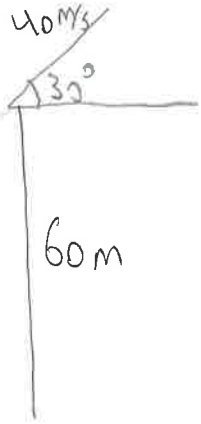
Physics F14 MT2 retake, question #4, Nov. 20, 2014 Name

5. (7 pts) I throw a ball off the edge of a 60 m high cliff with a velocity of 40 m/s at an angle of 30 degrees above the horizon. Any way you like, please find out:
a) how far from the base of the cliff the ball lands
b) (extra credit) what the final velocity of the ball is (include angle)



a) $V_{iy} = 40\sin(30)$ $\quad V_x = 40\cos(30)$

$V_{y_i} = 20\ m/s$ $\quad V_x = 34.6\ m/s$

$E_{iy} = E_{fy}$

$mgh + \frac{1}{2}mV_{iy}^2 = mgh + \frac{1}{2}mV_{fy}^2$

$10\ m/s^2(60m) + \frac{1}{2}(20\ m/s)^2 = 0 + \frac{1}{2}V_{fy}^2$

$800\ m^2/s^2 = \frac{1}{2}V_{fy}^2$

$V_{fy} = \sqrt{1600\ m^2/s^2}$

$V_{fy} = 40\ m/s$

$d = \frac{V_{iy} + V_{fy}}{2}(t)$

$-60m = \frac{20\ m/s - 40\ m/s}{2}(t)$

$-60m = -10\ m/s\,(t)$

$t = 6s$

$d_x = V_x(t)$

$= 34.6\ m/s\,(6s)$

$= \boxed{207.6\ m}$

b) $E_i = E_f$

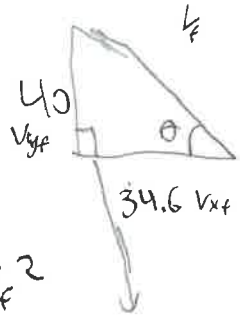
$mgh + \frac{1}{2}mV_{i}^2 = mgh + \frac{1}{2}mV_f^2$

$600\ m^2/s^2 + 800\ m^2/s^2 = \frac{1}{2}V_f^2$

$(2)(1400\ m^2/s^2) = V_f^2$

$\sqrt{2800\ m^2/s^2} = V_f$

$\boxed{V_f = 53\ m/s}$



$V_f = \sqrt{40^2 + 34.6^2}$

$V_f = 53\ m/s$

$\tan(\theta) = \frac{40\ m/s}{34.6\ m/s}$

$\theta = \tan^{-1}\left(\frac{40\ m/s}{34.6\ m/s}\right)$

$\boxed{\theta = 49°}$

I like this one better than mine because it used Energy conservation! (mine is below)

2. Your Statements:

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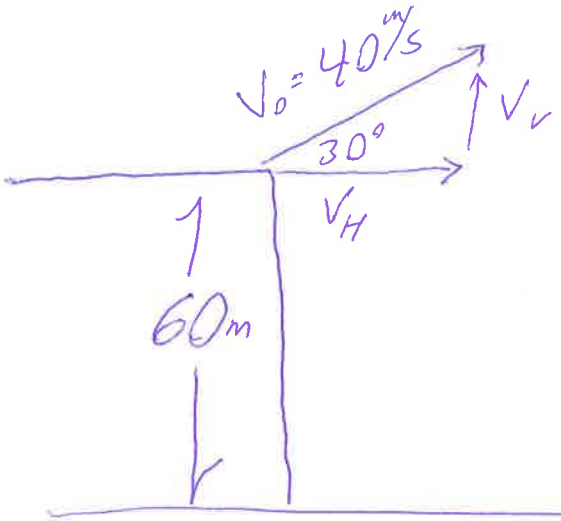


$V_V = V_0 \sin\theta = 20\ m/s$

$V_H = V_0 \cos\theta \approx 35\ m/s$

$X = V_H (t)$

$= (35\ m/s)(6\ s) = 210\ m$

Let's find time: We look only at the vertical motion

1) going up: It takes 2 s to come to a rest!

How high? $V_{ave} = \frac{V_0 + V_f}{2} = 20\ m/s\,\hat{y} + 0 = 10\ m/s$

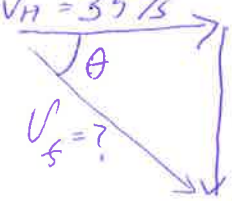
So height $= V_{ave} \cdot 2s = 20m$. Max height $= 60m + 20m = 80m$

2) going down how long does it take to drop 80m? $x_f = \cancel{x_0}^{0} + \cancel{v_0 t}^{0} + \frac{1}{2}at^2$ $\quad x_f = {}^{80m}_{0} + {}^{0}_{v_0 t} + \frac{1}{2}at^2$

$80m = \frac{1}{2}gt^2 \therefore t = 4s$ going down.

total air time = 6s $\quad V_f = V_{y0} + at = 20\ m/s\,\hat{y} - 10\ m/s^2\,(6s)$

$= -40\ m/s$



$\tan(\theta) = \frac{35}{40}$

$V_f \approx 53\ m/s \quad \theta \approx 49°$

2. Your Statements:
a) Please write and sign the following statement: "I have not received any information about this test."

I did - I wrote it. - Pete

Signature _____

b) If you didn't use a calculator for this test and would like extra credit for it, please write and sign the following statement: "I didn't use a calculator on this test - *your signature*"

I used Excel - Pete

Signature _____