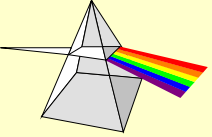
LAB #12

- BALLISTIC PENDULUM

GOALS

- **TO USE A BALLISTIC PENDULUM TO DETERMINE MUZZLE VELOCITY OF A MARBLE LAUNCHER**
- **TO DETERMINE THE KE LOST IN THE COLLISION**
- **TO SIMULATE A BALLISTIC PENDULUM AND COMPARE RESULTS.**



BHS Physics

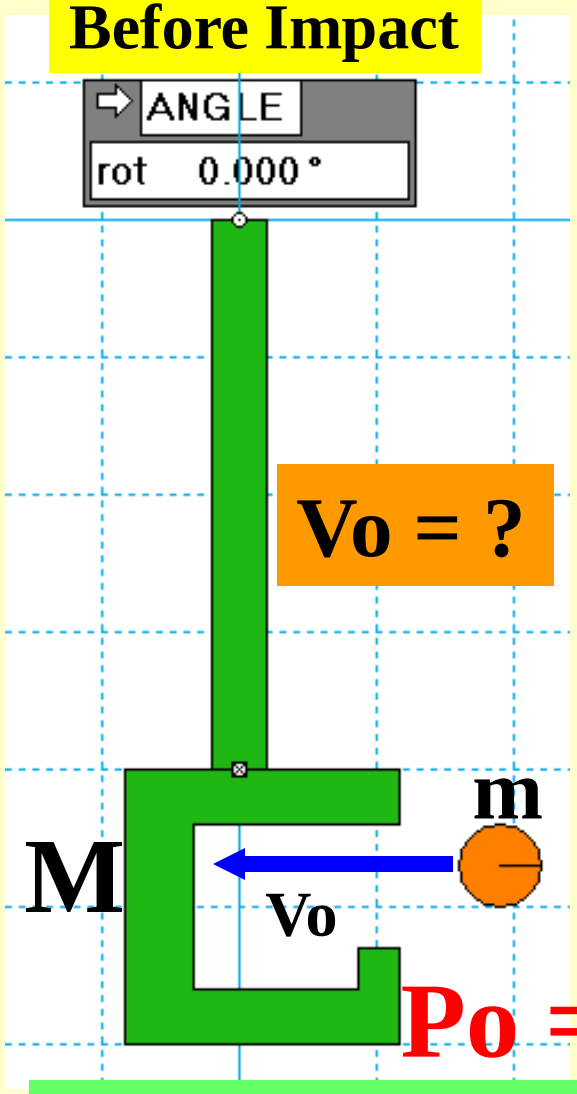
PROCEDURE

- **SHOOT THE PROJECTILE INTO THE BALLISTIC PENDULUM WITH PHOTOGATE TIMER IN PLACE**
- **MEASURE THE MAXIMUM ANGLE OF DEFLECTION OF THE PENDULUM**
- **RECORD PHOTOGATE TIME TO DETERMINE V PHOTO**
- **REPEAT FOR ALL FIVE NOTCHES OF THE LAUNCHER**
- **BUILD AN I.P. BALLISTIC PENDULUM**
- **REPEAT THE EXPERIMENT WITH THE VIRTUAL PENDULUM**
- **COMPARE RESULTS FOR EACH**

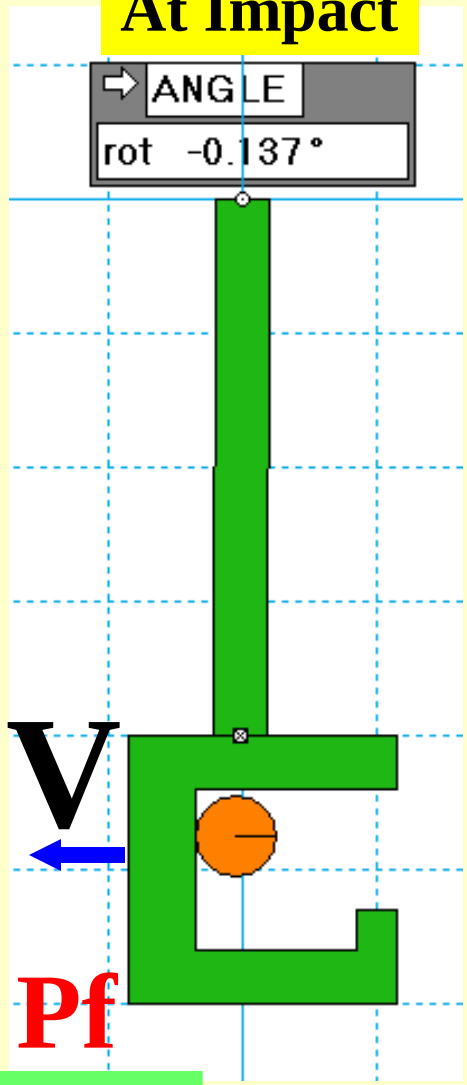
BHS Physics

Ballistic Pendulum

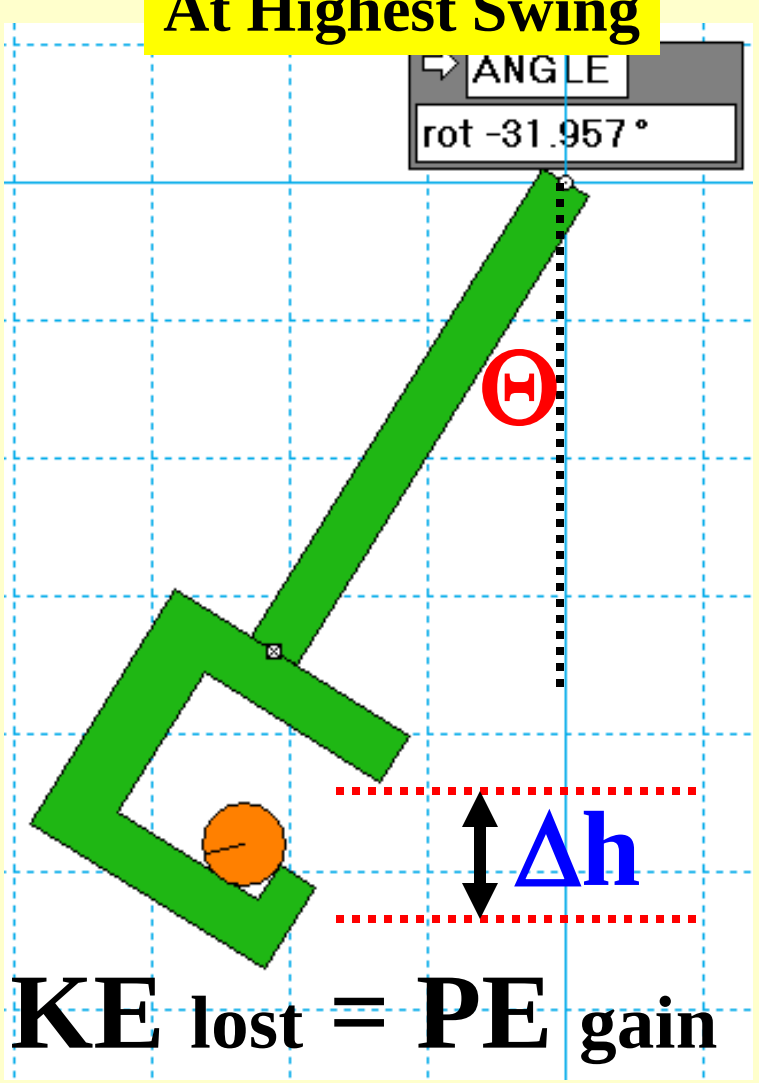
Before Impact



At Impact



At Highest Swing



$$mv_o = (M+m)\,V$$

$$\tfrac{1}{2}(M+m)V^2 = (M+m)\,g\Delta h$$

Ballistic Pendulum Equation

$$mv_o = (M+m)V$$

$$\tfrac{1}{2}(M+m)V^2 = (M+m)g\Delta h$$

$$V^2 = 2g\Delta h$$

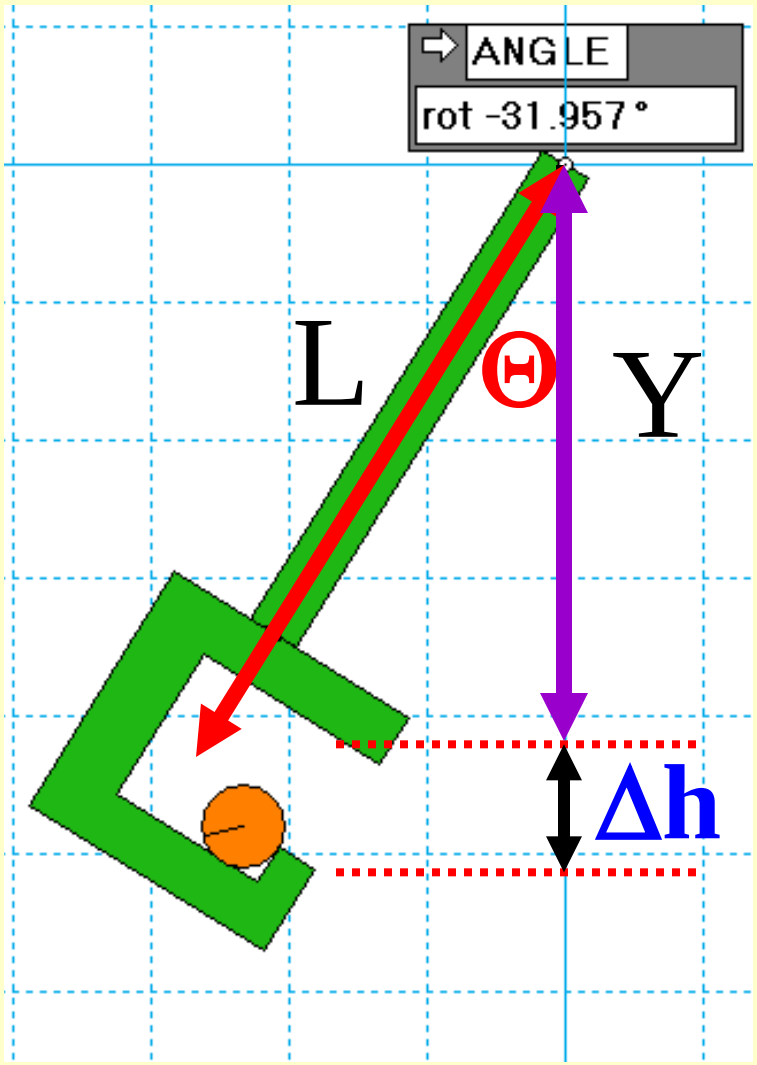
$$v_o = \frac{(M+m)}{m}V$$

$$V = \sqrt{2g\Delta h}$$

$$v_o = \frac{(M+m)}{m}\sqrt{2g\Delta h}$$

Determine Δh from Θ

At Highest Swing



L = length of pend

(pivot to center of bob)

$$\Delta h = L - Y$$

$$Y = L \cos \Theta$$

$$\Delta h = L - L \cos \Theta$$

DATA TABLE 1

SAMPLE DATA TABLE: (REAL BALLISTIC PENDULUM)

CONSTANTS:	M (kg) =	0.077	m (kg) =	0.028	L (m) =	0.65	dia (m) =	0.019	

NOTCH	t(s)	V photo	⊙ MAX	COS ⊙	L COS ⊙	Δh (m)	Vf (m/s)	Pf = Po	Vo (m/s)	Vo dev
1										
2										
3										
4										
5										

DATA TABLE 2

SAMPLE DATA TABLE: (I.P. BALLISTIC PENDULUM)

CONSTANTS: M (kg) = m (kg) = L (m) =

TRIAL	I.P. Vo	⊙ MAX	COS ⊙	L COS ⊙	Δh (m)	Vf	Pf = Po	Vo (m/s)	Vo dev
1									
2									
3									
4									
5									

BHS Physics

K.E. ANALYSIS

SAMPLE DATA TABLE: (REAL BALLISTIC PENDULUM)

CONSTANTS: M (kg) = m (kg) =

TRIAL	KE MARBLE (J)	KE CATCHER (J)	KE LOST (J)	%KE LOST
1				
2				
3				
4				
5				

SAMPLE DATA TABLE: (I.P. BALLISTIC PENDULUM)

CONSTANTS: M (kg) = m (kg) =

TRIAL	KE MARBLE (J)	KE CATCHER (J)	KE LOST (J)	%KE LOST
1				
2				
3				
4				
5				

GRAPH #1: REAL PENDULUM

$$V = \sqrt{2g\Delta h}$$

GRAPH #2: I.P. PENDULUM

$$V = \sqrt{2g\Delta h}$$

WRITE-UP

- SCREEN DUMP OF IP PEND
  - SHOW BALLISTIC PEND EQ PROOF
- DATA TABLES
- GRAPHS
  - TRENDLINES
  - GRAPH ANALYSIS
- CONCLUSION

LAB #12

DATA ANALYSIS

GRAPH #1: REAL PENDULUM

$$v_o = \frac{(M+m)}{m}\sqrt{2g\Delta h}$$