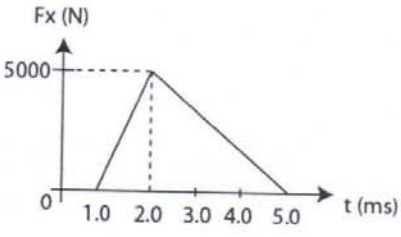
QUIZ#8- CHAPTER9
DATE: 05/11/18

Name: Key Id#: Sect.#:

An impulsive force F_x as a function of time (in ms) as applied to an object (m = 5.0 kg) at rest is shown in the figure.



(a) What will be speed of the object at t = 2.0 ms?

$\Delta p = J =$ area under the curve

$P_f - P_i = \frac{1}{2}(1\times10^{-3} \times 5000) = 2.5\ kg\cdot\frac{m}{s}$

$v_f = \frac{P_f}{m} = \frac{2.5}{5} = \boxed{0.5\ m/s}$

(b) What is the speed of the object at t = 5.0 ms?

$\Delta p = J =$ area under the Curve

$P_f - P_i = \frac{1}{2}(1\times10^{-3} \times 5000) + \frac{1}{2}(3\times10^{-3} \times 5000)$

$= \frac{5}{2} + \frac{15}{2} = 10\ kg\cdot\frac{m}{s} \Rightarrow v_f = \frac{10}{5} = \boxed{2\ m/s}$

(c) What is the average force on the object during the time interval t = 1.0 to t = 5.0 ms?

$F_{avg} = \frac{\Delta p}{\Delta t} = \frac{10}{4\times10^{-3}} = \boxed{2500\ N}$

$\Delta t = 5\times10^{-3} - 1\times10^{-3} = 4\times10^{-3}\ s$

Also $F_{avg} = \frac{5000 - 0}{2} = \boxed{2500\ N}$

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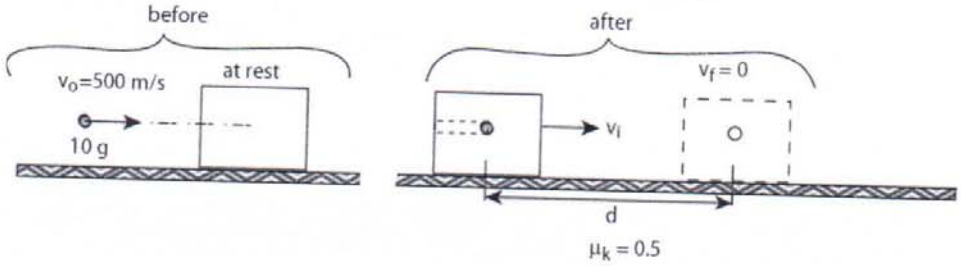
A 10 gram bullet is shot in the +x-direction with a speed of v = 500 m/s into a stationary block of wood that has a mass of 5.0 kg. The bullet embeds itself in the block.



(a) What distance (d) will the block slide on a surface having a coefficient of kinetic friction equal to 0.5?

Collision: $m_b v_{bi} + 0 = (m_b + m_B) v_f$

$$v_f = \frac{5}{5.01} = 0.99 \text{ m/s}$$

$\Delta K + \cancel{\Delta U_g} + \cancel{\Delta U_s} = W_f + \cancel{W_{app}}$

$$0 - \frac{1}{2}(m_b + m_B) v_i^2 = -\mu_k (m_b + m_B) g d$$

$$d = \frac{v_i^2}{2 \mu_k g} = \boxed{0.1 \text{ m}}$$

(b) What is the change in kinetic energy K_f-K_i?

$$K_f = \frac{1}{2}(m_b + m_B) v_f^2 = \frac{1}{2}(4.91) \text{J} = 2.46 \text{J}$$

$$K_i = \frac{1}{2} m_b v_{bi}^2 = \frac{1}{2}(2500) \text{J} = 1250 \text{J}$$

$$\Delta K = \cancel{4.91 - 25}\ 2.46 - 1250 = \boxed{-1247.5 \text{ J}}$$

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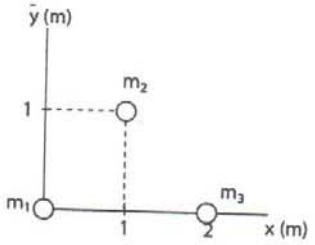
(a) If the masses of m_1 and m_3 in the figure are 1.0 *kg* each and m_2 is 2.0 *kg*, what are the coordinates of the center of mass?



$$X_{Cm} = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3}{m_1 + m_2 + m_3}$$

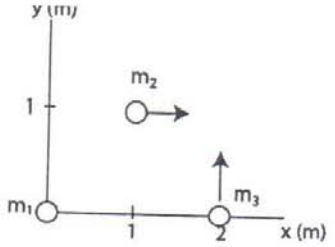
$$= \frac{1(0) + 2(1) + 1(2)}{4} = \frac{4}{4} = 1\ m$$

$$Y_{Cm} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3}{m_1 + m_2 + m_3}$$

$$= \frac{1(0) + 2(1) + 1(0)}{4} = \frac{2}{4} = 0.5\ m$$

Cm. (1, 0.5) m

(b) Each object in the figure has a mass of 2.0 *kg*. The mass m_1 is at rest, m_2 has a speed of 3.0 *m/s* and m_3 has a speed of 6.0 *m/s*. Find the momentum of the center of mass of the system is.



$$\vec{P}_{Cm} = \vec{P}_1 + \vec{P}_2 + \vec{P}_3$$

$$= 0 + 2 \times 3\,\hat{i} + 2 \times 6\,\hat{j}$$

$$= 6\hat{i} + 12\hat{j}\ \ kg \cdot \frac{m}{s}$$

$$|\vec{P}_{Cm}| = \sqrt{(6)^2 + (12)^2} = 13.4\ \ kg \cdot \frac{m}{s}$$