# Momentum

AT Momentum (14)

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

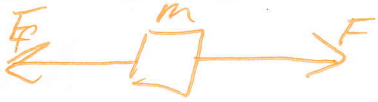
1) Determine the momentum of a person (mass 72kg) running at 8 m/s. The wind is blowing at 2 m/s and it is 64°F outside.

$\vec{p} = m\vec{v}$

$\vec{p} = (72kg)(8 m/s)$

$\vec{p} = 576 kg\ m/s$

2) Determine the change in momentum for the following situation: A 135 kg box, on a level surface, has a 450 N force being applied to the right with a rope for a time of 4 seconds. There is a coefficient of friction of 0.34 between the box and the surface it is sliding on.




must use $g = 9.8\ m/s^2$

$\Sigma F_x = F - F_f = ma$

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

$(F - F_f)t = \Delta p$

$(F - \mu N)t = \Delta p$

$(F - \mu mg)t = \Delta p$

$[450N - (.34)(135\ kg)(9.8\ m/s^2)](4s) = .72\ kg\ m/s$

$F = ma$

$F = \frac{m\Delta v}{t}$

$F = \frac{m\Delta v}{t}$

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

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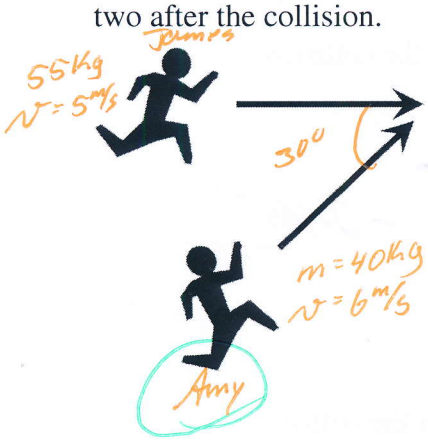
3) Two kids, James and Amy, are playing on ice. James has a mass of 55 kg and Amy has a mass of 40kg. James runs due east and slides at a speed of 5 m/s. Amy runs and slides on the ice at a speed of 6 m/s and at 30 degrees north of east. The two will collide in a totally inelastic collision. Determine the speed of the two after the collision.




James

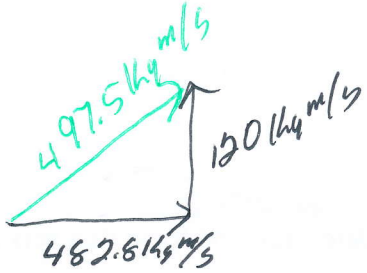
$275\ kg\,m/s\ \hat{i} + 0\hat{j} + 0\hat{k}$

$207.8\ kg\,m/s\ \hat{i} + 120\hat{j} + 0\hat{k}$

$1\ kg\,m/s$

$482.8\ kg\,m/s\ \hat{i} + 120\hat{j} + 0\hat{k}$

Oops... Did it Again ($1\ kg\,m/s$)




$$\frac{497.5\ kg\,m/s}{(55kg + 40kg)} = 5.2\ m/s$$

**(Use the information below to respond to problems 4-7)**

A red bumper car (At an amusement park) has a mass of 85kg and is moving to the right at 2 m/s. The car collides in a totally elastic collision with a blue bumper car of mass 92kg that was moving at 2.5 m/s to the left. The collision takes place in a time of 0.18s.

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

$-2.66\ m/s$

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

$1.82\ m/s$

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

$-2209\ N$

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

$2209\ N$

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$t = .1s$

8) A 0.05kg ball flies toward a wall at 18 m/s, then bounces off the wall at 9 m/s. Determine the change in momentum of the ball.


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

$\Delta p = p - p_0$

$\Delta p = m(v - v_0)$

$(.05kg)(-9\,m/s - 18\,m/s)$

$\Delta p = -1.35\,kg\,m/s$

9) On a billiard table, the 2 ball is moving toward the 14 ball. The two balls collide in a 2 D elastic collision. Write equations involving energy and momentum (Including trig functions) to describe the collision. Include a diagram to justify/verify your equations.

$P_x$/ $m_2 v_{2_0} = m_2 v_2 \cos\theta + m_{14} v_{14} \cos\alpha$

$P_y$/ $0 = m_2 v_2 \sin\theta - m_{14} v_{14} \sin\alpha$

} Or something that makes sense

KE/ $\frac{1}{2} m_2 v_{2_0}^2 = \frac{1}{2} m_2 v_2^2 + \frac{1}{2} m_{14} v_{14}^2$