

Momentum

AT Momentum (18).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 clay ball. The direction of the force should be obvious in your response.

$$F = \frac{\Delta p}{t} = \frac{m(\Delta v)}{t} = \frac{m(v - v_0)}{t} = \frac{mv - v_0}{t} = \frac{mv\sqrt{2gh}}{t} = \frac{(1.3\text{kg})(\sqrt{2(9.8\text{m/s}^2)3\text{m}})}{0.083\text{s}}$$

v = 2000

$F = 120\text{N}$

height

small width - End To End (Pinky - Pinky)

pull back - Tie Plumb To Center of Stick

measure From Center of bow from To string

A red 15 kg cart moving at 5m/s to the right collides with a 23 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 0.18 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

$$\begin{aligned} & \cancel{2.56 \text{ m/s}} \\ & = 4.66 \text{ m/s} \end{aligned}$$

$$0.16 \text{ m/s}$$

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

$$\begin{aligned} & \cancel{1.56 \text{ m/s}} \\ & = 3.7 \end{aligned}$$

$$0.16 \text{ m/s}$$

4) Determine the force acting on the red cart

$$-403 \text{ N}$$

5) Determine the force acting on the blue cart.

$$403 \text{ N}$$

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

$$-4.68 \text{ m/s}$$

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

$$3.32 \text{ m/s}$$

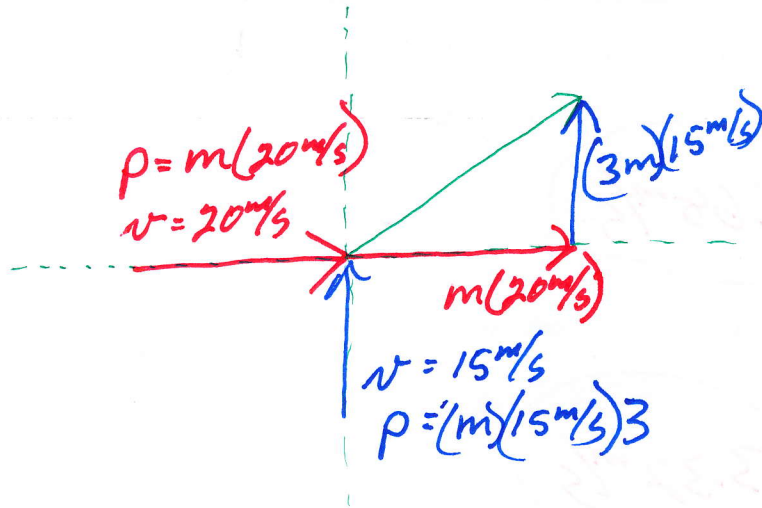
8) Determine the force acting on the red cart

$$-807 \text{ N}$$

9) Determine the force acting on the blue cart.

$$807 \text{ N}$$

10) A car traveling east at 20 m/s collides in an inelastic collision with a truck, 3 times the mass of the car, traveling north at 15 m/s. Determine the velocity of the two after the collision. (Hint...remember the difference between speed and velocity)



$$P = \sqrt{[3m(15m/s)]^2 + [m(20m/s)]^2}$$

$$\sqrt{(9m^2)(225m^2/s^2) + m^2 400m^2/s^2}$$

$$\sqrt{[2025m^2 + 400m^2] m^2/s^2}$$

$$\sqrt{2425m^2 \frac{m^2}{s^2}}$$

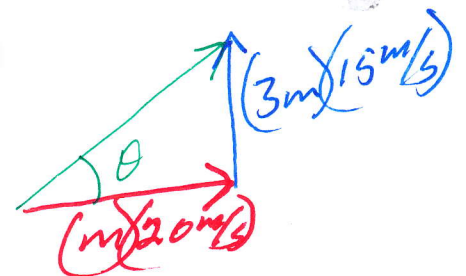
$$P = 49m \frac{m}{s}$$

$$(m+3m)v = (49m) \frac{m}{s}$$

$$(4m)v = (49m) \frac{m}{s}$$

$$v = \frac{49m}{4m} \frac{m}{s}$$

$$v = 12.3 \text{ m/s Speed After Collision}$$



$$\tan \theta = \frac{\text{OPP}}{\text{ADI}}$$

$$\theta = \tan^{-1} \frac{(3m)(15m/s)}{m(20m/s)}$$

$$\theta = \tan^{-1} \frac{45}{20}$$

$$\theta = 66^\circ$$

Answer Key Pd1

Velocity
12.3 m/s @ 66° North of East