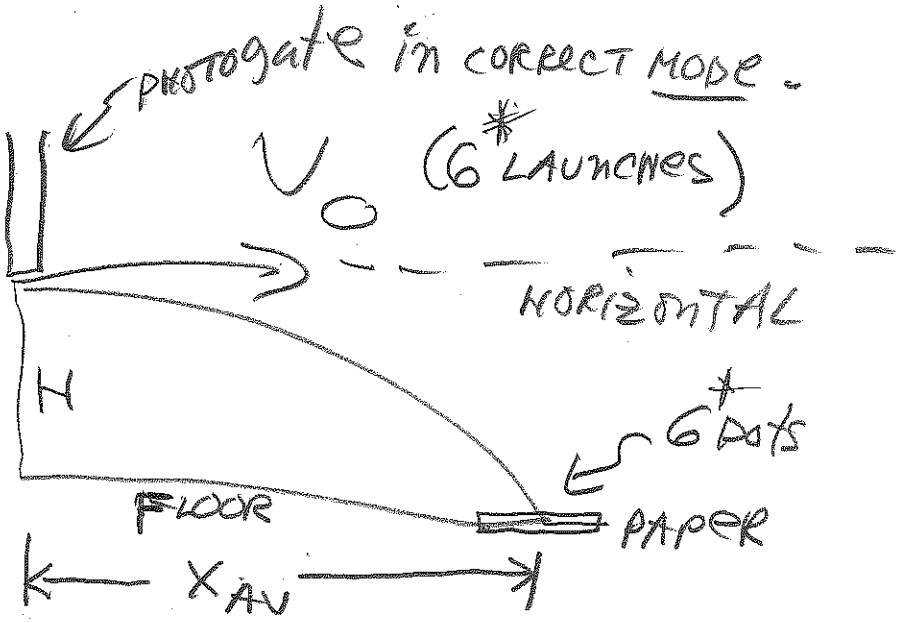
# Lab 3

## Statistics of Projectile Motion




$$V_0 = \frac{x}{t}$$

$$H = \frac{1}{2} g t^2 \Rightarrow t = \sqrt{\frac{2H}{g}}$$

* 6 OR MORE

$$x_{th} = V_0 \cdot t$$

$$= V_0 \sqrt{\frac{2H}{g}}$$

$$\Delta x_{th} \cong \frac{\partial x}{\partial V_0} \cdot \Delta V_0 + \frac{\partial x}{\partial H} \cdot \Delta H$$

$$\frac{\partial x}{\partial V_0} = \sqrt{\frac{2H}{g}} \text{ and } \frac{\partial x}{\partial H} = V_0 \cdot \left[ \sqrt{\frac{2}{g}} \cdot \frac{1}{2} H^{-\frac{1}{2}} \right]$$

$$= V_0 \cdot \sqrt{\frac{1}{2gH}}$$

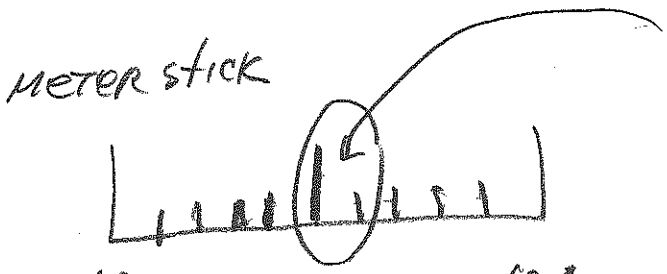
$$\Delta x_{th} \cong \sqrt{\frac{2H}{g}} \cdot \Delta V_0 + V_0 \sqrt{\frac{1}{2gH}} \cdot \Delta H$$

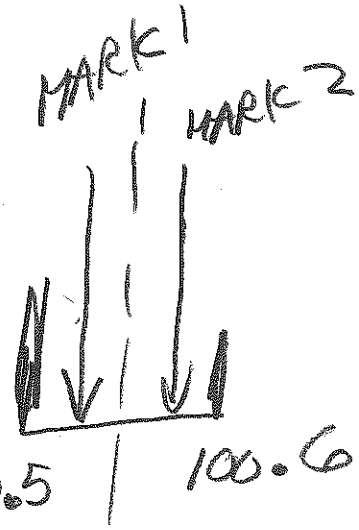
measure $V_0$ 6* times * 6 or more

$$\Delta V_0 = \frac{V_{0MAX} - V_{0MIN}}{2} \text{ or Standard deviation of mean (STDM)}$$

MINIMUM ERROR:

$$\Delta H = \frac{L.C.}{2}$$




L.C. = LEAST COUNT = 0.1 cm = 1 mm = 0.001 m

$$\text{MARK 1} : 100.50 \pm \frac{LC}{2}$$

$$(100.50 \pm 0.05)\ cm$$

$$\text{MARK 2} : (100.60 \pm 0.05)\ cm$$

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NOTE: $X_{EXP} = X_{AV}$ (6 # DOTS)

CHECK

* 6 OR MORE

$$|X_{AV} - X_{TH}| \overset{?}{<} \Delta X_{TH} + \Delta X_{EXP}$$

$$\Delta X_{EXP} = \frac{X_{MAX} - X_{MIN}}{2} \text{ OR STANDARD DEVIATION OF MEAN}$$

[ ..... 6 DOTS ] PAPER ON FLOOR

Note: $\Delta X_{TH}$ via quadrature

$$\Delta X_{TH} = \sqrt{\left(\frac{\partial X}{\partial V_0} \cdot \Delta V_0\right)^2 + \left(\frac{\partial X}{\partial H} \cdot \Delta H\right)^2}$$

see penn state site.