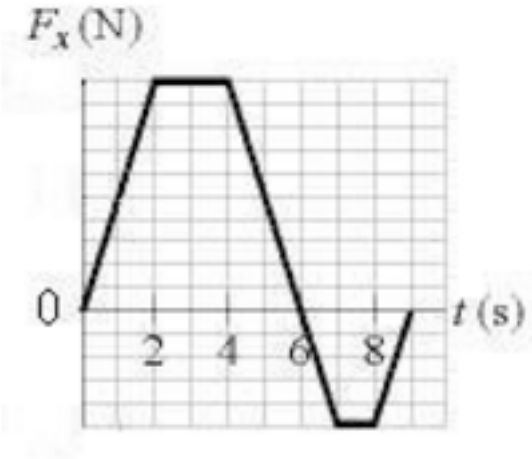
1. **A 0.70 [kg] ball is moving horizontally with a speed of 9.8 [m/s] when it strikes a vertical wall. The ball rebounds with a speed of 1 [m/s]. What is the magnitude of the change in linear momentum of the ball?**

2. **In February 1955, a paratrooper fell 380 [m] from an airplane without being able to open his chute but happened to land in snow, suffering only minor injuries. Assume that his speed at impact was 56 [m/s] (terminal speed), that his mass (including gear) was 85 [kg], and that the force on him from the snow was at the survivable limit of 1.2×10^5 [N].**
   a. **What is the minimum depth of snow that would have stopped him safely?**
   b. **What is the magnitude of the impulse on him from the snow?**

3. **A 1.0 [kg] ball drops vertically onto a floor, hitting with a speed of 25 [m/s]. It rebounds with an initial speed of 5 [m/s].**
   a. **What impulse acts on the ball during the contact?**
   b. **If the ball is in contact with the floor for 0.020 [s,] what is the average force exerted on the floor?**

4. **A 4.2 [kg] toy racecar can move along an x-axis. The figure shows the horizontal force F_x acting on the car, which begins at rest at time t = 0. The vertical axis is marked in increments of 0.5 [N].**



   a. **What is the momentum of the car at t = 2.0 s?**
   b. **What is the momentum of the car at t = 9.0 s?**
   c. **What is the car's velocity at t = 8.0 s?**

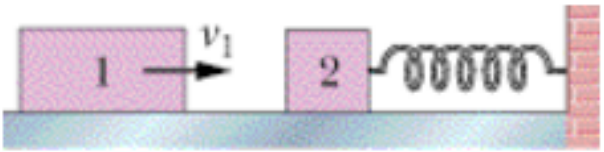
5. **A 96 [kg] man sitting on a surface of negligible friction shoves a 66 [g] stone away from himself, giving it a speed of 4 [m/s]. What speed does the man acquire as a result?**

6. **A stationary block explodes into two pieces L and R that slide across a frictionless floor and then into regions with friction, where they stop. Piece L, with a mass of 2.8 [kg], encounters a coefficient of kinetic friction μ_L = 0.40 [1] and slides to the left and stops after traveling distance d_L = 0.15 [m]. Piece R encounters a coefficient of kinetic friction μ_R = 0.50 [1] and slides to the right and stops after traveling distance d_R =0.37 [m]. What was the mass of the original block?**

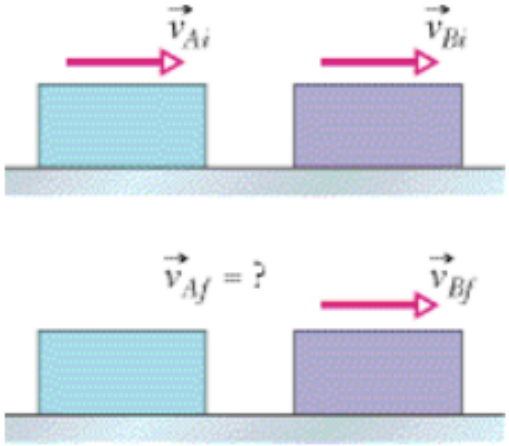
7. **A completely inelastic collision occurs between two balls of wet putty that move directly toward each other along a vertical axis. Just before the collision, one ball of mass 3.0 [kg] is moving upward at 20 [m/s], and the other ball, of mass 1.4 [kg], is moving downward at 17 [m/s]. How high do the combined two balls of putty rise above the collision point? (Neglect air resistance)**

8. **A car of mass 1200 [kg] is stopped at a traffic light when it is rear-ended by car B of mass 1300 [kg]. Both cars then slide with locked wheels until the frictional force from the road (with a low μ_k of 0.12 [1]) stops them, at distances d_A = 8.2 [m]and d_B = 6.1 [m].**
   a. **What is the speed of car A at the start of the sliding?**
   b. **What is the speed of car B at the start of the sliding?**
   c. **Assuming that linear momentum is conserved during the collision, find the speed of car B just before the collision.**

9. **In the figure below, block 2 of mass 1.5 [kg] is at rest on a frictionless surface and touching the end of an unstretched spring of spring constant 110 [N/m]. The other end of the spring is fixed to a wall. Block 1 of mass 2.1 [kg], traveling at speed v1 = 4.0 [m/s], collides with block 2, and the two blocks stick together. When the blocks momentarily stop, by what distance is the spring compressed?**



10. **In the figure below, block A of mass 1.8 [kg] slides into block B of mass 2.1 [kg], along a frictionless surface. The directions of the three velocities are indicated; the corresponding speeds are v_{Ai} = 5.5 [m/s], v_{Bi} = 2.5 [m/s], and v_{Bf} = 4.9 [m/s].**



a. **What is the speed of velocity v_{Af}?**
b. **What is the direction of v_{Af}?**
c. **Is the collision elastic?**

11. **In the figure below, block 1 of mass m_1 slides from rest along a frictionless ramp from height h = 2.30 [m] and then collides with stationary block 2, which has mass $m_2 = 2m_1$. After the collision, block 2 slides into a region where the coefficient of kinetic friction μ_k is 0.5 [1] and comes to a stop in distance d within that region.**

a. **What is the value of distance d if the collision is elastic? (i.e., the total KE of the blocks before and after the collision are equal)**
b. **What is the value of distance d if the collision is completely inelastic? (i.e., the two blocks stick together and move as one).**

12. A steel ball of mass 0.6 [kg] is fastened to a cord that is 80 [cm] long and fixed at the far end. The ball is then released when the cord is horizontal. At the bottom of its path, the ball strikes a 2.5 [kg] steel block initially at rest on a frictionless surface. The collision is elastic.

a. Find the speed of the ball just after collision.

b. Find the speed of the block just after collision.

HW Set 10 Answers

1. 7.56 [kg m/s]

2a. 1.11 [m]
2b. 5760 [kg m/s]

3a. 30 [kg m/s]
3b. 1500 [N]

4a. 5 [kg m/s]
4b. 15 [kg m/s]
4c. 3.87 [kg m/s]

5. 0.00275 [m/s]

6. 4.39 [kg]

7. 0.0766 [m]

7. 3.45 [m]

8a. 4.39 [m/s]
8b. 3.79 [m/s]
8c. 7.84 [m/s]

9. 0.422 [m]

10a. 2.7 [m/s]
10b. To the right
10c. No, because the total KE before the collision is **not equal** to the total KE after the collision.

11a. 2.04 [m]
11b. 0.511 [m]

12a. 2.43 [m/s]
12b. 1.53 [m/s]