Phys100 Assignment Cover Sheet

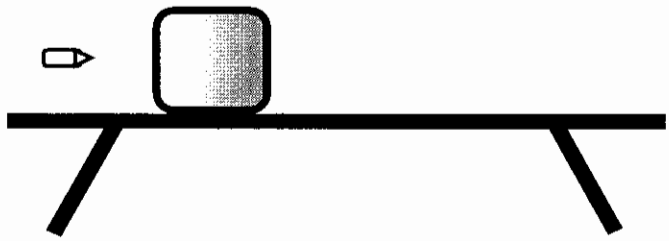
First Name:_____ Last Name:_____ Mark:_____

Student ID:_____ Computing ID:_____ Date:_____

Phys100 Written Assignment #7

Due Wed March 7, 2007, 9:00AM

1. As shown in the figure below, a 0.012-kg bullet is fired horizontally into a 1.5-kg block. The bullet sticks in the block. The coefficient of kinetic friction between the block and the table is 0.25. Compute the speed of the bullet if the impact causes the block to move 0.60 m.

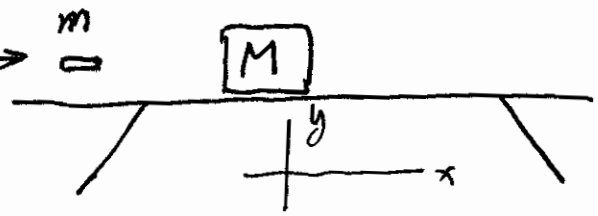


Assignment #7 Solution

Bullet hitting block : completely inelastic collision.
(hit and stick)

Conservation of total momentum:

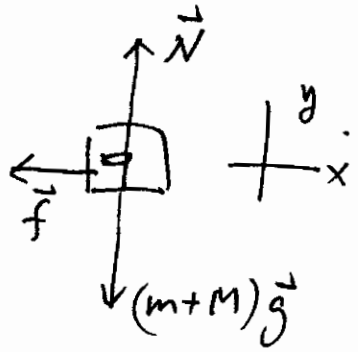
(Since $F_{ext} \ll$ force of impact)



x-comp: $m v_1 = (m+M) v_1'$

$$v_1' = \frac{m}{m+M} v_1 \qquad (1)$$

After collision : Free-body diagram :



$$N - (m+M)g = 0$$

$$N = (m+M)g.$$

$$f = \mu_k \cdot N = \mu_k (m+M) g. \quad \text{(friction is the net force)}$$

Work by friction : $W = \vec{f} \cdot \Delta\vec{x}$

$$= -\mu_k (m+M) g \cdot \Delta x$$

Work-energy Thm: $W = \Delta KE$

$$-\mu_k (m+M) g \cdot \Delta x = 0 - \frac{1}{2}(m+M) v'^2$$

from (1): $$\mu_k (m+M) g \cdot \Delta x = \frac{1}{2} \frac{m^2}{m+M} v_1^2 .$$

$$v_1^2 = \frac{2(m+M)^2 \mu_k \cdot g \cdot \Delta x}{m^2} = \frac{2(1.512)^2 (0.25)(9.8)(0.6)}{(0.012)^2} = 46675$$

$$v_1 = 216 \text{ m/s}.$$