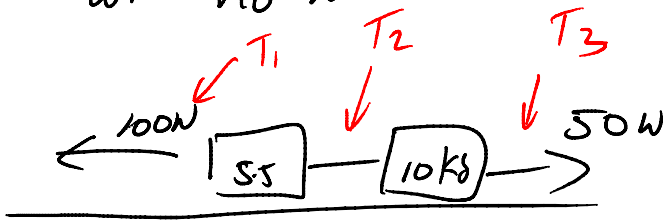
October-21-10
1:02 PM

f) with no "M"



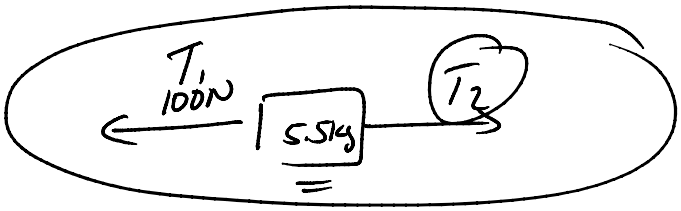
mass = 15.5kg

F_{NET} = −50N or 50N left

$$a = \frac{F_{NET}}{m} = \frac{-50N}{15.5} = -3.2\ m/s^2$$

T_1 = 100N left T_3 = 50N right

T_2 ⇒ ignore one of the masses



m = 5.5

$a = -3.2 m/s^2$ ∴ $F_{NET} = (5.5kg)(-3.2 m/s^2)$

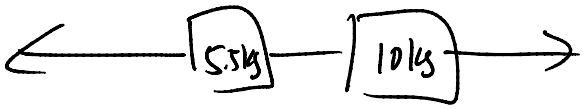
F_{NET} = 17.6N left, −17.6 N

Remember $F_{NET} = \sum F$

$= T_1 + T_2$

$-17.6N = -100 + T_2$

T_2 = 82.4 N right



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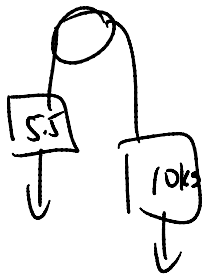


momentum

Recall Newtons 2ND law

$F = m \cdot a$ we know $a = \frac{v}{t}$ from kinematics

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

$F \cdot t = m \cdot v$

Impulse = momentum

Recall $\Delta \vec{V} = \vec{V_f} - \vec{V_i}$

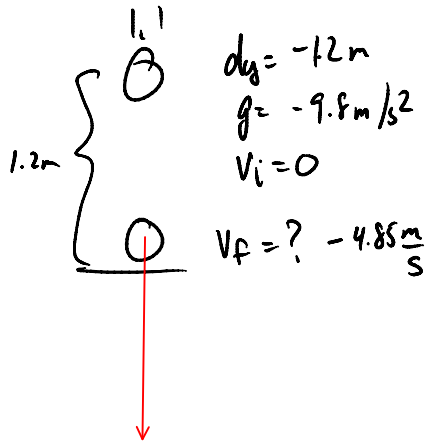
$\Delta p = \vec{P_f} \to P_i$

ex) if a ball of mass 300g strikes the floor from a height of 1.2m, determine the momentum just as it strikes the ground

$P = m \cdot V_f$

$= (.3)(-4.85)$

$= -1.455 \text{ kgm/s}$



b) Once the ball strikes the ground it returns to a height of .8 m, what is the momentum just as it bounce off the floor

just as it strikes the floor we know it comes to a stop eventually and the the disp = 0.8 m

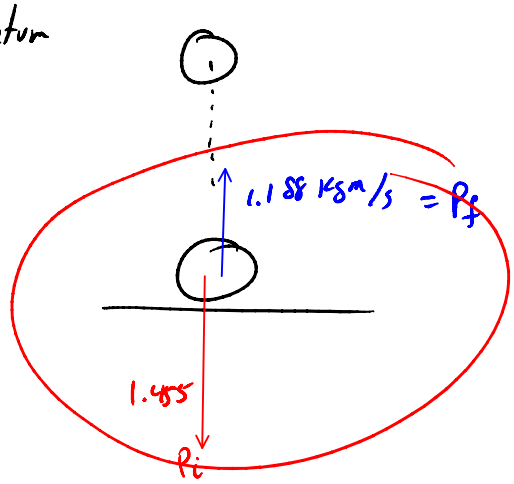
$V_i = ?$
$V_f = 0$
$g = -9.80 m/s^2$
$d = .80 m$

$V_i = 3.96 m/s$

$V_f^2 = V_i^2 + 2gd$

$P = (.3)(3.96) = 1.188 \frac{kgm}{s}$

What is the change in momentum when the ball strikes the ground



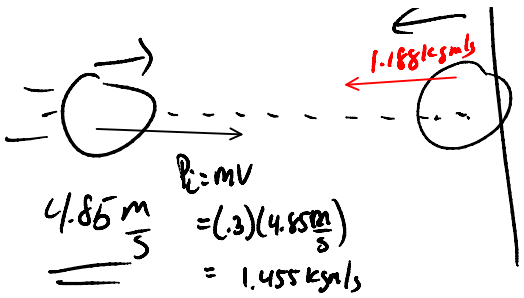
$\Delta p = p_f - p_i$

$= 1.188 \frac{kgm}{s} - \left(-1.455 \frac{kgm}{s}\right)$

$= 2.643 kgm/s$

ex) if a ball of mass 300 g strikes a vertical wall with speed of 4.85 m/s, it bounces back with a speed of 3.96 $\frac{m}{s}$ Calculate Δp

3.96m/s



$\Delta p = p_f - p_i$

$= -1.188 \text{ kgm/s} - 1.455 \text{ kgm/s}$

$= -2.643 \text{ kgm/s}$

$\Delta p = F_{avg} \cdot t$

if the ball made contact with the the wall for only 1.6×10^{-3} s how much avg force did the wall apply on the ball

$-2.643 \text{ kgm/s} = F_{avg} \cdot t$

$F_{avg} = \frac{-2.643 \text{ kgm/s}}{1.6 \times 10^{-3} \text{ s}} = -1.65 \times 10^{3} \text{ N}$

Conservation of Momentum

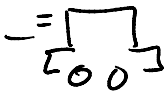
- Momentum is conserved meaning momentum is neither gained or lost in collisions

linear problems

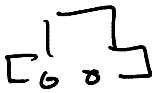
assume no friction

ex a 1500 kg car travels @ 12m/s, strikes an identical stationary car. The cars lock together, calculate the the velocity of the 2 cars

Before

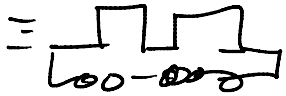


$m_1 v_1$



$m_2 v_2$

After



$m_1 v_1'$ $m_2 v_2'$

$P_B = P_A$

$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

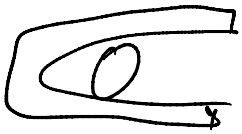
$(1500\text{kg})(12\text{m/s}) + (1500\text{kg})(0) = 1500\text{kg}\, V_1' + 1500\text{kg}\, V_2'$

$18000 \text{kg}\frac{\text{m}}{\text{s}} = V_f\,(1500\text{kg} + 1500\text{kg})$

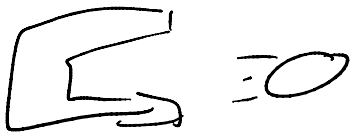
$V_f = 6\text{ m/s}$

ex) An 0.050 kg bullet is fired from a 5.0 kg gun if the velocity of the bullet is 275 m/s what is the recoil velocity of the gun.

Before



After



$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

$0 = (5\text{kg})(V_1') + (.050\text{kg})(275\frac{\text{m}}{\text{s}})$

$V_1' = \dfrac{-(.050\text{kg})(275\text{m/s})}{5\text{kg}}$

$= -2.75\text{ m/s}$

Objects that collide do not have to stick together

$P_B = P_A$

$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$ } 1 pt

deduct marks for no data

I expect to see units in the problem

PS 179 - 182 odd

Some time after Break we will cover simple 2-D problems

#9 ps/81

$$P_B = P_A$$

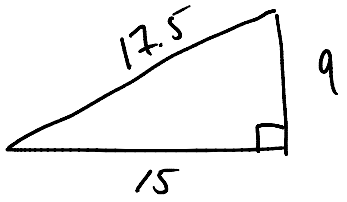
$$\underbrace{m_1 v_1 + m_2 v_2}_{0} = m_1 v_1' + m_2 v_2'$$

$$0 = (2\text{kg})(10\tfrac{\text{m}}{\text{s}}) + (5\text{kg})\, v_2'$$

$$v_2' = \frac{-(2\text{kg})(10\tfrac{\text{m}}{\text{s}})}{(5\text{kg})} = -4\text{ m/s}$$

$$= 4\text{ m/s left.}$$

Trig review



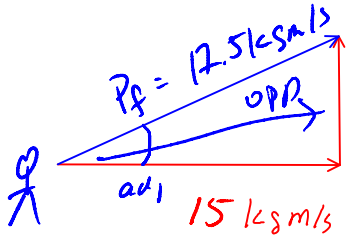
find hyp.

using pythagoras

$h^2 = 9^2 + 15^2$

$=$

ex a 3kg block travelling 5m/s east strikes a 4.5kg block travelling 2m/s North and they stick together calculate the final momentum



} vectors in Red are P_B

Vectors in Blue are P_A

2 q's find the new angle of motion

$\tan\theta = \frac{9 \frac{kgm}{s}}{15 \frac{kgm}{s}}$ $\theta = 31°$

find their new speed

I know their final momentum

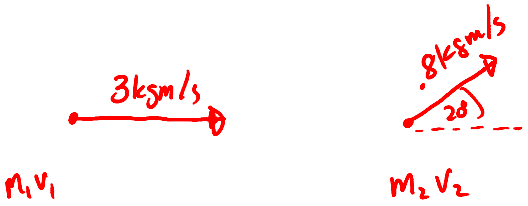
$17.5 \frac{kgm}{s} = (7.5kg)(v)$

$v = 2.33 m/s$

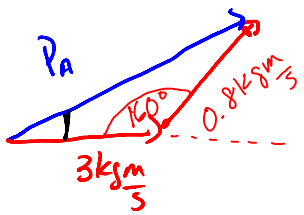
a 500g ball travelling 6m/s east is struck by a

200g ball travelling 4m/s 20° NofE, after the collision they stick together determine their new momentum

P_B



P_A



$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$c^2 = \left(3\,\tfrac{kgm}{s}\right)^2 + \left(.8\,\tfrac{kgm}{s}\right)^2 - 2(3)(.8)\cos 160$$

$$c = 3.76\,kg\tfrac{m}{s}$$

calc its speed

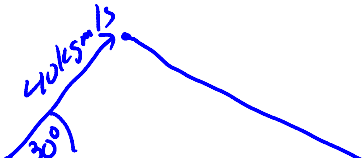
$$3.76\,kg\tfrac{m}{s} = (.7kg)(v_f)$$

$$v_f = 5.4\ m/s$$

ex an asteroid of mass 10kg travel east at 15m/s some time later it breaks up due to an explosion 4kg piece travels 10m/s @ 30 NofE find the momentum of the other piece

P_B

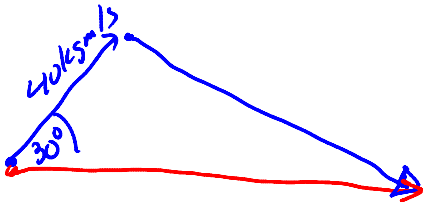
P_A



P_B

150kgm/s

P_A



150kgm/s

$c^2 = (40)^2 + (150)^2 - 2(40)(150)\cos 30$

$= 117 \text{ kgm/s}$