Episode No – 13
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COM & Collision

* A body of mass m hits normally a rigid wall with velocity v and returns with the same speed. The impulse experienced by the body is

(A) 0 (B) mv (C) 1.5 mv (D) 2 mv

Ans: D

* A smooth sphere is moving on a horizontal surface with velocity $2\hat{i} + 2\hat{j}$ just before it hits a vertical wall. The wall is parallel to $\hat{j}$ and the coefficient of restitution between the sphere and the wall is e = ½. The velocity of the sphere after the collision is

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

Ans: B

* A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed of 2 m/s. When the stone reaches the floor, the height of the man above the floor will be,

(A) 9.9 m (B) 10.1 m (C) 10 m (D) 20 m

Ans: B

* Two particles which are initially at rest move towards each other under the action their mutual attraction. If their speeds are v and 2v at an instant, then the speed of their center of mass will be

(A) 2v (B) 1.5 v (C) v (D) 0

Ans: D

* A ball moving with a velocity 2 m/s collides with a stationary ball of double the mass. If the coefficient of restitution is 0.5, their velocities in m/s after the collision will be

(A) 0, 1 (B) 1, 1 (C) 1, 0.5 (D) 0, 2

Ans: A

* A shell of mass 20 kg at rest explodes into two fragments whose masses are in the ratio 2: 3. The smaller fragment moves with a velocity of 6 m/s. The kinetic energy of the larger fragment is

a) 360 J (b) 144 J (c) 216 J (d) 96 J

Ans: D

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

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

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

Ans: A

* A body A of mass M while falling vertically downwards under gravity breaks into two parts B and C. B has a mass of M/3 and C has 2M/3. The centre of mass of the system of two bodies B and C shifts, compared to that of body A towards

(A) Body C (B) body B

(C) Depends on height of breaking (D) does not shift

Ans: D

* Consider a two particle system with masses m_1 and m_2. If the first particle is pushed towards the centre of mass through a distance d, by what distance should the second particle move, so as to keep the centre of mass at the same position?

(A) $\frac{m_2 d}{m_1}$ (B) $\frac{m_1 d}{m_1 + m_2}$ (C) $\frac{m_1 d}{m_2}$ (D) d

Ans: C

* Consider the 2 statements:

A)Linear momentum of a system of particles is Zero

B) Kinetic energies of a system of particles is Zero

a) A doesn't => B but B => A

b) A doesn't => B & B doesn't => A

c) A => B and B => A

d) A => B but B doesn't => A

Ans: A

* A body A of mass M while falling vertically downwards under gravity breaks into two parts B & C of mass M/3 & 2M/3. The Centre of mass of the system (B + C) shifts compared to A towards

a) Body C b) Body B

c) Depends on Height of breaking d) does not shift

Ans: D

*Two identical blocks of mass 1Kg are moving with 10m/s towards each other along a frictionless horizontal surface. They collide and stick to each other what is the work done by external force & internal force?

a) 0, -100J b) 5, 50J

c) 2.5, 200J c) 0, 0

Ans: A