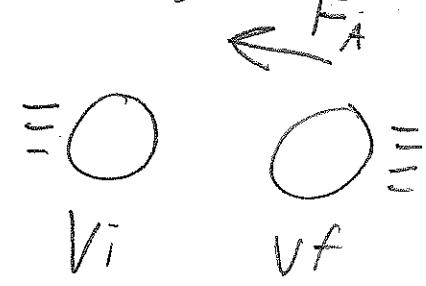
Momentum Review #1

1) a) $F_G = mg = .300\,kg \cdot 9.8\,m/s^2 = \boxed{2.94\,N}$

b)



$$m\Delta V = \Sigma F \cdot t$$

$$.300\,kg \cdot (vf - 18) = -780 \cdot .045\,s$$

$$vf - 18 = -117$$

$$vf = -99\,m/s$$

$$\boxed{\text{Speed} = 99\,m/s}$$

c) $vf = vi + at$ $\quad a = \dfrac{vf - vi}{t}$

$$a = \frac{-99 - 18}{.045} = \boxed{-2600\,m/s^2}$$

1) d) $m\Delta v = \Sigma F \cdot t$

$v_f \Delta v = \frac{\Sigma F \cdot t}{m}$

$mult = \frac{2 \cdot 1}{1} = 2$

$2 \cdot \Delta v \rightarrow$ **Δv would double**

2) a) $\Sigma p_f = (m_1 + m_2) \cdot v_f = 960\ N \cdot s$

$(55+65) \cdot v_f = 960\ N \cdot s$

$v_f = 8\ m/s$ right

b) **$960\ N \cdot s$** → mtm of both skaters combined

c) $\Sigma p_i = \Sigma p_f$ → Conservation of Momentum

$\Sigma p_i = 960 N \cdot s$

d) $\Sigma p_i = \Sigma p_f$ 1 = Claude 2 = Maude

$m_1 v_{i1} + m_2 \cdot v_{i2} = (m_1 + m_2) v_f$

$65.0 + 55 \cdot v_{i2} = 960 N \cdot s$

$55 v_{i2} = 960$

$v_{i2} = 17.5 m/s$

e) Inelastic

3) a) ≈ 7.5 m/s

b) ≈ -1.9 m/s

c) $p = mv = 55 \cdot 7.5 =$ **412.5 N·s**

d) $\Sigma p_i = \Sigma p_f$ $\Sigma p_i = m_1 v_{i1} + m_2 v_{i2}$

$\Sigma p_i = 55 \cdot 7.5 + 75 \cdot -3 =$ **187 N·s**

187 N·s = Σp_f

e) $\Sigma p_i = \Sigma p_f$ 1 = Damian 2 = Amy Ann

$187 N·s = m_1 v_{f1} + m_2 v_{f2}$

$187 N·s = (55 \cdot -1.9) + (75 \cdot v_{f2})$

$v_{f2} = 3.89$ m/s

3) f) $\Delta p = m\Delta v = m \cdot (v_f - v_i)$

$\Delta p = 75 \cdot (3.89 - (-3))$

$\Delta p = 516.8\ N \cdot s$

g) Elastic

4) a) $\sum p_i = \sum p_f$ 1 = bullet, 2 = wood

$m_1 v_{i1} + m_2 v_{i2} = (m_1 + m_2) v_f$

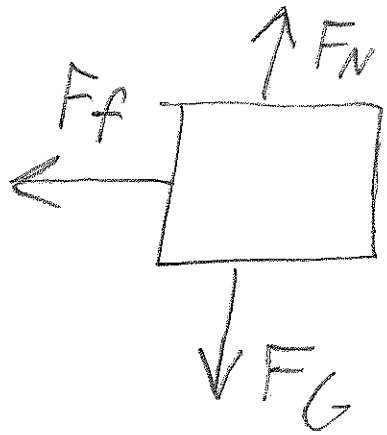
$.005 \cdot 900 + 8.0 = (.005 + 8) v_f$

$4.5\ N \cdot s = 8.009 \cdot v_f$

$v_f = .562\ m/s$

3.42

b)



c) $\Sigma F_x = ma$

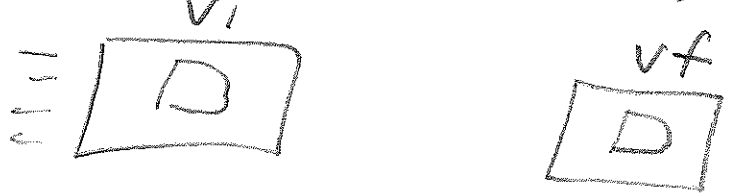
$-Ff = ma$

$-9 = 8.005, a$

$a = -1.12 m/s^2$

$\Delta x = ?$

$V_i = .562 m/s \quad V_f = 0 m/s$



$V_f^2 = V_i^2 + 2a\Delta x$

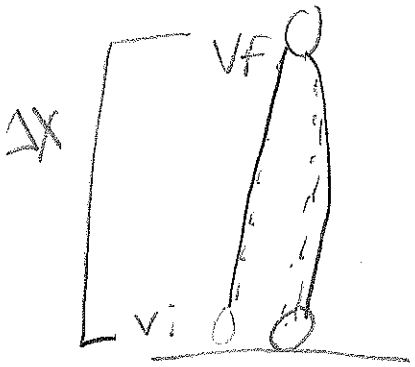
$0^2 = .562^2 + 2 \cdot -1.12 \cdot \Delta x$

$\boxed{\Delta x = .141 m}$

4) d) The distance traveled would decrease because the force of air resistance would be another force which would oppose the motion of the bullet/block.

5) a) $\Delta x = ?$ $t = 3\ s$ $v_f = 0\ m/s$

$a = -9.8\ m/s^2$



$v_f = v_i + at$

$0 = v_i + -9.8 \cdot 3$

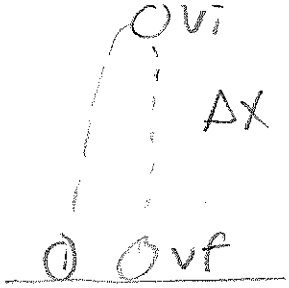
$29.4\ m/s = v_i$

5) a) $\Delta x = v_i t + \frac{1}{2} a t^2$

$\Delta x = 29.4 \cdot 3 + \frac{1}{2} \cdot -9.8 \cdot 3^2$

$\boxed{\Delta x = 44.1 \text{ m}}$

b) $m \Delta v = \sum F \cdot t$



$v_i = 0 \text{ m/s}$ $a = -9.8 \text{ m/s}^2$

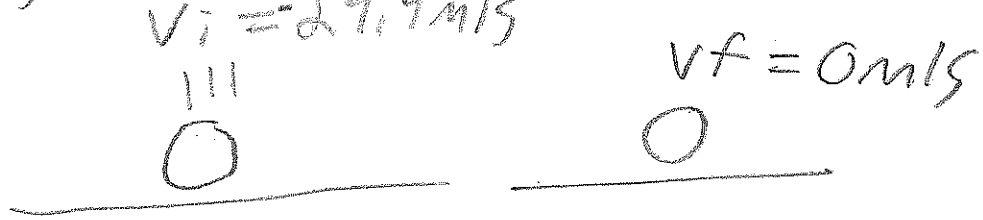
$\Delta x = -44.1 \text{ m}$

$v_f^2 = v_i^2 + 2a\Delta x$

$v_f^2 = 0^2 + 2 \cdot -9.8 \cdot -44.1$

$v_f = 29.4 \text{ m/s}$ → velocity hitting ground

5)b)



ball about to hit ground

ball stopped

$$m\Delta v = \Sigma F \cdot t$$

$$.150 \cdot (0 - (-29.4)) = \Sigma F \cdot .01$$

$$\Sigma F = 441 N$$

6) $p = mv$ $v_i = 0 m/s$ $\Delta x = -500 m$

$a = -9.8 m/s^2$

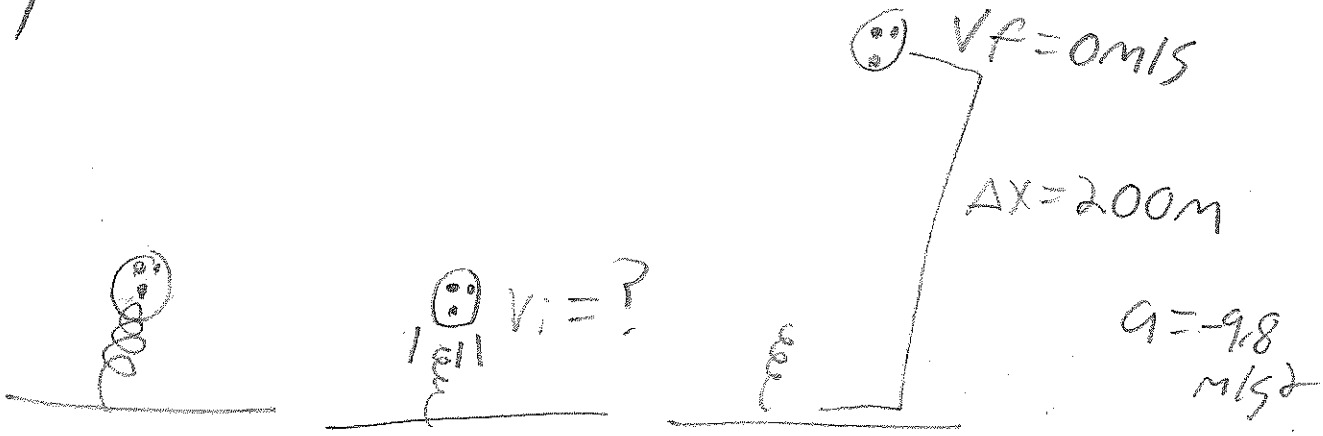
$$v_f^2 = v_i^2 + 2a\Delta x$$

$$v_f^2 = 0^2 + 2 \cdot -9.8 \cdot -500$$

$$v_f = -99.0 m/s$$

6) a) $p = 7 \cdot -99 = \boxed{-693\ N \cdot s}$

b)



$$v_f^2 = v_i^2 + 2g\Delta x$$

$$0^2 = v_i^2 + 2 \cdot -9.8 \cdot -200$$

$$v_i = 62.6\ m/s$$

$$\Delta p = m\Delta v = 7 \cdot (62.6) = \boxed{438.2\ N \cdot s}$$

c) $\Delta p = \Sigma F \cdot t$

$438.2 = \Sigma F \cdot 2$

$\boxed{\Sigma F = 219.1\ N}$