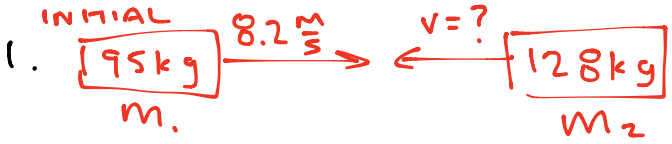
CONSERVATION OF MOMENTUM WORKSHEET - SOLNS

1.



FINAL

95kg + 128kg = 223kg, $v = 0$

$$\Sigma p_i = \Sigma p_f$$

$$p_{1i} + p_{2i} = p_f$$

$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$

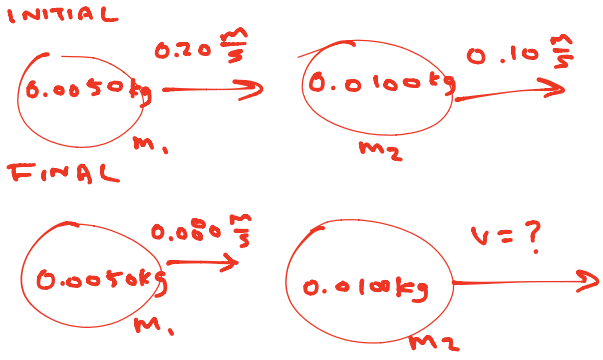
$$v_{2i} = \frac{M v_f - m_1 v_{1i}}{m_2}$$

$$= \frac{(223)(0) - (95)(8.2)}{128}$$

$$= -6.1 \frac{m}{s}$$

$6.1 \frac{m}{s}$

2.



$$\Sigma p_i = \Sigma p_f$$

$$p_{1i} + p_{2i} = p_{1f} + p_{2f}$$

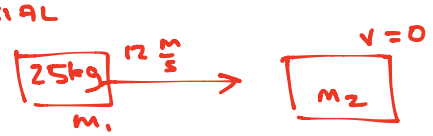
$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$$v_{2f} = \frac{m_1 v_{1i} + m_2 v_{2i} - m_1 v_{1f}}{m_2}$$

$$= \frac{(0.00500)(0.20) + (0.010)(0.10) - (0.00500)(0.080)}{0.010}$$

$$= 0.16 \frac{m}{s} \text{ or } 16 \frac{cm}{s} \text{ TO THE RIGHT}$$

3. INITIAL



FINAL

$$\sum p_i = \sum p_f$$

$$p_{1i} + p_{2i} = p_{1f} + p_{2f}$$

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + p_{2f}$$

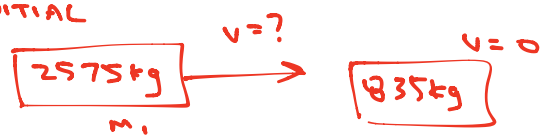
$$p_{2f} = m_1 v_{1i} + m_2 v_{2i} - m_1 v_{1f}$$

$$= (25)(12) + m_2(0) - (25)(8)$$

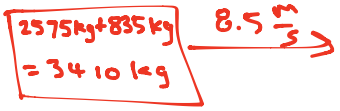
$$= 100 \text{ kg} \frac{m}{s} \text{ RIGHT}$$

NOTICE HOW WE DO NOT NEED m_2 TO SOLVE FOR p_{2f}.

4. INITIAL



FINAL



$$\sum p_i = \sum p_f$$

$$p_{1i} + p_{2i} = p_f$$

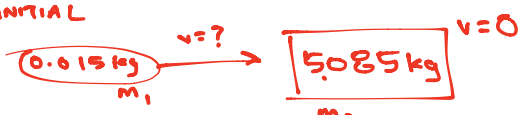
$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$

$$v_{1i} = \frac{M v_f - m_2 v_{2i}}{m_1}$$

$$= \frac{(3410)(8.5) - (835)(0)}{2575}$$

$$= 11 \frac{m}{s}$$

5. INITIAL



FINAL

$$\Sigma p_i = \Sigma p_f$$

$$p_{1i} + p_{2i} = p_f$$

$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$

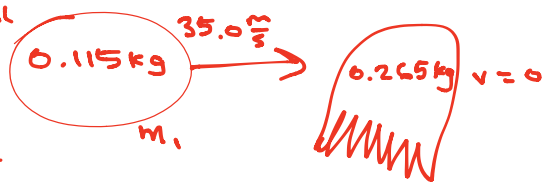
$$v_{1i} = \frac{M v_f - m_2 v_{2i}}{m_1}$$

$$= \frac{(5.100)(1.0) - (5.085)(0)}{0.015}$$

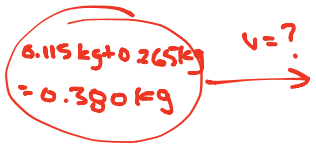
$$= 340 \frac{m}{s} \text{ RIGHT}$$

(SAME DIRECTION AS THE Block)

6. INITIAL



FINAL



$$\Sigma p_i = \Sigma p_f$$

$$p_{1i} + p_{2i} = p_f$$

$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$

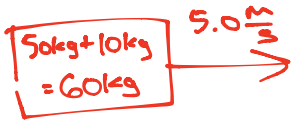
$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{M}$$

$$= \frac{(0.115)(35.0) + (0.265)(0)}{0.380}$$

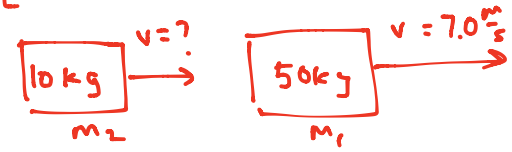
$$= 10.6 \frac{m}{s} \text{ RIGHT}$$

(INITIAL DIRECTION OF THE PUCK)

7. INITIAL



FINAL



$$\Sigma p_i = \Sigma p_f$$

$$p_i = p_{1f} + p_{2f}$$

$$Mv_i = m_1 v_{1f} + m_2 v_{2f}$$

$$v_{2f} = \frac{Mv_i - m_1 v_{1f}}{m_2}$$

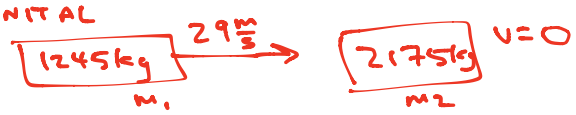
$$= \frac{(60)(5.0) - (50)(7.0)}{10}$$

$$= -5 \frac{m}{s}$$

$5 \frac{m}{s}$ WEST

NOTE THAT WHEN I DREW THE DIAGRAM, I ASSUMED INCORRECTLY THAT THE CART WOULD BE MOVING EAST.

8. INITAL



FINAL

$$\Sigma p_i = \Sigma p_f$$

$$p_{1i} + p_{2i} = p_f$$

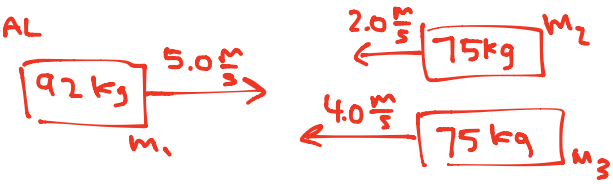
$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$

$$v_f = \frac{m_1 v_i + m_2 v_{2i}}{M}$$

$$= \frac{(1245)(29) + (2175)(0)}{3420}$$

$$= 11 \frac{m}{s}$$

9. INITIAL



FINAL

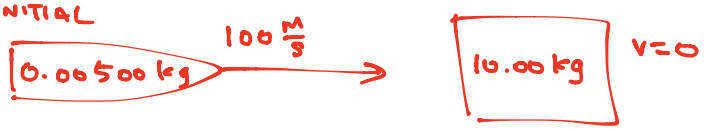
92kg + 75kg + 75kg = 242kg → v = ?

$$\Sigma p_i = \Sigma p_f$$
$$p_{1i} + p_{2i} + p_{3i} = p_f$$
$$m_1 v_{1i} + m_2 v_{2i} + m_3 v_{3i} = M v_f$$
$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i} + m_3 v_{3i}}{M}$$
$$= \frac{(92)(5.0) + (75)(-2.0) + (75)(-4.0)}{242}$$
$$= 0.041 \ \frac{m}{s} \text{ RIGHT}$$

(THE FULLBACK'S INITIAL DIRECTION; TOWARDS THE END ZONE)

YES, HE SCORES

10. INITIAL



a) FINAL

$$\Sigma p_i = \Sigma p_f$$
$$p_{1i} + p_{2i} = p_f$$
$$m_1 v_{1i} + m_2 v_{2i} = M v_f$$
$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{M}$$
$$= \frac{(0.00500)(100) + (10.00)(0)}{10.00500}$$
$$= 0.05 \ \frac{m}{s} \text{ Right (INITIAL DIRECTION)}$$

$$\Delta p = m \Delta v$$
$$= m(v_f - v_i)$$
$$= (0.00500)(0.05 - 100)$$
$$= -0.5 \ kg \frac{m}{s}$$

0.5 kg m/s LEFT

b)

NOTE THAT WE DONT HAVE TO USE THE CONSERVATION OF MOMENTUM HERE AS WE ARE GIVEN THE INITIAL AND FINAL VELOCITIES OF THE BULLET.

$$\Delta P = m \Delta v$$
$$= m(v_f - v_i)$$
$$= (0.00500)(-99 - 100)$$
$$= -1 \ kg \frac{m}{s}$$

1 kg m/s LEFT