key Level I Physics Pd3

Momentum

AT Momentum (15).doc

Directions: Solve the following problems. Show all work, and circle your final answer. #'s1-6 are worth 5 points each, and #7 is worth 10 points.

1) A 4 cm diameter 0.37 kg clay ball is dropped from a height of 12 m. It hits the floor, taking 0.023 seconds to stop. Determine the force applied to the floor by the clay ball.

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

$F = \frac{m(v - v_0)}{t}$ Initial Speed => Just Prior To Impact $v \Rightarrow$ zero

$F = \frac{m\,v}{t}$ $KE = PE$

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

$v = \sqrt{2gh}$ - Downward

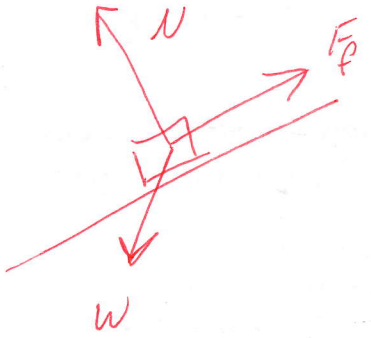
$F = \frac{m\,(-v)}{t}$

$F = \frac{mv}{t}$

$F = \frac{m\sqrt{2gh}}{t} = \frac{(.371kg)(\sqrt{2}(9.8 m/s^2)(12m))}{.023s}$

$F = 247\ N$

2) A cart with a mass of 22 kg starts at rest on an incline of 39 degrees. When the cart is released, determine the rate of change of momentum of the cart if there is a coefficient of friction of 0.27 between the cart and the incline.



$$\Sigma F_y = N - W\cos\theta = 0$$

$$N = mg\cos\theta$$

$$\Sigma F_x = F_f - W_x = \frac{\Delta p}{t}$$

$$\mu N - W\sin\theta = \frac{\Delta p}{t}$$

$$\mu N - mg\sin\theta = \frac{\Delta p}{t}$$

$$\mu mg\cos\theta - mg\sin\theta = \frac{\Delta p}{t}$$

$$mg(\mu\cos\theta - \sin\theta) = \frac{\Delta p}{t}$$

$$(22\,kg)(9.8\,m/s^2)(.27\cos(39) - \sin(39)) = \frac{\Delta p}{t}$$

$$-90.4\,kg\frac{m}{s^2} = \frac{\Delta p}{t}$$

To the Left

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.

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

-1 m/s

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

7 m/s

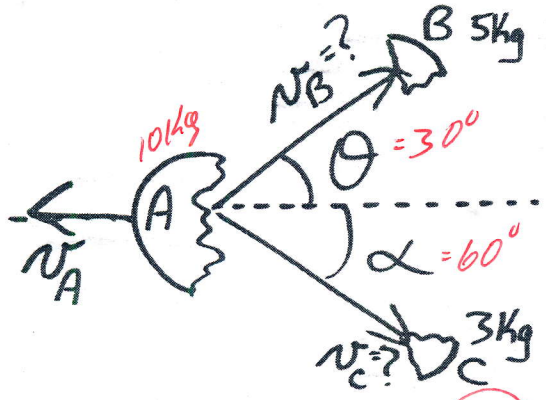
5) Determine the force acting on the red cart

-375 N

6) Determine the force acting on the blue cart.

375 N

7) 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.



$\Sigma P_x = m_B v_B \cos\theta + m_C v_C \cos\alpha - m_A v_A = 0$

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

$v_B = \dfrac{m_A v_A - m_C v_C \cos\alpha}{m_B \cos\theta}$

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

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

$m_B\left(\dfrac{m_A v_A - m_C v_C \cos\alpha}{m_B \cos\theta}\right)\sin\theta = m_C v_C \sin\alpha$

$\sin\theta\, m_A v_A - m_C v_C \cos\alpha \sin\theta$

x/ $m_A v_A - m_B v_B \cos\theta - m_C v_C \cos\alpha$

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

$(10kg)(12\,m/s) = (5kg)(\cos 30^\circ) v_B + (3kg)(v_C)\cos 60^\circ$

$120\,kg\,m/s = 4.33kg\, v_B + 1.5kg\, v_C$

y) $m_B v_B \sin 30^\circ - m_C m_v \sin 60 = 0$

$m_B v_B \sin 30^\circ = m_C v_C \sin 60^\circ$

$v_B = \dfrac{(3kg)(v_C)(.866)}{(5kg)(.5)}$

$v_B = 1.04 v_C$

$120\,kg\,m/s = 4.33kg\, v_B + (1.5kg)\, v_C$

$120\,kg\,m/s = (4.33kg)(1.04) v_C + (1.5kg) v_C$

$120\,kg\,m/s = 4.5kg\, v_C + 1.5kg\, v_C$

$120\,kg\frac{m}{s} = 6kg\, v_C$

$20\,m/s = v_C$

$v_B = 1.04 v_C$

$v_B = (1.04)(20\,m/s)$

$v_B = 20.8\,m/s$