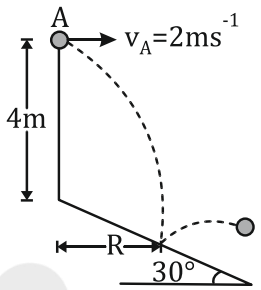
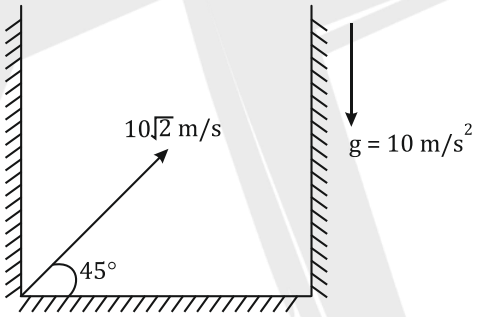
DPP – 06

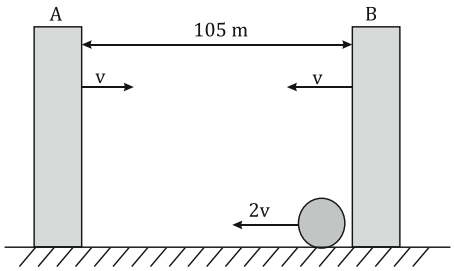
Q.1 A 0.5 kg ball is thrown horizontally from point A with velocity $v_A = 2\ ms^{-1}$. Determine the horizontal distance R where the ball strikes the smooth inclined plane. If the coefficient of restitution is $e = 0.6$, determine the speed at which it bounces from the plane. Take $g = 9.8\ ms^{-2}$.



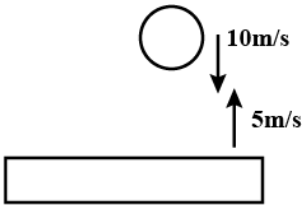
Q.2 There are two vertical walls separated by a distance 3 m. A projectile is projected from the foot of one wall with a speed $10\sqrt{2}$ m/s at angle 45° with horizontal as shown in the figure. During its motion, it collides many a times with vertical walls elastically. During collision, the velocity of the projectile perpendicular to wall get reversed and the one which is parallel to wall remains unchanged. The number of collision projectile will make with the vertical walls before hitting the ground is



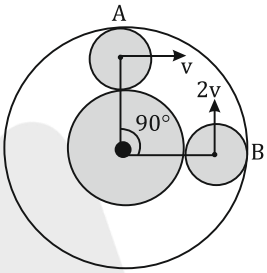
Q.3 As shown in the figure, a small ball is moving with speed 2v towards wall A and both the walls are moving with constant velocity v towards each other. Find the speed v (in m/s), if the time taken by the ball in first three collision is 5 s. (Assume all collision are perfectly elastic and friction is absent)



Q.4 A ball of mass 1 kg strikes a heavy platform, elastically, moving upwards with a velocity of 5 m/s. The speed of the ball just before the collision is 10 m/s downwards. Then the impulse (in N-s) imparted by the platform on the ball is

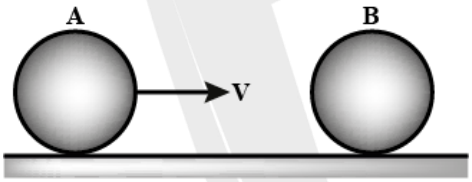


Q.5 Body A of mass m and B of mass 3m move towards each other with velocities V and 2V respectively from the positions as shown, along a smooth horizontal circular track of radius r. After the first elastic collision, they will collide again after the time:



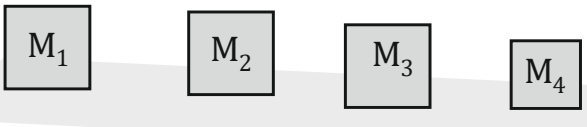
(A) $\frac{2\pi r}{V}$ (B) $\frac{\pi r}{2V}$ (C) $\frac{\pi r}{V}$ (D) $\frac{2\pi r}{3V}$

Q.6 The sphere A of mass m_1 moves with velocity V on a frictionless horizontal surface and strikes with sphere B of mass m_2 at rest. The sphere A comes back with speed V/10. Find the correct option:



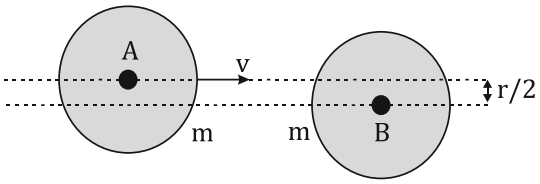
(A) $m_1 > m_2$ (B) $m_1 = m_2$ (C) $m_1 < m_2$ (D) none of these

Q.7 Four blocks of masses M_1, M_2, M_3 and M_4 are placed on a smooth horizontal surface along a straight line as shown. It is given that $M_1 \gg M_2 \gg M_3 \gg M_4$. All the blocks are initially at rest. M_1 is given initial velocity v_0 towards right such that it will collide with M_2. Consider all collisions to be perfectly elastic. The speed of M_4 after all collision are over is



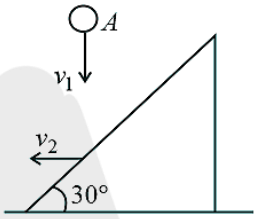
(A) v_0 (B) $4v_0$ (C) $8v_0$ (D) $16v_0$

Q.8 A disk A of radius r moving on perfectly smooth surface at a speed v undergoes an elastic collision with an identical stationary disk B. Find the velocity of the disk B after collision if the impact parameter is r/2 as shown in the figure



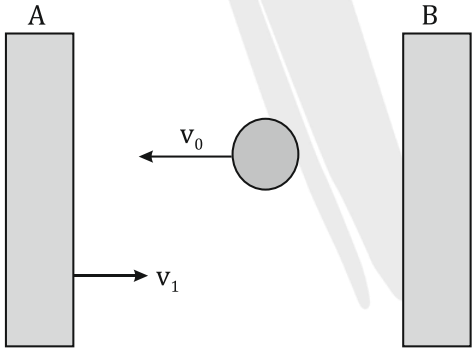
(A) $\frac{v\sqrt{15}}{4}$ (B) $\frac{v}{4}$ (C) $\frac{v}{2}$ (D) $\frac{\sqrt{3}v}{2}$

Q.9 A ball A is falling vertically downwards with velocity v_1. It strikes elastically with a wedge moving horizontally with velocity v_2 as shown in the figure. What must be the ratio $\frac{v_1}{v_2}$ so that the ball bounces back in vertically upwards direction relative to wedge?



(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$ (C) 2 (D) $\frac{1}{2}$

Q.10 A ball of mass m moving with speed v_0 bounces back and forth between two massive stationary walls separated by a distance ℓ. The collisions are perfectly elastic and effect of gravity is to be neglected. One of the walls starts moving slowly towards the other wall with speed $v_1 (v_1 \ll\ll v_0)$, find the velocity of ball when the distance between the walls has been reduced to $\ell/2$. (Assume mass of wall $\gg$ m):



(A) v_0 (B) $v_0 + 2v_1$ (C) $2v_0$ (D) data insufficient

ANSWER KEY

1. (8) **2.** (6) **3.** (9) **4.** (30) **5.** (D) **6.** (C) **7.** (C)
8. (A) **9.** (B) **10.** (C)

Home Work

Ex. 1	Q. 17
Ex. 2	Q
Ex.3	Q. 10, 12
Ex.4	Q. 18,19, 23
Ex.5	Q. 8, 17, 21