

MOMENTUM

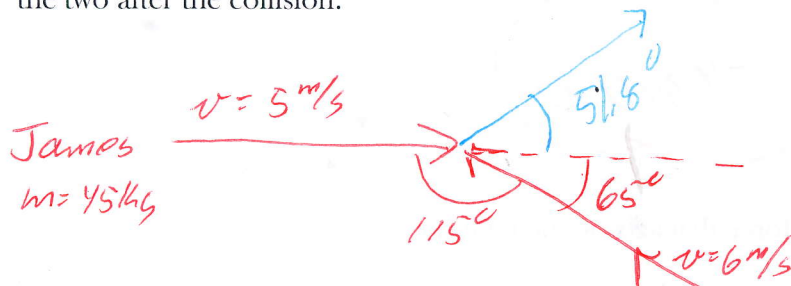
AT Momentum(11)

Solve the following problems showing ALL work and CIRCLING your answers. Each is worth 5 points.

- 1) Determine the momentum of a person (mass 72kg) running at 8 m/s. The wind is blowing at 2 m/s.

$$p = mv = (72\text{kg})(8\text{m/s}) = 576\text{kg m/s}$$

- 2) Two kids, James and Amy, are playing on ice. James has a mass of 45 kg and Amy has a mass of 33kg. James runs and slides at a speed of 5 m/s. Amy runs and slides on the ice at a speed of 6 m/s and at an angle of 115 degrees from the path of James. The two will collide in a totally inelastic collision. Determine the velocity of the two after the collision.



$$P_{J_0} - P_{A_0} = P_{JA}$$

$$m_J v_{J_0} - m_A v_{A_0} \cos \theta = m_{AJ} v_{AJ} \cos \alpha$$

$$m_J v_{J_0} - m_A v_{A_0} \cos 65 = \frac{m_{AJ} m_A v_{A_0} \sin 65 \cos \alpha}{m_{AJ} \sin \alpha}$$

$$m_J v_{J_0} - m_A v_{A_0} \cos 65 = m_A v_{A_0} \sin 65 \tan \alpha$$

$$\tan \alpha = \frac{m_A v_{A_0} (\sin 65)}{m_J v_{J_0} - m_A v_{A_0} \cos 65} = \frac{(33\text{kg})(6\text{m/s}) \sin 65}{(45\text{kg})(5\text{m/s}) - (33\text{kg})(6\text{m/s}) \cos 65}$$

Amy
m = 33kg

$$y = m_A v_{A_0} \sin 65 = m_{AJ} v_{AJ} \sin \alpha$$

$$\frac{m_A v_{A_0} \sin 65}{m_{AJ} \sin \alpha} = v_{AJ}$$

$$v = \frac{(33\text{kg})(6\text{m/s}) \sin 65}{(45\text{kg}) \sin(51.8)}$$

$$v = 2.9\text{m/s}$$

$$\alpha = 51.8^\circ \quad 2.9\text{m/s}$$

key Level I Physics Pd 2

(Use the information below to respond to problems 3-6)

A red bumper car (At an amusement park) has a mass of 85kg and is moving to the right at 4 m/s. The car collides in a totally elastic collision with a blue bumper car of mass 92kg that was moving at 4.5 m/s to the left. The collision takes place in a time of 0.08s.

3) Determine the final velocity of the red car after the collision

$$-4.84 \text{ m/s}$$

4) Determine the final velocity of the blue car after the collision

$$3.66 \text{ m/s}$$

5) Determine the force that acts on the red car.

$$-9390 \text{ N}$$

6) Determine the force that acts on the blue car.

$$9390 \text{ N}$$

key Level I Physics Pd 2

- 7) A 0.05 ball flies toward a wall at 12 m/s, then bounces off the wall at 9 m/s.
Determine the change in momentum of the ball.

$$\Delta p = m \Delta v = m(v - v_0) = (0.05 \text{ kg})(-9 \text{ m/s} - 12 \text{ m/s})$$

$$1.05 \text{ kg m/s}$$

- 8) On a billiard table, the 2 ball and the 14 ball are both in motion. The two balls are moving at an angle of θ with respect to each other. The two balls collide in a 2 D elastic collision. Write equations involving energy and momentum (Including trig functions) to describe the collision.

$$P_x / m_2 v_2 + m_{14} v_{14} \cos \theta = m_2 v_2 \cos \alpha + m_{14} v_{14} \cos \beta$$

$$P_y / m_{14} v_{14} \sin \theta = m_2 v_2 \sin \alpha + m_{14} v_{14} \sin \beta$$

$$v_{2_0}^2 + v_{14_0}^2 = v_2^2 + v_{14}^2$$