A1) many solutions

A2) explain

A3)

$m_o = 3g \quad m_p = .75g \quad m_m = 40g$

$\rightarrow x$

$m_T = 5m_o + 5m_p + m_m = 58.75g$

$m_T x_{cm} = m_o x_{o1} + m_o x_{o2} + m_o x_{o3} + m_o x_{o4} + m_o x_{o5}$
$+ m_p[x_{p1} + x_{p2} + x_{p3} + x_{p4} + x_{p5}] + m_m x_m$

$= m_o[x_{o1} + x_{o2} + x_{o3} + x_{o4} + x_{o5}] +$

$m_p[x_{p1} + x_{p2} + x_{p3} + x_{p4} + x_{p5}] + m_m x_m$

$58.75 x_{cm} = 3[1.5 + 4 + 5.5 + 10.75 + 11.75] +$
$.75[2 + 3.5 + 5 + 10.5 + 12] + 40(7)$

$x_{cm} = 6.90$ cm

$m_T y_{cm} = m_o[y_{o1} + y_{o2} + y_{o3} + y_{o4} + y_{o5}] +$

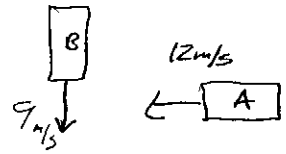
$m_p[y_{p1} + y_{p2} + y_{p3} + y_{p4} + y_{p5}] + m_m y_m$

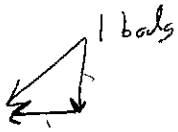
$= 3[2.25 + 4.25 + 4.75 + 11.25 + 10.75]$
$+ [.75][2.5 + 4.5 + 4.5 + 10.5 + 11.25] + 40(7)$

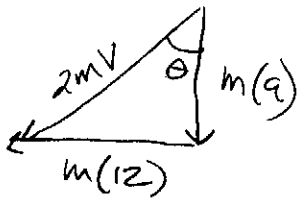
$y_{cm} = 6.89$ cm

A47 Momentum is conserved and the two cars become 1 body afterwards

A44)







$P_B = P_A$

$(12m)^2 + (9m)^2 = (2mV)^2$

$V = 7.5\ m/s$

$\tan\theta = \frac{m(12)}{m(9)}$ $\quad \theta = 53.1^\circ$

7.5 m/s @ 53.1° W of S

A57 The contact with the soface produces an impulse that changes the balls momentum. assume totally elastic

A57

$m_B = .045\ kg$

$V_f^2 = V_i^2 + 2ad$

$V_f^2 = 0^2 + 2(9.8)(2.13)$ $\quad V_f = 6.46\ m/s$

$\Delta p = \Delta p$

$m\Delta V = Ft$

$(.045)(-6.46 - 6.46) = F(.123)$

F = 4.73 N

A6) $m_T x_{cm} = m_H x_H + m_{Head} x_{Head}$

$(.25 + 1.35) x_{cm} = (.25)(.45/2) + (1.35)(.45 + .15/2)$

$\boxed{x_{cm} = .478\ m}$

A7) Momentum is conserved.

A7) $P_B = P_A$

$P_u + P_B + P_f = P_{UB} + P_f$

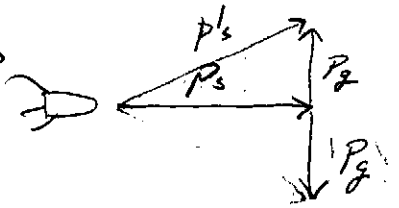
$m_u v_u + m_B v_B + m_A v_f = m_{UB} v_{UB} + m_f v_f'$

$(70)(3.55) + (5.5)(3.55) + (53)(3.55) = (70 + 5.5) v_{UB} + (53)(-2)$

$\boxed{v_{UB} = 7.45\ m/s}$

A8) The momentum is going to be conserved vectorly. The forward F of the rocket is not changed only the horizontal

A8)

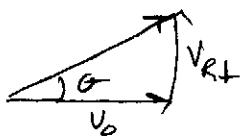


$P_\perp$ to travel

$P_{R\perp} + P_{G\perp} = P_{R\perp}' + P_{G\perp}'$

$0 + 0 = (4000 - 18) v_{R\perp} + 18(260)$

$v_{R\perp} = 1.1753\ m/s$



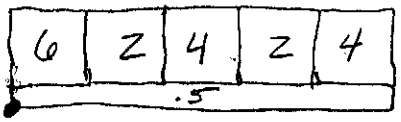
$\tan\theta = \frac{v_{R\perp}}{v_0} = \frac{1.1753}{16.5}$

$\boxed{\theta = 4.07°}$

B1)

$m_T = 18.5\,m$

X|

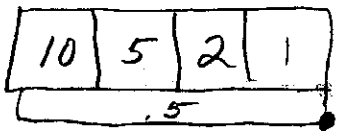


$$m_T x_{cm} = m_6 x_6 + m_2 x_2 + m_4 x_4 + m_2 x_2 + m_4 x_4 + m_{.5} x_{.5}$$

$$18.5\,x_{cm} = 6(.5) + (2)(1.5) + (4)(2.5) + 2(3.5) + 4(4.5) + (.5)(2.5)$$

$$\boxed{x_{cm} = 2.28\,L}$$

y|



$$m_T y_{cm} = m_1 y_1 + m_2 y_2 + m_3 y_3 + m_4 y_4 + m_p y_p$$

$$(18.5)\,y_{cm} = 1(.5) + 2(1.5) + 5(2.5) + 10(3.5) + .5(2)$$

$$\boxed{y_{cm} = 2.81\,L}$$

z|

$$m_T z_{cm} = m_p z_p + m_1 z_1 + m_2 z_2 + m_3 z_3$$

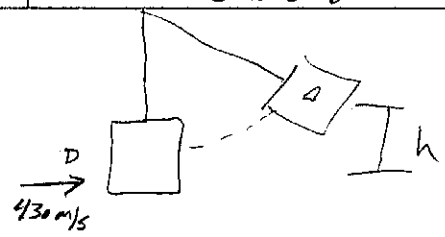
$$(18.5)\,z_{cm} = .5(.25) + 11(1) + 6(2) + 1(3)$$

$$\boxed{z_{cm} = 1.41\,L}$$

B2)

Momentum is conserved during the inelastic collision between the bullet and the block. Mech E is conserved as the block swings upward.

B2)



$P_{B0} + P_{B1} = P_{BB1}$

$(.035)(430) + 0 = (1.78 + .035) V_{BB1}$

$V_{BB1} = 8.292 \text{ m/s}$

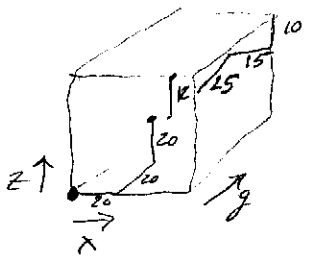
$KE_B \rightarrow PE_T$

$\frac{1}{2} m v^2 = mgh$

$\frac{1}{2}(8.292)^2 = (9.81)h$

$\boxed{h = 3.50 \text{ m}}$

B3)



$B_1 = (20, 20, 20)$

$B_2 = (60, 50, 65)$

$B_3 = (37.5, 37.5, 49.5)$

Vol cheese $= (.75)(.75)(.75) - 3(500)$

$= 420375$

dens cheese $= \frac{\text{mass}}{\text{vol}} = 9.515 \times 10^{-6} \text{ kg/cm}^3$

mass hole $= .00475765 \text{ kg}$

mass chees $= 4.0143 \text{ kg}$

$m_T x_{cm} = m_c x_c - m_{B1} x_{B1} + m_{B2} x_{B2} + m_{B3} x_{B3}$

$4 x_{cm} = 4.0143(37.5) - (.00475765)(20 + 60 + 37.5)$

$x_{cm} = 37.49 \text{ cm}$

B3) cont.

$$m_T y_{cm} = m_c y_c - m_B (y_{B1} + y_{B2} + y_{B3})$$

$$4\, y_{cm} = 4.0143(37.5) - .004757657(20 + 50 + 37.5)$$

$$y_{cm} = 37.51 \text{ cm}$$

$$m_T z_{cm} = m_c z_c - m_B (z_{B1} + z_{B2} + z_{B3})$$

$$4\, z_{cm} = 4.0143(37.5) - .004757657(20 + 65 + 49.5)$$

$$z_{cm} = 37.47 \text{ cm}$$

B4) Momentum must be conserved.

B4)

$$P_B = P_A$$

$$P_I + P_c = P_I' + P_c'$$

$$0 + 0 = mV + (\tfrac{1}{3}m)V_c$$

$$\boxed{V_c = -3V}$$

B5) Impulse changes momentum

B5)

$$\Delta p = \Delta p$$

$$m\Delta V = Ft$$

$$m\,\Delta V = F_F t = \mu F_N t = \mu m g t$$

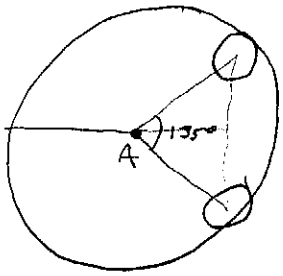
$$4.4 = (.84)(5.8)\, t$$

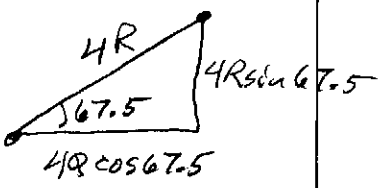
$$\boxed{t = .534 \text{ s}}$$

B6) area big $= 25\pi R^2$.

area small $= \pi R^2$

so true area large $= 23\pi R^2$





X.] $m_T x_{cm} = m_L x_L + m_S x_S + m_S x_S$ $\quad m = \rho A$

$$\left[25\pi R^2 + 2\left(\tfrac{1}{2}\right)(\pi R^2)\right] x_{cm} = 23\pi R^2(0) + \tfrac{1}{2}\pi R^2 (4R\cos 67.5)(2)$$

$$24\pi R^2 x_{cm} = \pi R^2 (4R\cos 67.5)$$

$$x_{cm} = 6.38\times 10^{-2} R$$

4] Symetry on this radius.

B7) on sheet.