Part G Problems

1. A 6 kg object is moving to the right at 10 m/s. An impulse of 150 N-s directed to the *left* is delivered to the object. What is the final speed of the object?

2. An impulse of 600 N-s was delivered to an object over a 0.20 second time-period. What was the force of the impulse?

3. A 60-kg jogger traveling at 2.0 m/s comes to rest suddenly by running into a tree. If the contact time of the collision is 0.40 second, what was the absolute value of the average force (in newtons) exerted by the tree on the jogger?

4. A 5-kg object sliding to the right at 6 m/s collides head-on with a 10-kg object moving to the left at 3.0 m/s, and they stick together, and stop. What impulse (in N-s) was suffered by the 5-kg object?

5. A baseball having a mass of 0.21 kg is moving at a speed of 40 m/s to the left toward a batter. The bat delivers an impulse of 20 N-s to the ball, directed to the right. What is the ball's approximate speed after it leaves the bat?

6. A 4 kg ball is thrown horizontally to the left toward a wall. It strikes the wall at a speed of 7 m/s. It rebounds from the wall with a speed of 5 m/s, traveling to the right. If the impulse delivered to the ball lasted 0.30 seconds, what was the average force (in newtons) exerted by the wall on the ball?

7. A 7 kg object is moving to the right at 10 m/s. It is about to collide with a 5 kg object also moving to the right, but at a lower speed of 8 m/s. After collision, the 7 kg object's speed is reduced to 8 m/s. What is the speed of the 5 kg object after collision?

8. A 4-kg object moving to the right at 16.0 m/s collides head-on with a 6-kg object moving to the left at 5.0 m/s. The objects stick together. About how much kinetic energy (in joules) was lost in this collision?

9. A 120-kg space-walker becomes un-tethered from the space shuttle and begins drifting away at a negligible small speed. To return to the ship, she throws a 0.7 kg tool away from her, at speed 2.3 m/s. What speed back toward the shuttle does she acquire?

Solutions

1. $I = -150$ N-s

$p_o = 6(10)$

$= 60$ kg-m/s

$p - p_o = I$

$6v - 60 = -150$

$v = -15$ m/s

speed $= |-15|$

$= 15$ m/s

2. $\bar{F}(0.20) = 600$

$\bar{F} = 3000$ N

3. $p - p_o = \bar{F}\,t$

$60(0) - 60(2) = \bar{F}(0.40)$

$\bar{F} = -300$ N

$|\bar{F}| = 300$ N

4. $I = \Delta p$

$= 0 - (5)(6)$

$= -30$ kg-m/s

5. $mv - mv_o = I$

$v - v_o = I/m$

$v = I/m + v_o$

$= 20/0.21 - 40$

$= 55.24$ m/s

6. $\bar{F}\,t = m(v - v_o)$

$\bar{F} = m(v - v_o)/t$

$= 4\,[5 - (-7)]\,/0.30$

$= 160$ N

7. $p_o = 7(10) + 5(8)$

$= 110$ kg-m/s

$p = p_o$

$7(8) + 5v = 110$

$v = 10.8$ m/s

8.

$K_o = \frac{1}{2}(4)16^2 + \frac{1}{2}(6)5^2$

$= 587.0$ J

The two objects stick together and become a single object whose mass is 10 kg:

$P = P_o$

$10v = 4(16) + 6(-5)$

$v = 3.4$ m/s

$K = \frac{1}{2}(10)3.4^2$

$= 57.8$ J

$\Delta K = 57.8 - 587.0$

$= -529.2$ J

529.2 J of kinetic energy was lost

9. The tool and the spacewalker are each at rest initially so the initial total momentum is zero.

$P = P_o$

$120\,v + 0.7(2.3) = 0$

$v = -0.0134$ m/s