

Key

- 1) What is the momentum of a 140 kg football player traveling at 27 m/s?

$$p = m \cdot v$$

$$140 \cdot 27 \text{ m/s} =$$

$$p = 3780 \text{ kg} \cdot \text{m/s}$$

- 2) What impulse is needed to stop a 40 kg mass traveling at a velocity of 17 m/s?

$$F \Delta t = m \cdot (v_f - v_i) \quad m = 40 \text{ kg} \quad v_i = 17 \text{ m/s} \quad v_f = 0 \text{ m/s}$$

$$= 40(0 - 17)$$

$$F \cdot \Delta t = -680 \text{ N} \cdot \text{s}$$

- 3) A force with a magnitude of 370 N is used to stop an object with a mass of 62 kg traveling at 125 m/s. How long will it take to bring the object to a stop?

$$F \cdot \Delta t = m(v_f - v_i)$$

$$370 \cdot \Delta t = 62(0 - 125)$$

$$\Delta t = \frac{62(-125)}{370}$$

$$\Delta t = 20.9 \text{ s}$$

$$F = 370 \text{ N} \quad m = 62 \text{ kg}$$

$$v_f = 0 \text{ m/s} \quad v_i = 125 \text{ m/s}$$

$$\Delta t = ?$$

- 4) A car with a mass of 1200 kg rolls on ice at 33 m/s and strikes another non-moving car with a mass of 700 kg. The 1st car stops completely. At what speed does the 2nd car move away?

$$\text{Car A } m = 1200 \text{ kg}$$

$$\text{Car B } m = 700 \text{ kg}$$

$$p_{ai} + p_{bi} = p_{af} + p_{bf}$$

$$v_{ai} = 33 \text{ m/s} \quad v_{af} = 0 \quad v_{bi} = 0 \quad v_{bf} = ?$$

$$\frac{3,900}{700} = \frac{700 v_{bf}}{700}$$

$$m_a v_{ai} + m_b v_{bi} = m_a v_{af} + m_b v_{bf}$$

$$1200(33) + 700(0) = 1200(0) + 700 \cdot v_{bf}$$

$$v_{bf} = 56.6 \text{ m/s}$$

- 5) A ball with a mass of 7 kg is moving at 20 m/s and collides with another ball with a mass of 21 kg moving at 10 m/s. After they collide, the 7 kg ball continues moving at 13 m/s. Find the final velocity of the 21 kg ball.

$$\text{Ball A } m_a = 7 \text{ kg} \quad v_{ai} = 20 \text{ m/s} \quad v_{af} = 13 \text{ m/s}$$

$$\text{Ball B } m_b = 21 \text{ kg} \quad v_{bi} = 10 \text{ m/s} \quad v_{bf} = ?$$

$$p_{ai} + p_{bi} = p_{af} + p_{bf} \Rightarrow m_a(v_{ai}) + m_b(v_{bi}) = m_a(v_{af}) + m_b(v_{bf})$$

$$7(20) + 21(10) = 7(13) + 21(v_{bf})$$

$$140 + 210 = 91 + 21v_{bf}$$

$$350 = 91 + 21v_{bf}$$

$$\frac{350 - 91}{21} = \frac{21v_{bf}}{21} \quad v_{bf} = 12.3 \text{ m/s}$$

- 6) Complete problems 33 - 34, 36 - 37, 49 - 50 on pg. 250

33) Yes, the bullet will need a higher velocity to have the same momentum as a truck, because its mass is less than a truck.

$$m_{\text{bullet}} \cdot v_{\text{bullet}} = m_{\text{truck}} \cdot v_{\text{truck}}$$

34) a) The pitcher & catcher exert the same amount of impulse on the ball, but the two impulses are in opposite directions.

b) The catcher exerts the larger force on the ball because the time interval over which the force was applied is smaller.

36) Cars are made w/ bumpers that compress during a crash to increase the time of collision, to reduce the force.

37) a) by applying an external torque
b) by changing the moment of inertia

49) A - positive velocity
B - at rest
C - negative velocity

50) When the gas pistol is fired in the opposite direction, it provides the impulse needed to move the astronaut toward the space ship.