

Phy 2004 Exams. Fall 2007  
Solutions

(1)

(1)  $x \rightarrow M v_A - \frac{1}{2} m v_A = (m+m) v_F = 2m v_F$

$\frac{1}{2} m v_A = 2m v_F \Rightarrow v_F = \frac{1}{4} v_A$

$\frac{1}{2} (M+m) v_F^2 = M v_F^2 = \frac{M v_A^2}{16}$

(2)  $x: M v_{AI} = M v_{AFx} + M v_{BF} \cos \theta_B$

$v_{AFx} = v_{AI} - v_{BF} \cos \theta_B$

$= 10 - 5 \cos 30 = 10 - 5 \times 0.866$

$= 5.67 \text{ m/s}$

(3) Two autos of masses  $M_A = 10^3 \text{ kg}$  and  $M_B = 4 \times 10^3 \text{ kg}$  undergo a 1-dimensional sticking collision (same final velocity).

The autos travel along the  $x$ -axis. The initial velocity

$v_{AI}$  of A is  $20 \text{ m/s}$  and the initial velocity of B is  $-5 \text{ m/s}$ .

What is the value of the final common velocity?

- (A) 0 (B)  $+5 \text{ m/s}$  (C)  $-5 \text{ m/s}$  (D)  $-10 \text{ m/s}$  (E)  $+2.5 \text{ m/s}$

$M_A v_{AI} + M_B v_{BI} = (M_A + M_B) v_F$

$10^3 \times 20 + 4 \times 10^3 \times (-5) = 0 \Rightarrow v_F = 0$

Phy 2004 Exam 3 Fall 2007  
Solutions

(3)

(4)  $U_{AI} + U_{AF} = U_{BI} + U_{BF}$   
 $U_{AI} + 10 = 0 + 20$   
 $\Rightarrow U_{AI} = 10 \text{ m/s}$

(5)  $F \Delta t = M_{\text{rifle}} \Delta V_{\text{rifle}}$   
 $M_{\text{rifle}} \Delta V_{\text{rifle}} = M_{\text{bullet}} V_{\text{bullet}}$   
 $= 0.05 \times 10^3 \text{ Ns} = 0.5 \times 10^2 \text{ Ns}$   
 $\Rightarrow F = \frac{0.5 \times 10^2 \text{ N}}{10^{-2}} = 0.5 \times 10^4 \text{ N} = 5000 \text{ N}$

(6) Initial y momentum > Initial x momentum  
 $\Rightarrow$  sample found  $\Rightarrow \theta > 45^\circ$

