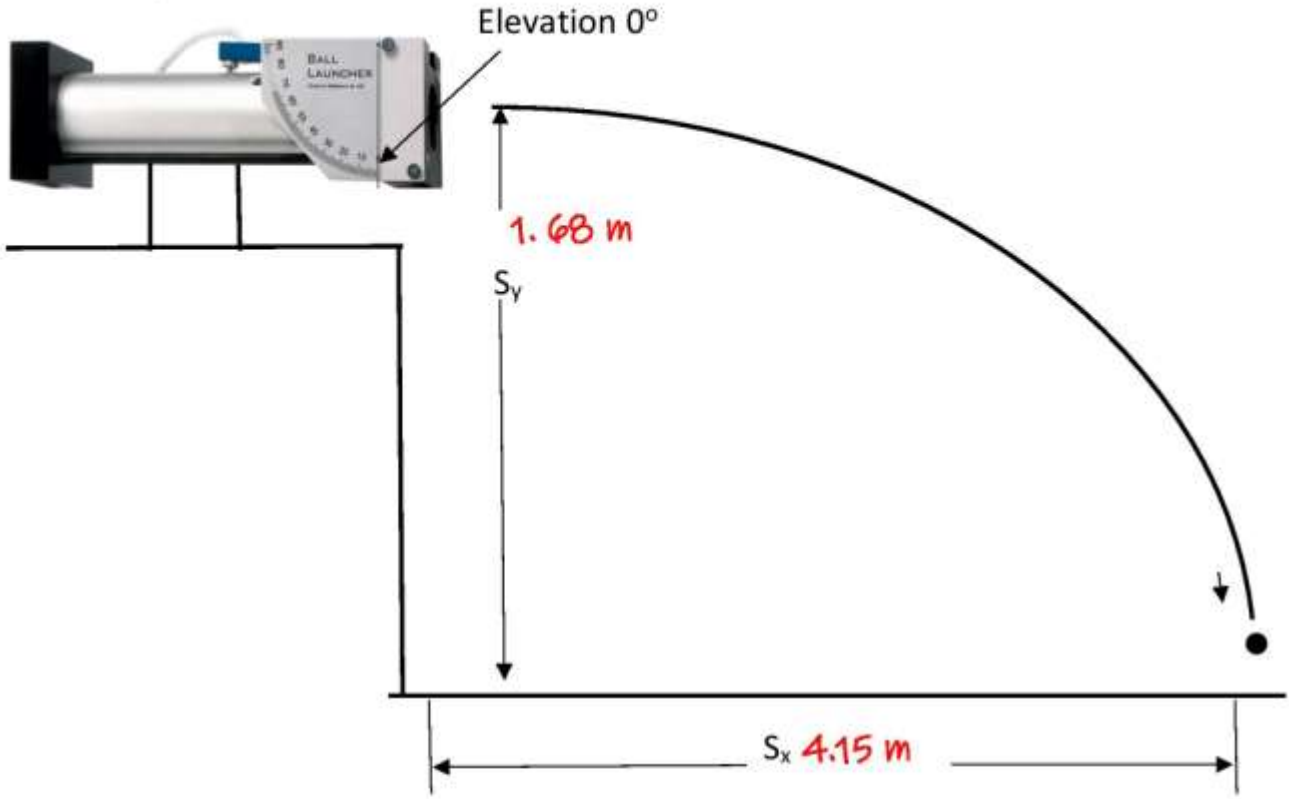
Kinematics Practice Problem 2a Solutions:

Determining Muzzle Velocity



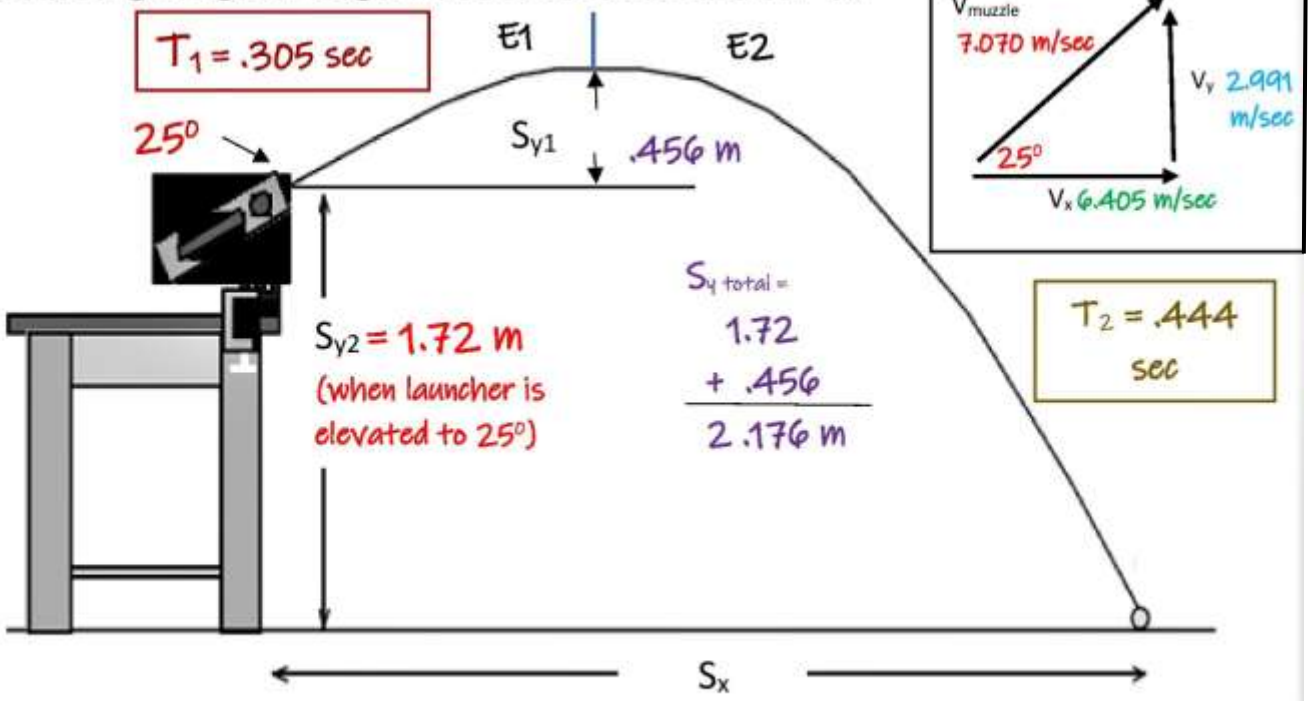
S_y = 1. 68 m (as measured)

S_x = 4.15 m (as measured)

$$t = \sqrt{\frac{S_y}{.5a}} = \sqrt{\frac{1.68}{(.5)(9.8)}} = \sqrt{\frac{1.68}{4.9}} = \sqrt{.343} = .587 \text{ sec}$$

$$V_x = \frac{S_x}{t} = \frac{4.15}{.587} = 7.070 \text{ m/sec} = V_{muzzle}$$

Predicting range of angled shot based on known V_m



OBJECTIVE: Predict S_x given known V_{muzzle}

1. Proposition: $S_x = V_x \times t_{total,} \rightarrow (t_{total} = [(t_1) + (t_2)]$

$(6.405) \times (.305 + .666) = (6.405) \times (.971) =$ **6.219 m**

2. $V_x = (\cos\theta)(H) = (\cos 25)(7.070)$

$= (.906)(7.070) = 6.405$ m/sec

3. $V_y = (\sin\theta)(H) = (\sin 25)(7.070)$

$= (.423)(7.070) = 2.991$ m/sec

4. t_1

$$t_1 = \frac{V_f - V_i}{a} = \frac{0 - 2.991}{a - 9.8} = .305 \text{ sec}$$

5. S_{y1}

$$S_{y1} = \frac{V_f^2 - V_i^2}{2a} = \frac{(0^0) - (2.991^2)}{2(-9.8)}$$

$$= \frac{-8.946}{-19.6} = .456 \text{ m}$$

$S_{y\,total} = S_{y1} + S_{y2}$

$= (.456) + (1.72) =$ **2.176 m**

6. $T_2 = \sqrt{\frac{S_{y\,total}}{.5a}} = \sqrt{\frac{2.176}{.5(9.8)}} = \sqrt{\frac{2.176}{4.9}} = \sqrt{.444} =$ **.666**