

# Collisions + Impulse HW

2)  $m = 0.227 \text{ kg}$   $t = 0.061 \text{ s}$   
 $v = 16 \text{ m/s}$   
 $\theta = 30^\circ$

1.  $\Delta p_x = 0.227 \cos 30^\circ \cdot 16 = 3.1454$

Rebounds at same angle so same speed  $\rightarrow$  same  $p_x$  but other way.  
 $\Delta p = 3.1454 - (-3.1454) = 6.2908 \text{ kg m/s}$

3.  $F_{\text{avg}} = ?$   $F_{\text{avg}} \cdot t = \Delta p$   $F_{\text{avg}} = \frac{6.2908}{0.061} \approx 103.128 \text{ N}$

4.  $v_i = 16 \text{ m/s}$  inelastic collision  $\rightarrow v_f = 11 \text{ m/s}$   
 $F_{\text{avg}} = 103.128 \text{ N}$

$I = \Delta p = (0.227 \text{ kg} \cdot 16 \text{ m/s}) - (0.227 \cdot -11) = 6.129 \text{ kg m/s}$

5.  $I = F_{\text{avg}} \cdot t = 6.129 \text{ kg m/s}$   $t = \frac{6.129}{103.128} = 0.05943 \text{ s}$

6.  $\Delta KE = ?$

$K_0 = \frac{1}{2} (0.227) (16)^2 = 29.056 \text{ J}$   
 $\Delta K = K_f - K_0 = (-15.73225 \text{ J})$

4)  $m_{\text{tot}} = 14.7 \text{ kg}$   $m_1 = 4.8 \text{ kg}$   $\theta_1 = 20^\circ$   $v_1 = 23 \text{ m/s}$   
 $m_2 = 5.1 \text{ kg}$   $\theta_2 = 25^\circ$   $v_2 = 23.8 \text{ m/s}$

1.  $P_{\text{sys}} = \Delta p = 0 \text{ kg m/s}$

2.  $m_{\text{tot}} = m_1 + m_2 = m_3$

$m_3 = 4.8 \text{ kg}$

3.  $v_{3x} = ?$   $\Delta p_x = p_{1x} + p_{2x} = p_{3x} = 0$

$(4.8)(-27 \cos 20^\circ) + (5.1)(23.8 \sin 25^\circ) + 4.8 v_{3x} = 0$   
 $4.8 v_{3x} = 70.486709$   $v_{3x} = 14.68 \text{ m/s}$

4.  $v_{3y} = ?$   $(4.8)(27 \sin 20^\circ) + (5.1)(23.8 \cos 25^\circ) + 4.8 v_{3y} = 0$   
 $4.8 v_{3y} = 65.6618$   $v_{3y} = 13.68 \text{ m/s}$

6.  $\Delta KE_{\text{tot}}$

$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} (4.8 \cdot 27^2) + \frac{1}{2} (5.1 \cdot 23.8^2) + 4.8 \cdot 20.05^2$   
 $= 4160.9476 \text{ J}$