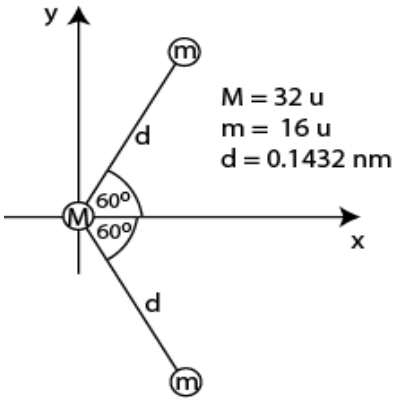
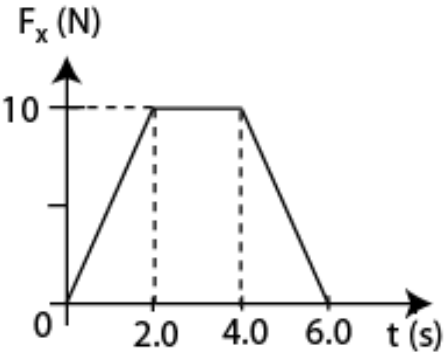
Old Exam. Questions Ch. 9

T072

Q9: A sulfur dioxide molecule SO_2 consists of a Sulfur atom (M = 32 u) located at the origin with two Oxygen atoms each of mass (m = 16 u) bound to it as in Fig 4. The angle between the two bonds is 120°. If each bond is 0.1432 nm long, what is the location of the center of mass of the molecule (x,y)? (Ans: (0.0358, 0) nm)



Q10. A 10.0 kg toy car is moving along the *x* axis. The only force F_x acting on the car is shown in Fig. 5 as a function of time (t). At time $t = 0$ s the car has a speed of 4.0 m/s. What is its speed at time $t = 6.0$ s? (Ans: 8.0 m/s)

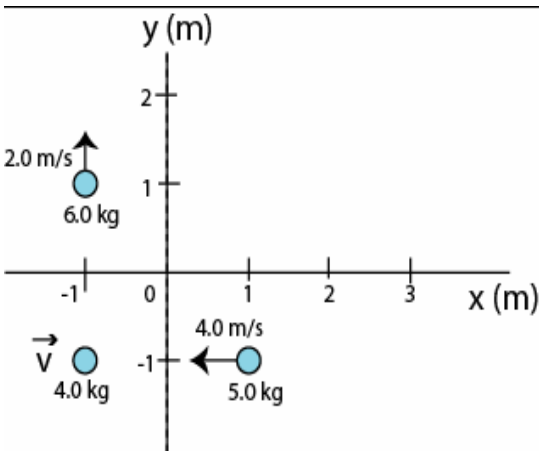


Q11. An object of mass M moving on a frictionless frozen lake with speed V explodes into two equal pieces, one moving at 6.0 m/s due north, and the other at 8.0 m/s due west. Determine V. (Ans: 5.0 m/s)

Q12. A 4.0 kg block with a velocity of $2\boldsymbol{i}$ m/s makes an elastic collision with a 2.0 kg block moving with a velocity of $(2i+j)$ m/s. What is the total kinetic energy of the two blocks after the collision? (Ans: 13 J)

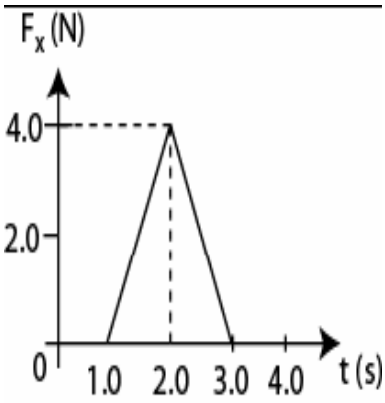
T071

Q8. Two velocities of the three-particle system are shown in the Fig. 1. If the velocity of the center of mass is zero, find the velocity $\boldsymbol{v}$ of the 4.0 kg mass. (Ans: $(5i-3j)$ m/s)



Q9. A 4.0 kg object moving with velocity (9.0) *i* m/s explodes into two pieces, one with mass 1.0 kg and velocity *(6.0 j)* m/s and the other with mass 3.0 kg and velocity *v* . Determine *v*. (Ans: *(12i-2.0 j)* m/s)

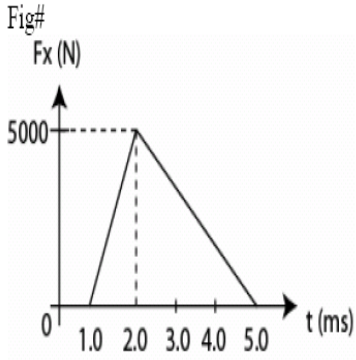
Q10. A 5 kg object moving along the *x* axis is subjected to a force F_x in the positive *x* direction. A graph of F_x as a function of time *t* is shown in Fig. 2. Find the magnitude of the change in the velocity of the object during the time the force is being applied. (Ans: 0.8 m/s)



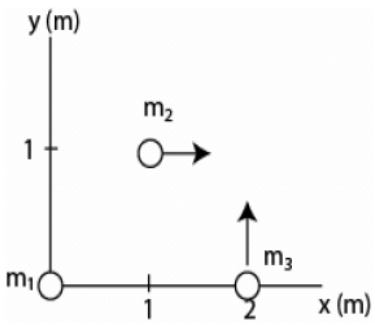
Q11. A block of mass m = 500 g moving on a frictionless track at an initial speed of 3.20 m/s undergoes an elastic collision with an initially stationary block of mass M. After collision, the first block moves opposite to its original direction at 0.500 m/s. The mass M is: (Ans: 685 g)

Q12. Two bodies , *A* and *B* each of mass 2.0 kg moving with velocities v_A = *(2.0i+5.0 j)* m/s and v_B = *(1.0i-5.0j) m/s* collide and stick together after collision. After the collision, the velocity of the composite object is: (Ans: 1.5 i m/s)

T062: Q9. An impulsive force Fx as a function of time (in ms) is shown in the Fig. 3 as applied to an object (m = 5.0 kg) at rest. What will be its final speed? A) 2.0 m/s.

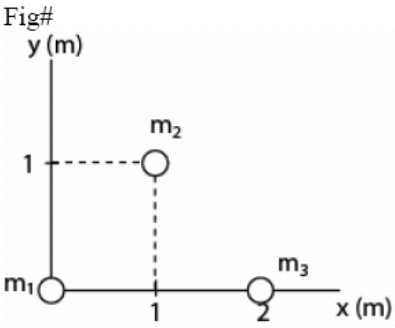


Q10. Each object in Fig. 4 has a mass of 2.0 kg. The mass m_1 is at rest, m_2 has a speed of 3.0 m/s in the direction of +ve x-axis and m_3 has a speed of 6.0 m/s in the direction of +ve y-axis. The momentum of the center of mass of the system is: (Ans: 6*i*+12*j*)



Q11. A 0.20 kg steel ball, travels along the x-axis at 10 m/s, undergoes an elastic collision with a 0.50 kg steel ball traveling along the y-axis at 4.0 m/s. The total kinetic energy of the two balls after collision is: (Ans: 14 J.)

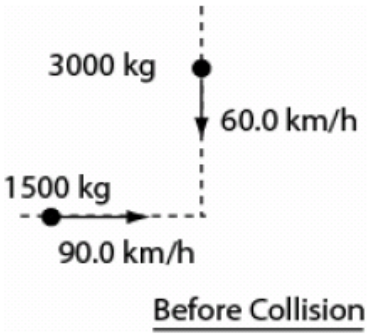
Q12. If the masses of m_1 and m_3 in Fig. 5 are 1.0 kg each and m_2 is 2.0 kg, what are the coordinates of the center of mass? (Ans: (1.00, 0.50) m)



T061;

Q10. A small object with linear momentum 5.0 *kg·m/s* makes a head-on collision with a large object at rest. The small object bounces straight back with a momentum of magnitude 4.0 *kg·m/s*. What is the magnitude of the change in momentum of the large object? (Ans: 9.0 *kg·m/s)*

Q11. A 1500 *kg* car traveling at 90.0 *km/h* east collides with a 3000 *kg* car traveling at 60.0 *km/h* south. The two cars stick together after the collision (see Fig 2). What is the speed of the cars after collision? (Ans: 13.9 *m/s*)



Q12. A 3.0 *kg* mass is positioned at (0, 8.0) *m*, and a 1.0 *kg* mass is positioned at (12, 0) *m*. What are the coordinates of a 4.0 *kg* mass which will result in the center of mass of the system of three masses being located at the origin (0, 0)? (Ans: (–3.0, –6.0) *m*)

T052:

Q9: The location of two thin flat objects of masses m_1= 4.0 kg and m_2 = 2.0 kg are shown in Fig. 3, where the units are in m. The *x* and *y* coordinates of the center of mass of this system are: (Ans: 1.0 m, 0.33m).

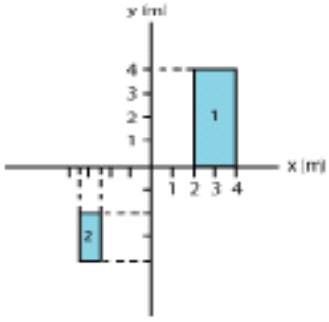


Figure 3

Q10: The impulse which will change the velocity of a 2.0-kg object from v_1 =+30*j* *m*/ s to v_2== −30 *i* m/s is : (-60i-60j)N.s.

Q11: A 2.00 kg pistol is loaded with a bullet of mass 3.00 g. The pistol fires the bullet at a speed of 400 m/s. The recoil speed of the pistol when the bullet was fired is: (Ans: 0.600 m/s)

Q#12: Sphere *A* has mass 3*m* and is moving with velocity *v* in the positive the *x* direction. Sphere *B* has a mass *m* and is moving with velocity *v* in the negative *x* direction. The two spheres make a head-on elastic collision. After the collision the velocity of *A* (v_A) is: (Ans:zero)

T051:

Q9: Sphere A has a mass M and is moving with speed 10 m/s. It makes a head-on elastic collision with a stationary sphere B of mass 3M. After the collision the speed of B is: (Ans: 5.0 m/s)

Q10: The two pieces of uniform sheets made of the same metal are placed in the x-y plane as shown in the Figure 2. The center of mass (x_{com}, y_{com}) of this arrangement is(Ans: (-0.75, 0.75) cm)

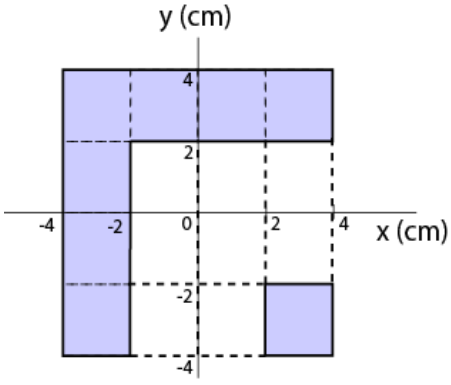


Figure 2

Q#11: A 0.50 kg ball moving at 2.0 m/s perpendicular to a wall rebounds from the wall at 1.4 m/s. The impulse on the ball is: (Ans: 1.7 N · s away from wall)

Q#12: An object of 12.0 kg at rest explodes into two pieces of masses 4.00 kg and 8.00 kg. The velocity of the 8.00 kg mass is 6.00 m/s in the +ve x-direction. The change in the kinetic is: (Ans: 432 J)