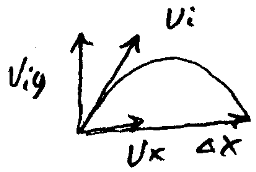
Honors Physics - Ch. 4 quarter exam - 10-24-02 - Mr. Ward

Name WARD ____ o

1. (33 pts) A mortar shell is fired on level ground at a 55.0° angle at 250 m/s. (a) How far does it go along the ground? (b) What is its maximum height above ground? Draw a good, well-labeled diagram.



$V_x = V_i \cos\theta$

$= 250\,\frac{m}{s} \cos 55°$

$\underline{V_x = 143\,\frac{m}{s}}$

$V_{iy} = V_i \sin\theta$

$= 250\,\frac{m}{s} \sin 55°$

$\underline{V_{iy} = 205\,\frac{m}{s}}$

$\theta = 55°$

$V_i = 250\,\frac{m}{s}$

$a = -9.8\,\frac{m}{s^2}$

$\Delta x = \_\_\_\ m$

$\Delta y_{max} = \_\_\_\ m$

$\overset{0}{\cancel{V_{fy}}} = V_{iy} + at$

$t_{\frac{1}{2}} = -\frac{V_{iy}}{a}$

$= \frac{-205\,\frac{m}{s}}{-9.8\,\frac{m}{s^2}}$

$t_{\frac{1}{2}} = 20.9s$

$t_T = 41.8s$

$\Delta x = V_x t$

$= 143\,\frac{m}{s}\,(41.8s)$

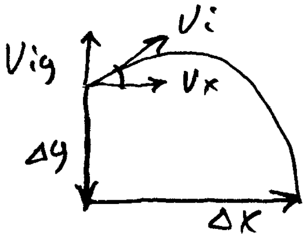
a) $\boxed{\Delta x = 5977m}$

$\Delta y = V_{iy}t + \frac{1}{2}at^2$

$= 205\,\frac{m}{s}\,(20.9s) - 4.9\,\frac{m}{s^2}\,(20.9s)^2$

b) $\boxed{\Delta y = 2144\ m}$

2. (33 pts) A mass is thrown up from the edge of the roof of the Clavius Science Center at 25 m/s at an angle of 36.0°. If it hits on the ground 12.5 meters below, how far from edge of the building does it land? Draw a good, well-labeled diagram.



$V_i = 25\frac{m}{s}$

$\theta = 36°$

$\Delta y = -12.5m$

$a = -9.8\frac{m}{s^2}$

$\Delta X = \_\_ m$

$V_x = V_i \cos\theta$

$= 25\frac{m}{s} \cos 36°$

$\underline{V_x = 20.2\frac{m}{s}}$

$V_{iy} = V_i \sin\theta$

$= 25\frac{m}{s} \sin 36°$

$\underline{V_{iy} = 14.7\frac{m}{s}}$

$\Delta y = V_{iy}t + \frac{1}{2}at^2$

$-12.5 = 14.7t - 4.9t^2$

$\underline{t = 3.69s}, -0.691s$

$\Delta K = V_x t$

$= 20.2\frac{m}{s}(3.69s)$

$\boxed{\Delta X = 74.5m}$

OR

$V_{fy}^2 = V_{iy}^2 + 2a\Delta y$

$= (14.7\frac{m}{s})^2 + 2(-9.8\frac{m}{s^2})(-12.5m)$

$V_{fy} = \pm 21.5\frac{m}{s}$

$V_{fy} = V_{iy} + at$

$t = \frac{V_{fy} - V_{iy}}{a}$

$= \frac{21.5\frac{m}{s} - 14.7\frac{m}{s}}{-9.8\frac{m}{s^2}}$

$t = -0.694s$

OR

$t = \frac{-21.5\frac{m}{s} - 14.7s}{-9.8\frac{m}{s^2}}$

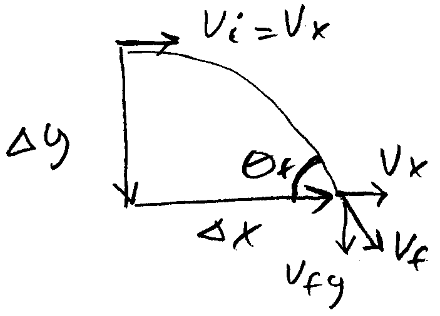
$\underline{t = 3.69s}$

$\Delta X = V_x t$

$= 20.2\frac{m}{s}(3.69s)$

$\boxed{\Delta X = 74.5m}$

3. (33 pts) A car drives off the edge of a cliff at 42.5 m/s and lands115 m from the base of the cliff. (a) How high is the cliff? (b) At what angle does it hit the ground? Draw a good, well-labeled diagram. Mark angle on diagram.



$V_x = 42.5 \frac{m}{s}$

$\Delta x = 115 m$

$V_{fy} = 0 \frac{m}{s}$

$a = -9.8 \frac{m}{s^2}$

$\Delta y = -\_\_\_\_ m$

$\theta_f = \_\_\_\_ ^\circ$

$\Delta x = V_x t$

$t = \frac{\Delta x}{V_x}$

$= \frac{115 m}{42.5 \frac{m}{s}}$

$t = 2.71 s$

$\Delta y = \overset{0}{\cancel{V_{iy}}} t + \frac{1}{2} a t^2$

$= \frac{1}{2}(-9.8 \frac{m}{s^2})(2.71 s)^2$

$\boxed{\Delta y = -36.0 m}$ height = 36.0 m

$V_{fy} = \overset{0}{\cancel{V_{iy}}} + at$

$= -9.8 \frac{m}{s^2}(2.71 s)$

$V_{fy} = -26.6 \frac{m}{s}$

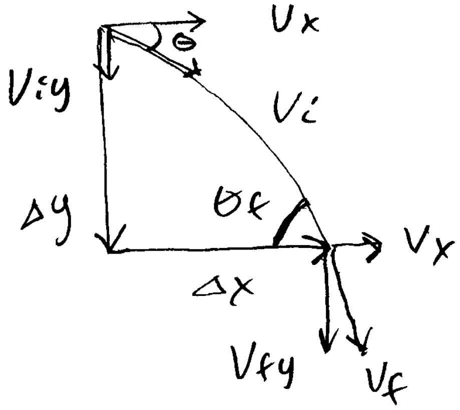
$\tan\theta = \frac{V_{fy}}{V_x}$

$\tan\theta = \frac{-26.6 \frac{m}{s}}{42.5 \frac{m}{s}}$ 4TH Q

$\theta = -32.0^\circ$

$\boxed{\theta_f = 32.0^\circ \text{ as marked on diagram}}$

EC. (5 pts) If the cliff in problem 3 is slanted downhill at 22.5° and the car rolls off at 42.5 m/s, how far from the base of the building does it hit and at what angle? Draw a good, well-labeled diagram.



$V_x = V_i \cos\theta$

$= 42.5\frac{m}{s}\cos(-22.5^\circ)$

$\underline{V_x = 39.3\frac{m}{s}}$

$V_{iy} = V_i \sin\theta$

$= 42.5\frac{m}{s}\sin(-22.5^\circ)$

$\underline{V_{iy} = -16.3\frac{m}{s}}$

$V_i = 42.5\frac{m}{s}$

$\theta_i = 22.5^\circ$

$a = -9.8\frac{m}{s^2}$

$\Delta x = \_\_\_ m$

$\theta_f = \_\_\_ ^\circ$

$\Delta y = -36m$

$\Delta y = V_{iy}t + \frac{1}{2}at^2$

$-36 = -16.3t - 4.9t^2$

$\underline{t = 1.52s}, -4.84s$

$\Delta x = V_x t$

$= 39.3\frac{m}{s}(1.52s)$

$\boxed{\Delta x = 59.7m}$

$V_{fy} = V_{iy} + at$

$= -16.3\frac{m}{s} - 9.8\frac{m}{s^2}(1.52s)$

$\underline{V_{fy} = -31.2\frac{m}{s}}$

$\tan\theta = \frac{V_{fy}}{V_x}$

$\tan\theta = \frac{-31.2\frac{m}{s}}{39.3\frac{m}{s}}$ 4TH Q

$\theta = -38.4^\circ$

$\boxed{\theta_f = 38.4^\circ \text{ as marked on diagram}}$