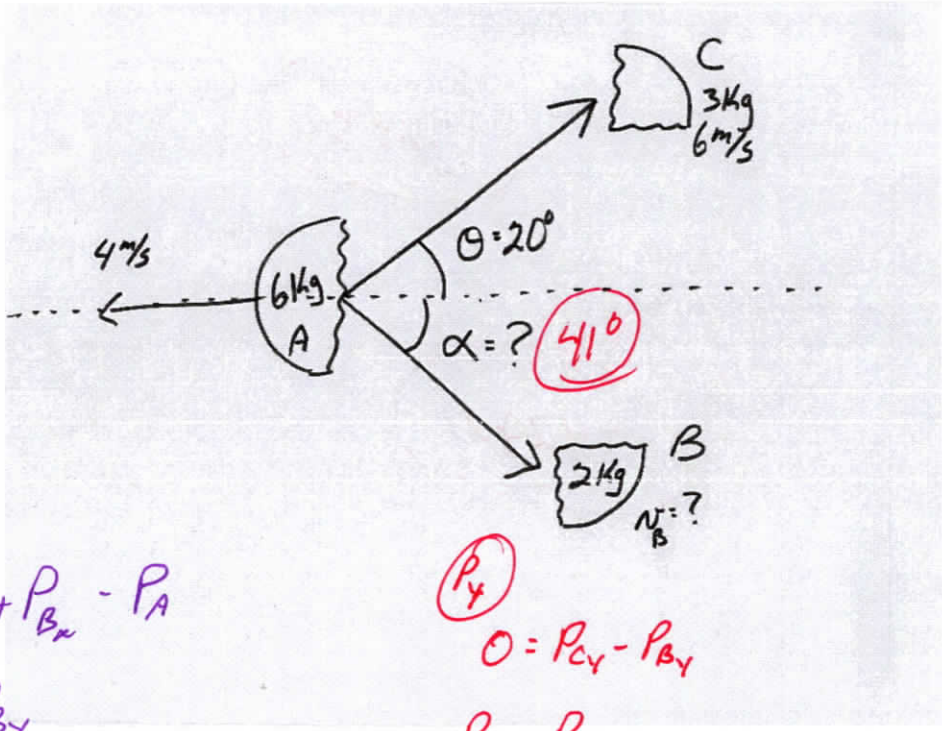
key Level I Physics Pd1

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) An object "explodes" into the three pieces as shown in the diagram. Solve for the unknown values.



P_x

$0 = P_{C_x} + P_{B_x} - P_A$

$P_A = P_{C_x} + P_{B_x}$

$m_A v_A = m_C v_C \cos 20 + m_B v_B \cos\alpha$

$m_A v_A = m_C v_C \cos 20 + \frac{m_C v_C \sin 20 \cos\alpha}{m_B \sin\alpha}$

$m_A v_A = m_C v_C \cos 20 + \frac{m_C v_C \sin 20}{\tan\alpha}$

$m_A v_A - m_C v_C \cos 20 = \frac{m_C v_C \sin 20}{\tan\alpha}$

P_y

$0 = P_{C_y} - P_{B_y}$

$P_{B_y} = P_{C_y}$

$m_B v_B \sin\alpha = m_C v_C \sin 20°$

$v_B = \frac{m_C v_C \sin 20°}{m_B \sin\alpha}$

$v_B = \frac{(3\text{Kg})(6\text{m/s})(\sin 20°)}{(2\text{Kg})(\sin 41°)}$

$v_B = 4.7\text{ m/s}$

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$\tan\alpha = \frac{m_C v_C \sin 20°}{m_A v_A - m_C v_C \cos 20°}$ $\Rightarrow \alpha = \tan^{-1}\left[\frac{(3\text{Kg})(6\text{m/s})(\sin 20°)}{(6\text{Kg})(4\frac{\text{m}}{\text{s}}) - (3\text{Kg})(6\text{m/s})\cos 20}\right]$ $\alpha = 41°$

A red 15 kg cart moving at 5m/s to the right collides with a blue 13 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 0.13 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

~~-2.43 m/s~~ 1.29 m/s

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

1.29 m/s

4) Determine the force acting on the red cart

-429 N

5) Determine the force acting on the blue cart.

429 N

A red 15 kg cart moving at 5m/s to the right collides with a blue 13 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 0.13 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

-2.43 m/s

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

5.57 m/s

8) Determine the force acting on the red cart

-857 N

9) Determine the force acting on the blue cart.

857 N

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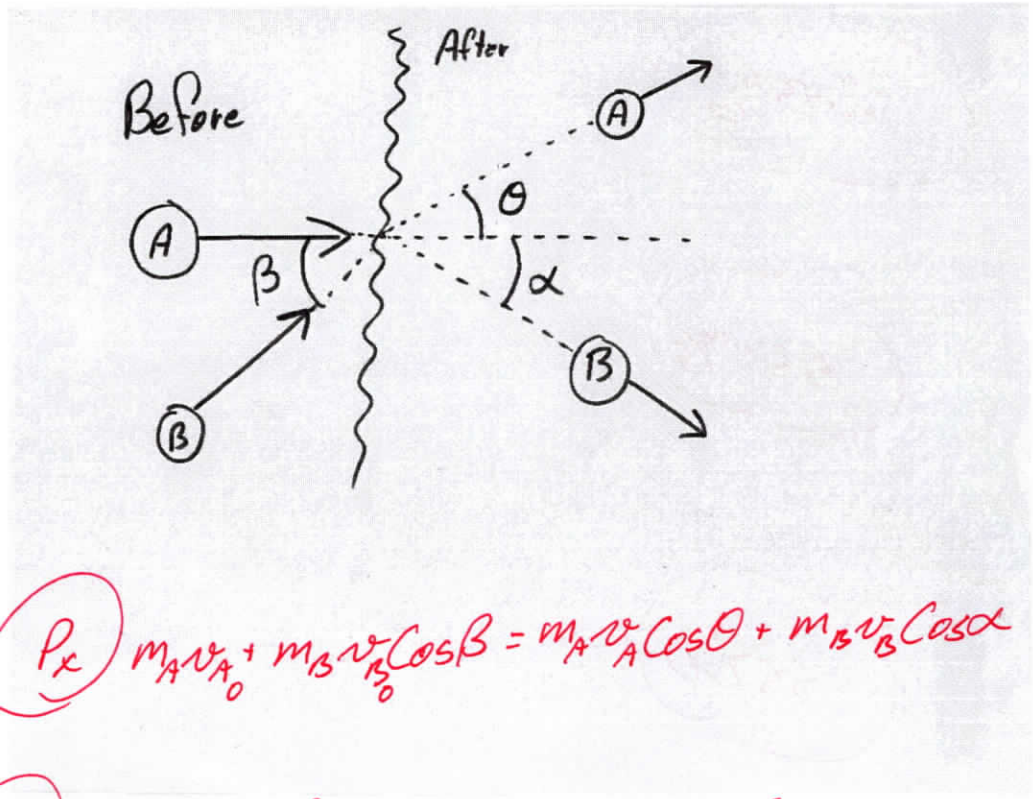
10) The two objects shown in the diagram below collide in a totally elastic collision. Write the equations for conservation of momentum and conservation of energy that describe the situation. Write in terms of trig functions, mass, and velocity.



P_x $m_A v_{A_0} + m_B v_{B_0} \cos\beta = m_A v_A \cos\theta + m_B v_B \cos\alpha$

P_y $m_B v_{B_0} \sin\beta = m_A v_A \sin\theta - m_B v_B \sin\alpha$

KE $\frac{1}{2} m_A v_{A_0}^2 + \frac{1}{2} m_B v_{B_0}^2 = \frac{1}{2} m_A v_A^2 + \frac{1}{2} m_B v_B^2$