Final Exam PHYS 1B

#1]

a] $3\left(\frac{2}{3}\right) = 2$ hence $\uparrow\uparrow\uparrow$

b] conserves energy & momentum

c] $F = -\nabla U = -\frac{d}{dx} Ax^3 = -3x^2$

$F(2) = -12A$

d] $F = dp/dt \quad F_{12} = -F_{21}$; if $F = 0 \rightarrow a = 0$

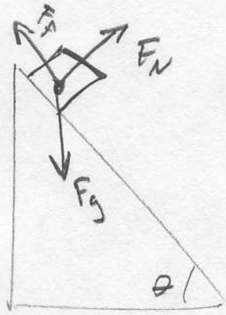
e] emitted balmer β

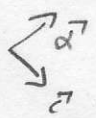
f] 750 nm ~ 400 nm

red blue

g] QHO ; E levels of H atom

#2]





b] $\vec{F}_g$ in $\hat{i}$ = $mg\sin\theta$

c] $\vec{F}_N = mg\cos\theta\ \hat{j}$

d]

$mg\sin\theta = F_f = \mu F_N = \mu mg\cos\theta$

$\mu = \tan\theta$

e] $F_{Net} = mg\sin\theta - \mu mg\cos\theta = mg(\sin\theta - \mu\cos\theta)$

f] $Q = W_{F_f} = \vec{F}_f \cdot \vec{d} = F_f d$

$= (\mu mg\cos\theta)(h/\sin\theta)$

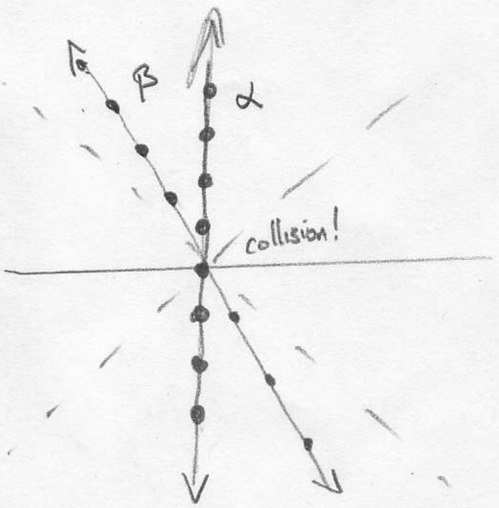
$= \mu mgh\cot\theta$

#3]

a] $V = .6c$ → $\gamma = (1-(.6)^2)^{-1/2} = 1.25$

$u = -.6c$

$$u' = \frac{u-V}{1-\frac{uV}{c^2}} = -.88c$$



c] Momentum is conserved so $p_{net} = 0$
energy is conserved so $E = E'$

$$E = 2\left((mc^2)^2 + (pc)^2\right)^{1/2}$$

$$p = mv\gamma = 1.35 \cdot 10^{10} \text{ kg m/s}$$

$$E = 1.35 \cdot 10^{19} \text{ J}$$

$$E = E' = m_f c^2$$

$$M_f = 150 \text{ kg}$$

$$p_f = 0 \rightarrow v_f = 0$$

#4] a]

$F = \Delta p / \Delta t \qquad \Delta p = F\Delta t = (30N)(.1s) = 3\ kg\,m/s$

b] $V = \frac{p}{m} = \frac{3}{.3} = 10\ m/s$ since $\gamma \approx 1$

c] d]

$p_3 = p_1 \left(\frac{m_1 - m_2}{m_1 + m_2} \right) \qquad V_3 = .91\ m/s$

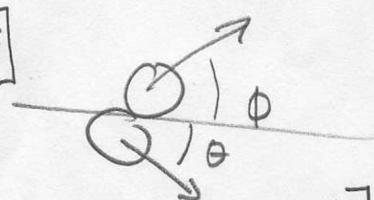
$p_4 = p_1 \left(\frac{2m_2}{m_1 + m_2} \right) \qquad V_4 = 11\ m/s$

e]

$$\theta = \cos^{-1}\left[\frac{m_1 + m_2 - 2m_2\cos^2\phi}{\sqrt{m_1^2 + m_2^2 + 2m_1m_2 - 4m_1m_2\cos^2\phi}} \right] \cong -40°$$

$$\phi = \sin^{-1}\left({}^{1.4R}/_{20R} \right) = 44.4°$$

f]



#5]

	E_1	E_2	E_3	E_4
E_1	—	4eV	9eV	11eV
E_2	-4eV	—	5eV	7eV
E_3	-9eV	-5eV	—	2eV
E_4	-11eV	-7eV	-2eV	—

b] 8eV, its when $U > 0$

c] From E_1 there is no other level ± 5eV, so nothing happens

d] $-1eV - (-12eV) = 11eV$

e] $\lambda = \frac{hc}{E} = 112\ nm$

f] at bottom particle would have $p=0$, but r would be known exactly! This violates $\Delta x \Delta p \geq \hbar/2$