Momentum

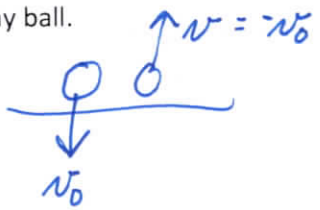
AT Momentum (21).doc

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 15g bouncy ball is dropped from a height of 1.75 m. It hits the floor, taking 0.083 seconds to be in contact with the floor. Assume a perfectly elastic collision with the floor. Determine the force applied to the floor by the clay ball.

$F = \frac{\Delta p}{t}$

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



$PE = KE$

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

$2gh = v^2$

$\sqrt{2gh} = v$

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

$F = \frac{m(2\sqrt{2gh})}{t} = \frac{(.015kg)(2\sqrt{2}\sqrt{9.8\frac{m}{s^2}}\sqrt{1.75m})}{.083s} = 2.12N$

A red 8 kg cart moving at 8m/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 the collision for a time of 0.08 seconds (the time where the momentum is changing). *(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

5 m/s

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

5 m/s

4) Determine the force acting on the red cart

-300N

5) Determine the force acting on the blue cart.

300N

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

2 m/s

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

13 m/s

8) Determine the force acting on the red cart

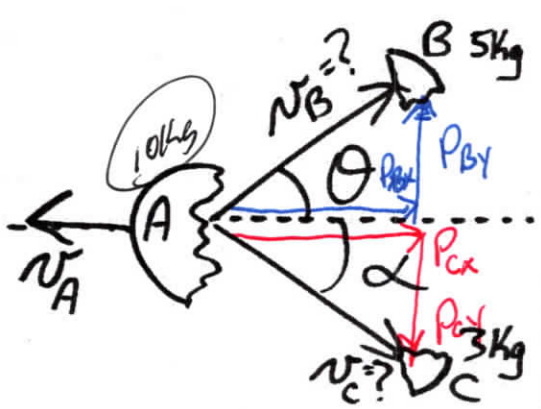
-600 N

9) Determine the force acting on the blue cart.

600 N

Level I Answer Key Pd3

10) Level I Answer detonates an explosive device that splits a 18 kg ball as described in the following diagram. Find the speeds of B & C knowing the velocity of A is 12 m/s, and theta is 30 degrees and alpha is 60 degrees.



$P_0 = P$

P_x $\quad 0 = P_{Bx} + P_{Cx} - P_A$

$P_A = P_{Bx} + P_{Cx}$

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

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

P_y $\quad P_{By} - P_{Cy} = 0$

$m_B v_B \sin\theta - m_C v_C \sin\alpha = 0$

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

$m_A v_A = v_C \left[\dfrac{m_C \sin\alpha \cos\theta}{\sin\theta} + m_C \cos\alpha\right]$

$\dfrac{m_A v_A}{\left[\dfrac{m_C \sin\alpha}{\tan\theta} + m_C \cos\alpha\right]} = v_C = \dfrac{m_A v_A}{m_C\left[\dfrac{\sin\alpha}{\tan\theta} + \cos\alpha\right]}$

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

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

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

$v_B = 20.79\text{ m/s}$