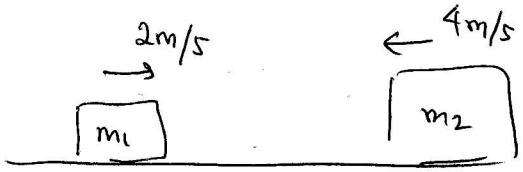
PHYS101
QUIZ#8 - CHAPTER 9
DATE: 18/11/12

Name: Key Id#: Sect#

A particle of mass m1 = 1.0 kg is moving toward the east with a speed of 2.0 m/s. It makes a head-on elastic collision with a particle of mass m2 = 5.0 kg moving toward the west with a speed of 4.0 m/s. Calculate their velocities just after the collision.

$m_1 = 1$ kg $\quad m_2 = 5$ kg

$v_{1i} = 2$ m/s $\quad v_{2i} = 4$ m/s



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

$$= \frac{1-5}{6} \times (2) + \frac{2 \times 5}{6} \times (-4) = -\frac{8}{6} - \frac{40}{6}$$

$$= -\frac{48}{6} = \boxed{-8 \text{ m/s}}$$

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

$$= \frac{2 \times 1}{6} \times (2) + \frac{5-1}{6} \times (-4) = \frac{4}{6} - \frac{16}{6}$$

$$= -\frac{12}{6} = \boxed{-2 \text{ m/s}}$$

both particles will move to the West. (left)

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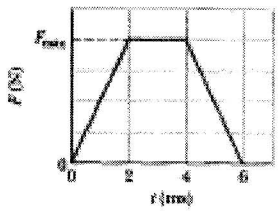
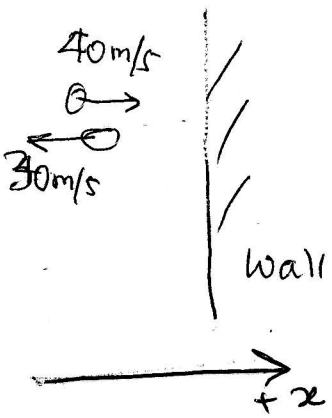
The figure shows F versus t during a collision of a particle of mass 70 g with a vertical wall. The initial speed of the ball is 40 m/s perpendicular to the wall. The ball rebounds back with a speed of 30 m/s perpendicular to the wall. What is the value of F_{max}?



$$\Delta\vec{p} = \int \vec{F}\, dt$$

$$\vec{p}_f - \vec{p}_i = \int \vec{F}\, dt = \text{Area} = F_{max} \times 4 \times 10^{-3}$$



$$m(\vec{v}_f - \vec{v}_i) = 4\, F_{max} \times 10^{-3}$$

$$0.07(-30-40) = 4\, F_{max} \times 10^{-3}$$

magnitude $\boxed{F_{max} = 1225\,N}$

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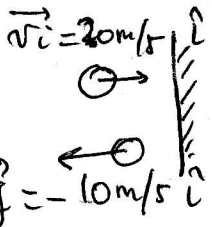
A ball of mass 100 g traveling horizontally at 20 m/s to the right hits a vertical wall and bounces back with a speed of 10 m/s to the left. If the duration of the impact is 3.0 ms, what is the magnitude and direction of the force of the ball on the wall?



Force of the wall on the ball

$$\vec{F}_{avg} = \frac{\Delta \vec{p}}{\Delta t} = \frac{\vec{p}_f - \vec{p}_i}{\Delta t} = \frac{0.1(-10-20)\hat{i}}{0.003} = -1000\ N\ \hat{i}$$

Force of the ball on the wall is $= 1000\ N\ \hat{i}$