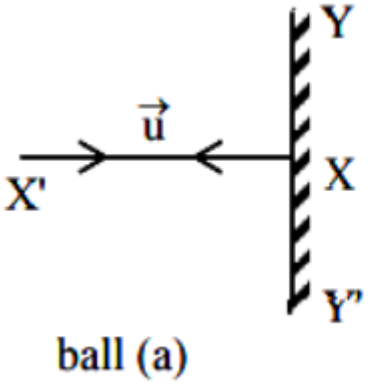
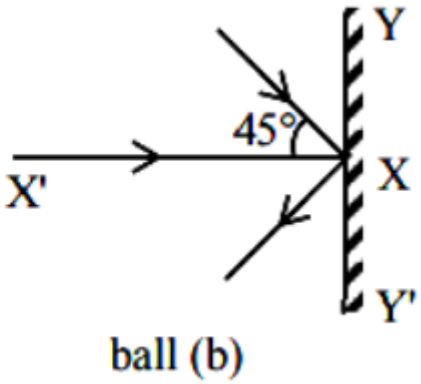
LAWS OF MOTION

1	A 0.5 kg ball moving with speed of 12 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 seconds, the average force acting on the wall is (a) 24 N (b) 12 N (c) 6 N (d) 48 N
2	A ball of mass 0.15 kg hits the wall with its initial speed of 12 m/s and bounces back without changing its initial speed. If the force applied by the wall on the ball during the contact is 100 N. Calculate the time duration of the contact of ball with the wall. (a) 0.018 s (b) 0.036 s (c) 0.009 s (d) 0.072 s
3	A particle of mass M originally at rest is subjected to a force whose direction is constant, but magnitude varies with time according to the relation $F = F_0\left[1 - \left(\frac{t-T}{T}\right)^2\right]$ where F_0 and T are constants. The force acts only for the time interval 2T. The velocity v of the particle after time 2T is (a) $\frac{2F_0T}{M}$ (b) $\frac{2F_0T}{2M}$ (c) $\frac{4F_0T}{3M}$ (d) $\frac{F_0T}{3M}$
4	Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be: (a) Mv newton (b) 2Mv newton (c) Mv / 2 newton (d) zero
5	A force on an object of mass 100 g placed at origin is (10 i + 5 j) N. The position of that object at t = 2 s is (a) 10 i + 5 j (b) 100 i + 50 j (c) 20 i + 10 j (d) 200 i + 100 j
6	An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to [Use g = 10 ms^{-2}] (a) 1: 1 (b) √2: √3 (c) √3: √2 (d) 2: 3

7	A particle is projected with velocity v_0 along x-axis. A damping force is acting on the particle which is proportional to the square of the distance from the origin i.e., $ma = -\alpha x^2$. The distance at which the particle stops (a) $\left[\frac{3v_0^2 m}{2\alpha}\right]^{1/2}$ (b) $\left[\frac{2v_0^2 m}{3\alpha}\right]^{1/3}$ (c) $\left[\frac{2v_0^2 m}{3\alpha}\right]^{1/2}$ (d) $\left[\frac{3v_0^2 m}{2\alpha}\right]^{1/3}$
8	A balloon held fixed in space, has 10 g air in it. The air escapes from the balloon at a uniform rate with velocity 4.5 cm/s. If the balloon shrinks in 5 s completely. Then, the average force acting on that balloon will be (in dyne) (a) 3 (b) 9 (c) 12 (d) 18
9	The initial mass of a rocket is 1000 kg. Calculate at what rate the fuel should be burnt so that the rocket can accelerate vertically at 20 ms^{-2} . The gases come out at a relative speed of 500 ms^{-1} with respect to the rocket: [Use g = 10 m/s^2] (a) 40 kg / s (b) 60 kg / s (c) 500 kg / s (d) 600 kg / s
10	Two billiard balls of equal mass 30 g strike a rigid wall with same speed of 108 kmph (as shown) but at different angles. If the balls get reflected with the same speed, then the ratio of the magnitude of impulses imparted to ball a and ball b by the wall along X direction is  ball (a)  ball (b) (a) 1 : 1 (b) √2 : 1 (c) 2 : 1 (d) 1 : √2