two particles of mass 1 kg and 3 kg have position vectors $2\hat{i}+3\hat{j}+4\hat{k}$ and $-2\hat{i}+3\hat{j}-4\hat{k}$ respectively. The centre of mass has a position vector.

(A) $\hat{i}+3\hat{j}-2\hat{k}$ (B) $-\hat{i}-3\hat{j}-2\hat{k}$ (C) $-\hat{i}+3\hat{j}+2\hat{k}$ (D) $-\hat{i}+3\hat{j}-2\hat{k}$

11. Initially stable two particles x and y start moving towards each other under mutual attraction. If at one time the velocities of X and Y are V and 2V respectively, what will be the velocity of centre of mass of the system ?

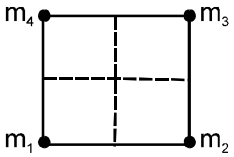
(A) V (B) V/2 (C) V/3 (D) zero

12. Two blocks of equal mass are ties with a light string which passes over a massless pulley as shown in figure. The magnitude of acceleration of centre of mass of both the blocks is (neglect friction everywhere):



(A) $\frac{\sqrt{3}-1}{4\sqrt{2}}g$ (B) $(\sqrt{3}-1)g$ (C) $\frac{g}{2}$ (D) $\left(\frac{\sqrt{3}-1}{\sqrt{2}}\right)g$

13. Four particles of masses $m_1 = 2m$, $m_2 = 4m$, $m_3 = m$ and m_4 are placed at four corners of a square. What should be the value of m_4 so that the centres of mass of all the four particles are exactly at the centre of the square ?



(A) 2m (B) 8m (C) 6m (D) none of these

14. Two particles of equal masses have velocities $\vec{V_1} = 2\hat{i}$ m/s .The first particle has an acceleration $\vec{a_1} = (3\hat{i}+3\hat{j})\frac{m}{s^2}$.

while the acceleration of the other particle is zero. The centre of mass of the particles moves in a :

(A) Circle (B) Parabola (C) Straight line (D) Ellipse

15. Mass is non-uniformly distributed on the circumference of a ring of radius a and centre at origin. Let b the distance of centre of mass of the ring from origin. Then :

(A) b = a (B) $0 \le b \le a$ (C) b < a (D) b > a

16. In which of the following cases the centre of mass of a rod is certainly not at its centre ?

(A) The density continuously increases from left to right.

(B) The density continuously decreases from left to right.

(C) The density decreases from left to right upto centre and then increases.

(D) The density increases from left to right upto centre and then decreases.

Answers

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1. (C) **2.** (A) **3.** (D) **4.** (B) **5.** (C) **6.** (A) **7.** (C) **8.** (A) **9.** (D) **10.** (D)
11. (D) **12.** (A) **13.** (D) **14.** (C) **15.** (B) **16.** (A, B)