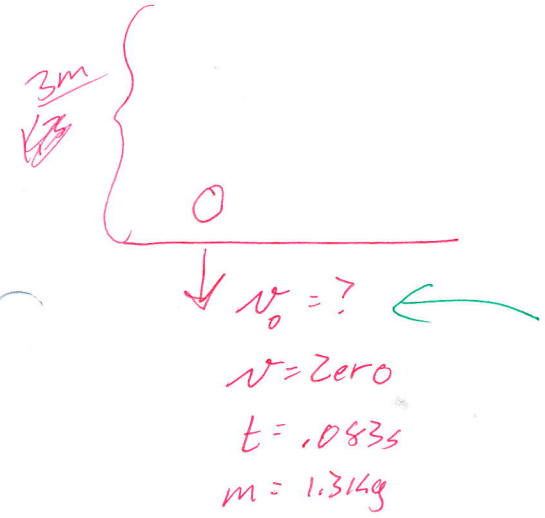
Answer Key Pd1

Momentum

AT Momentum (17).doc

Directions: Solve the following problems. Show all work, and circle your final answer. All problems are worth 5 points each.

1) A 4 cm diameter 1.3 kg clay ball is dropped from a height of 3 m. It hits the floor, taking 0.083 seconds to stop. Determine the force applied to the floor by the clay ball.



$KE = PE$

$\frac{1}{2}mv^2 = mgh$

$v_0 = v = \sqrt{2gh}$

$$F = \frac{\Delta p}{t} = \frac{m(\Delta v)}{t} = \frac{m(v - v_0)}{t}$$

$$F = \frac{m(\sqrt{2gh} + 0)}{t}$$

$$F = \frac{m\sqrt{2gh}}{t} = \frac{(1.31kg)\sqrt{2(9.8m/s^2)(3m)}}{.083s} = 137N$$

120 N

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A red 5 kg cart moving at 5m/s to the right collides with a 3 kg cart moving at 3m/s to the left. The two carts collide in a totally inelastic collision. The two carts are in contact for a time of 0.08 seconds.
(Double jeopardy is in effect in this problem, so be confident in your work and know what to expect)

2) Determine the speed of the red cart after the collision

$P_{A_0} + P_{B_0} = P_{AB}$ .... 2 m/s

3) Determine the speed of the blue cart after the collision

2 m/s

4) Determine the force acting on the red cart

-188 N

5) Determine the force acting on the blue cart.

188 N

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A red 5 kg cart moving at 5m/s to the right collides with a 3 kg cart moving at 3m/s to the left. The two carts collide in a totally elastic collision. The two carts are in contact for a time of 0.08 seconds.
(Double jeopardy is in effect in this problem, so be confident in your work and know what to expect)

6) Determine the speed of the red cart after the collision

-1 m/s

7) Determine the speed of the blue cart after the collision

7 m/s

8) Determine the force acting on the red cart

-375N

9) Determine the force acting on the blue cart.

375N

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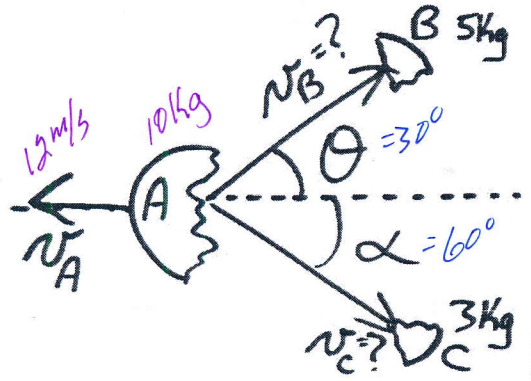
10) An explosive device splits a 18 kg ball in the following diagram Find the velocity of B & C knowing the velocity of A is 12 m/s, and theta is 30 degrees and alpha is 60 degrees.



P_x: $v_{B_x} m_B + v_{C_x} m_C - v_A m_A = 0$

$m_B v_B \cos\theta + v_C \cos\alpha\, m_C = m_A v_A$

$\frac{m_B m_C v_C \sin\alpha \cos\theta}{m_B \sin\theta} + m_C v_C \cos\alpha = m_A v_A$

$\frac{m_C v_C \sin\alpha}{\tan\theta} + m_C v_C \cos\alpha = m_A v_A$

$v_C \left(\frac{m_C \sin\alpha}{\tan\theta} + m_C \cos\alpha\right) = m_A v_A$

$v_C = \frac{m_A v_A}{m_C\left[\frac{\sin\alpha}{\tan\theta} + \cos\alpha\right]} = \frac{(10\text{kg})(12\text{m/s})}{3\text{kg}\left[\frac{\sin(60^\circ)}{\tan(30^\circ)} + \cos(60^\circ)\right]}$

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$v_C = 20\text{m/s}$

P_y: $m_B v_B \sin\theta = m_C v_C \sin\alpha$

$v_B = \frac{m_C v_C \sin\alpha}{m_B \sin\theta}$

$v_B = \frac{(3\text{kg})(20\text{m/s})\sin(60^\circ)}{(5\text{kg})\sin(30)}$

$v_B = 20.7\text{m/s}$

$m_B v_B \cos\theta + m_C v_C \cos\alpha = m_A v_A$

$(5\text{kg})(20.7\text{m/s})\cos(30) + (3\text{kg})(20.7\text{m/s})\cos(60) = (120\text{kg}\cdot\text{m/s})$

Check

$m_B v_B \sin\theta = m_C v_C \sin\alpha$

$(5\text{kg})(20.7\text{m/s})\sin(30) \;?\; (3\text{kg})(20\text{m/s})\sin(60)$

$51.75 = 51.96$

Check