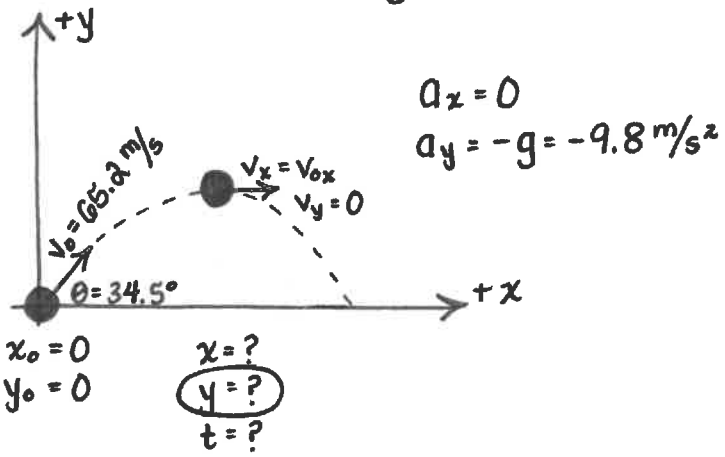
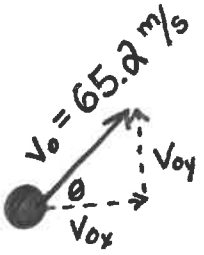
3-30 - Part A

Given/Want/Figure:



$a_x = 0$

$a_y = -g = -9.8\ m/s^2$



$v_{ox} = v_0 \cos\theta$

$v_{oy} = v_0 \sin\theta$

Calculations:

Eqn for Uniform Acceleration

$\cancel{v_y^2} = v_{oy}^2 + 2a_y(y - \cancel{y_0})$

$0 = (v_0 \sin\theta)^2 + 2a_y y$

$0 = (65.2 \sin 34.5)^2 + 2(-9.8)y$

$19.6y = (65.2 \sin 34.5)^2$

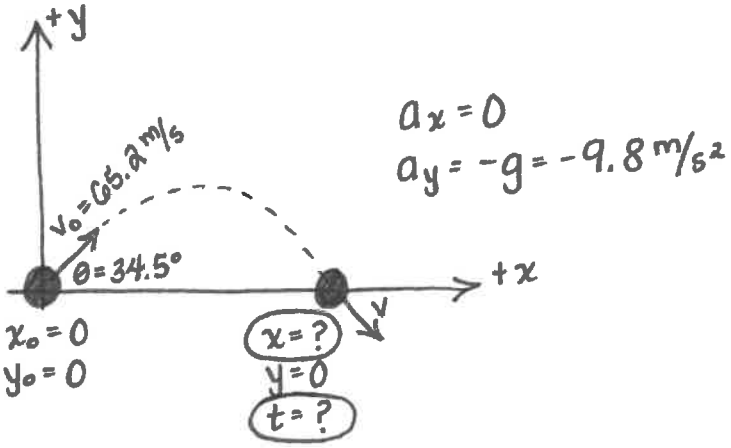
$y = 69.5817$ m

$\boxed{y = 69.6\ m}$

Conclusion: The projectile reached a maximum height of 69.6 m.

3-30 - Part B & C

Given / Want / Figure:



$a_x = 0$

$a_y = -g = -9.8\ m/s^2$

Calculations:

Eqn for Uniform Acceleration

$x = \cancel{x_0} + v_{0x}t + \cancel{\frac{1}{2}a_x t^2}$

$x = v_0 \cos\theta\, t$

$x = (65.2\cos 34.5)(7.5366)$

$x = 404.9681\ m$

$\boxed{x = 405\ m}$

$\cancel{y} = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$

$0 = v_0 \sin\theta\, t + \frac{1}{2}a_y t^2$

$0 = (65.2\sin 34.5)t + \frac{1}{2}(-9.8)t^2$

$0 = t[65.2\sin 34.5 - 4.9t]$

$t = 0$ or $65.2\sin 34.5 - 4.9t = 0$

$t = \frac{65.2\sin 34.5}{4.9}$

$t = 7.5366\ s$

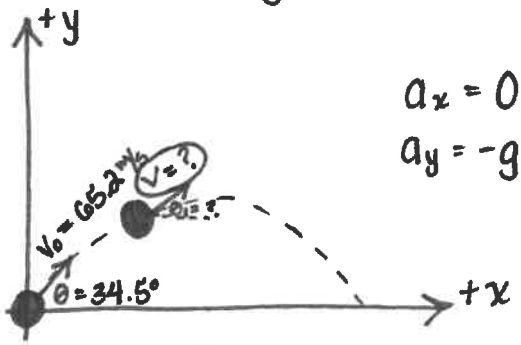
$\boxed{t = 7.54\ s}$

Conclusion:

The projectile was in the air for 7.54 s and traveled a horizontal distance of 405 m.

3-30 - Part D

Given/Want/Figure:



$a_x = 0$

$a_y = -g = -9.8\ m/s^2$

$x_0 = 0$ $\quad x = ?$

$y_0 = 0$ $\quad y = ?$

$t = 1.50\ s$

Calculations:

Eqn for Uniform Acceleration

$V_x = V_{0x} + a_x t$

$V_x = V_0 \cos\theta$

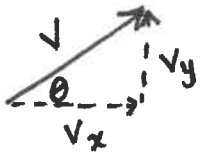
$V_x = 65.2 \cos 34.5$

$V_y = V_{oy} + a_y t$

$V_y = V_0 \sin\theta + a_y t$

$V_y = 65.2 \sin 34.5 - 9.8(1.50)$

$V_y = 65.2 \sin 34.5 - 14.7$



$V_x^2 + V_y^2 = V^2$

$V = \sqrt{(65.2\cos 34.5)^2 + (65.2\sin 34.5 - 14.7)^2}$

$V = 58.1497\ m/s$

$\boxed{V = 58.1\ m/s}$

$\tan\theta_1 = \frac{V_y}{V_x}$

$\theta_1 = \tan^{-1}\left(\frac{V_y}{V_x}\right)$

$\theta_1 = \tan^{-1}\left(\frac{65.2\sin 34.5 - 14.7}{65.2\cos 34.5}\right)$

$\theta_1 = 22.4751°$

$\boxed{\theta_1 = 22.5°}$

Conclusion: The velocity of the projectile 1.50 s after firing is 58.1 m/s, directed at 22.5° above the horizontal.