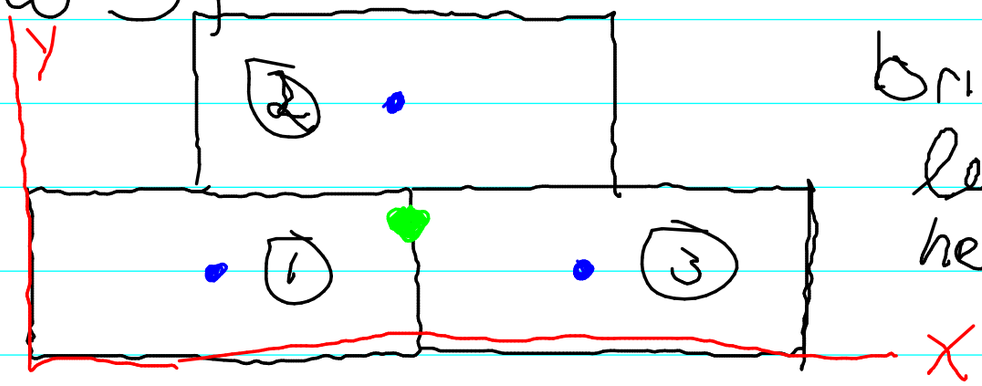
HW 5)

35)

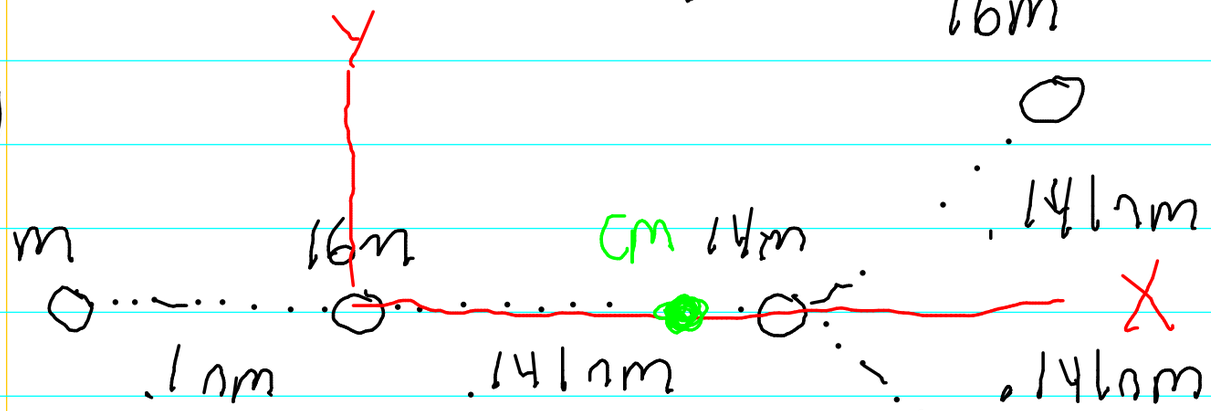


bricks have length ℓ height h

$$x_{cm} = \frac{\frac{m\ell}{2} + m\ell + \frac{m3\ell}{2}}{3m} = \ell$$

$$y_{cm} = \frac{\frac{mh}{2} + \frac{m3h}{2} + \frac{mh}{2}}{3m} = \frac{5}{6}h$$

41)



$$x_{cm} = \frac{(-.1)m + (0)16m + (.141)14m + 2((.141)\cos 65^\circ + .141)16m}{63\,m}$$

$\Rightarrow$

$X_{cm} = .132\,nm$

$Y_{cm} = 0\,nm$ (by symmetry)

46) Side 1 - $(L/2, 0, L/2)$

Side 2 - $(0, L/2, L/2)$

Side 3 - $(L/2, L/2, 0)$

$$X_{cm} = \frac{2m(L/2)}{3m} = \frac{1}{3}L$$

$$Y_{cm} = \frac{2m(L/2)}{3m} = \frac{1}{3}L$$

$$Z_{cm} = \frac{2m(L/2)}{3m} = \frac{1}{3}L$$

59) Internal forces so CM should stay const.

$$\frac{m_B(0) + m_S(300m)}{m_{TOT}} = \frac{m_B(45m) + m_S(45m)}{m_{TOT}} \Rightarrow$$

$$m_s(300m) = 5400kg(45m) + m_s(45m)$$

$$m_s = \frac{5400kg\,(45m)}{255m} = 953\,kg$$

ch11)

9) $v_0 = 15\,m/s \quad v_f = -15\,m/s$

$\xrightarrow{.5cm}$ $2a\Delta x = v_f^2 - v_0^2$ (halfway)

$2a(.005m) = 0^2 - (15m/s)^2$

$a = 2.25 \times 10^4\,m/s^2$

so $F = (.06kg)(2.25 \times 10^4\,m/s^2) = 1350N$

$I = \Delta p = mv_f - mv_0 = -(.06kg)(15+15)$

$= -1.8\,kg\,m/s$

12) $\Delta p = F\Delta t = (3N)(.0205) = .06\,Ns$

$(.05kg)(0 - v_0) = .06\,kg\,m/s \Rightarrow v_0 = 1.2\,m/s$

(ch 2) $so\ 2g\Delta y = (1.2m/s)^2 - (0m/s)^2 \Rightarrow$

$\Delta y = .073\ m \Rightarrow 7.3\ cm$

17) 

① $m(.80 m/s) = mV_1' + 2mV_2'$ (momentum)

② $\frac{1}{2}m(.80 m/s)^2 = \frac{1}{2}mV_1'^2 + \frac{1}{2}(2m)V_2'^2$ (Energy)

① $V_1' = -.8 m/s - 2V_2'$

so $V_1'^2 = (.8 m/s)^2 - 3.2V_2' + 4V_2'^2$

put in ②

② $(.8 m/s)^2 = (.8 m/s)^2 - 3.2V_2' + 4V_2'^2 + 2V_2'^2$

$0 = 6V_2'^2 - 3.2V_2' = V_2'(6V_2' - 3.2)$

$V_2' = 0,\ .53 m/s$

using ① $V_1' = -.26 m/s$

Energy Before: $\frac{1}{2}(.06kg)(.8m/s)^2$

$= .0192 J$

After: $\frac{1}{2}(.06kg)(-.26m/s)^2$

$+ \frac{1}{2}(.120kg)(.53m/s)^2$

$= .188 J$ Elastic

24)

(1) $mV_0 = m(.5m/s) + (.15kg)(1.50m/s)$

(2) $\frac{1}{2}mV_0^2 = \frac{1}{2}m(.5m/s)^2 + \frac{1}{2}(.15kg)(1.50)^2$

square (1) $m^2V_0^2 = (m^2.25) + .0506 + .225m$

so $mV_0^2 = .25m + .225 + \frac{.0506}{m}$

(2) $.25m + .225 + \frac{.0506}{m} = .25m + .3375$

$.1125m = .0506$ $m = .45 kg$

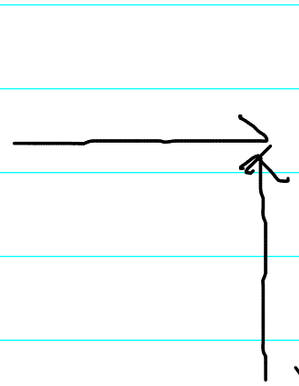
using (1) $V_0 = .5 + \frac{.15kg}{.45kg}(1.5) = 1 m/s$

40) momentum Conservation

$(35kg)(3m/s) = 65kg\,V'$

$V' = 1.6\ m/s$

57



x: $mV_0 = 2mV_x'$ (1)

y: $mV_0 = 2mV_y'$ (2)

momentum

Energy $E_f - E_0 = -6.1 \times 10^{-22}\ J$

(3) $\frac{1}{2}(2m)(V_x'^2 + V_y'^2) - \frac{1}{2}mV_0^2 - \frac{1}{2}mV_0^2$

$= -6.1 \times 10^{-22}\ J$

(1) $V_x' = \frac{V_0}{2}$ (2) $V_y' = \frac{V_0}{2}$

(3) $(1.66 \times 10^{-27}\ kg)\left(\frac{V_0^2}{4} + \frac{V_0^2}{4}\right) - (1.66 \times 10^{-27})V_0^2$

$= 6.1 \times 10^{-22}\ J$ ⇒

$\frac{1}{2}V_0^2 = 3.67 \times 10^5 \, m^2/s^2$

so $V_0 = 860 \, m/s$

58) $W_f = -2mg\mu_k d = -m(280 \, m^2/s^2)$

$= \Delta E$

$E_f = 0, \; E_0 = \frac{1}{2}mv_1^2 + \frac{1}{2}mv_2^2$

Assume both were 14 m/s

$0 - \left(\frac{1}{2}m(14 \, m/s)^2 + \frac{1}{2}m(14 \, m/s)^2\right)$

$\overset{?}{=} -m(280 \, m^2/s^2)$

$\overset{?}{=}$

$196 \, m^2/s^2 \neq 280 \, m^2/s^2$

Energy lost do to friction was greater than drivers speed claim, at least one was going faster...

Ch 12

6) $5000 \frac{\text{Rev}}{\text{min}} \left(\frac{1\text{min}}{60\text{sec}}\right) = 83 \frac{\text{Rev}}{\text{sec}}$

so $t = \frac{1}{83}$ sec $\qquad \omega = \frac{2\pi(83)}{\text{sec}} = 523/\text{sec}$

10) $3450 \text{ rev}/\text{min} \left(\frac{2\pi \text{ rad}}{\text{rev}}\right)\left(\frac{1\text{min}}{60\text{s}}\right)$

$= 360 \text{ rad}/\text{sec}$

$v = (.065\text{m})(360 \text{ rad/sec}) = 23 \text{ m/s}$

$\omega = \bar{\alpha} t$ so $\bar{\alpha} = \frac{\omega}{t} = \frac{360 \text{ rad/s}}{1.6\text{s}}$

$= 225 \text{ rad/s}^2$

$\bar{\alpha}_2 = \frac{-360 \text{ rad/s}}{35\text{s}} = -10 \text{ rad/s}^2$