Physics 2110
Autumn 1999
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EXAM 2

3

Name:_____ Social Security #:_____

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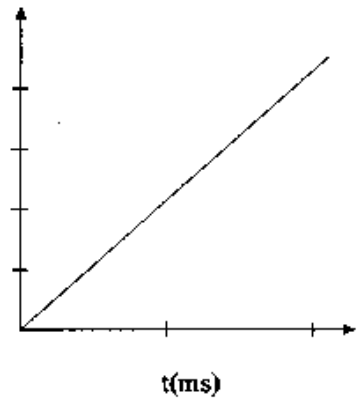
A. (20 PTS)

A 12.0 kg object initially at rest suddenly feels an impulsive force $\vec{F} = (2.00 \times 10^4\ \text{N/s})\,t\,\hat{i}$. The force lasts for 100 ms (0.100 s). See figure. What total impulse $\vec{I}$ does the object feel and what is the object's velocity after 100 ms?



3 WAYS OF GETTING $\vec{I}$

1) $\vec{I}$ = AREA OF TRIANGLE $= \frac{1}{2} * (2.00\times10^4\ \text{N/s})t^2$
$= (.5)(.15)^2(2.00\times10^4\ \text{N/s}) = 100\ \text{N·s}\,\hat{i}$

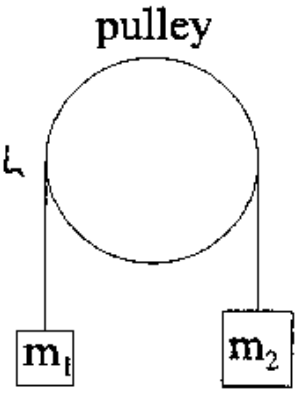
2) $\vec{I} = \vec{F}_{AV}\,\Delta t = \frac{0 + (2\times10^4\ \text{N/s})(.15)}{2}(.15) = 100\ \text{N·s}\,\hat{i}$

3) $\vec{I} = \int_0^{.15} (2\times10^4\ \text{N/s})\,t\,dt = \boxed{100\ \text{N·s}\,\hat{i}}$

$\vec{I} = \Delta\vec{p} = m\vec{v} - 0$

$\vec{v} = \frac{\vec{I}}{m} = \frac{100\ \text{N·s}\,\hat{i}}{12.0\ \text{kg}} = \boxed{8.33\ \text{m/s}\,\hat{i}}$

B. *[10 pts.]* Two masses, $m_1 = 1.00$ kg and $m_2 = 2.00$ kg, are tied together by a string that is put through a massless, frictionless pulley. See figure. Both masses start from rest at the same height. How fast is m_2 moving after falling 0.500 m?



USE ENERGY CONSERVATION

$ME_{TOT}(INIT) = 0$

$ME_{TOT}(FIN) = \frac{1}{2}(m_1+m_2)v^2 + m_1gh - m_2gh$

$v^2 = \frac{2gh(m_2-m_1)}{m_1+m_2}$

$= \frac{(2)(9.8\ \text{m/s}^2)(.5\ \text{m})(1\ \text{kg})}{3\ \text{kg}}$

$= 3.27\ \text{m}^2/\text{s}^2$

$\boxed{v = 1.81\ \text{m/s}}$