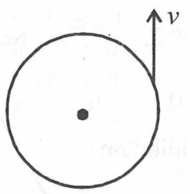
PHYSICS

1. (4)
Mutual force of attraction with which two particles A and B move towards each other is a internal force. There are no external forces acting on the system.
We know $F_{ext} = Ma_{cm}$
$a_{cm} = 0$ v_{cm} = constant.
Since, initially $v_{cm} = 0$
$\therefore$ Final $v_{cm} = 0$

2. (2)
Angular momentum, $|\vec{L}| = mvr$
Particle in circular motion moving with constant speed.



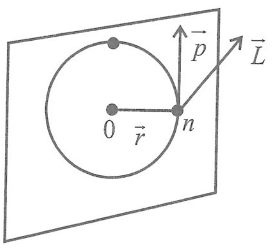
$\therefore$ Direction will be upward and speed remains constant.

3. (2)
Given: Force, $\vec{F} = 3\hat{j}\,N$
Position vector, $\vec{r} = 2\hat{k}\,m$
Torque, $\vec{\tau} = \vec{r}\times\vec{F} = 2\hat{k}\times 3\hat{j} = 6(\hat{k}\times\hat{j}) = 6(-\hat{i})$
$\Rightarrow \vec{\tau} = -6\hat{i}$ Nm

4. (1)
Kinetic Energy of rotating body
$K = \frac{1}{2}Iw^2 = \frac{L^2}{2I}$
$K_A = K_B \Rightarrow \frac{L_A^2}{2I_A} = \frac{L_B^2}{2I_B}$
$\because I_B > I_A \therefore L_A^2 < L_B^2 \Rightarrow L_A < L_B$

5. (2)

6. (1)
$\because \vec{L} = \vec{r}\times\vec{p}$

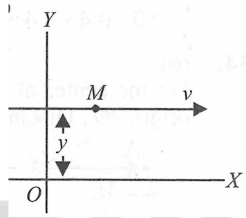


By right hand screw, rule, the direction of $\vec{L}$ is $\perp$ to the plane containing $\vec{r}$ and $\vec{p}$

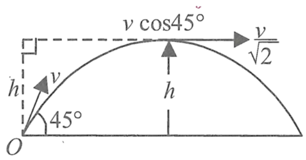
7. (1)
Angular momentum $\vec{L}$ is defined as $\vec{L} = \vec{r}\times m(\vec{v})$
So, $\vec{L}$ is an axial vector.

8. (4)
The MI. is minimum about EG because mass distribution is at minimum distance from EG.

9. (2)
Angular momentum $\vec{L} = r \perp \vec{p}$
$L = Mv \times y$



10. (2)
Angular momentum $L = r\perp \times P$
Angular momentum about point O
$L = \frac{mv}{\sqrt{2}}\times h$ ... (i)



Also, $h = \frac{v^2\sin^2\theta}{2g} = \frac{v^2}{4g}$ $[\because \theta = 45°]$ ... (ii)

From eq. (i) and (ii)
$L = \frac{m}{\sqrt{2}}(2\sqrt{gh})h = m\sqrt{2gh^3}$

Also, $L = \frac{mv}{\sqrt{2}}\times\frac{v^2}{4g} = \frac{mv^3}{4\sqrt{2}g}$