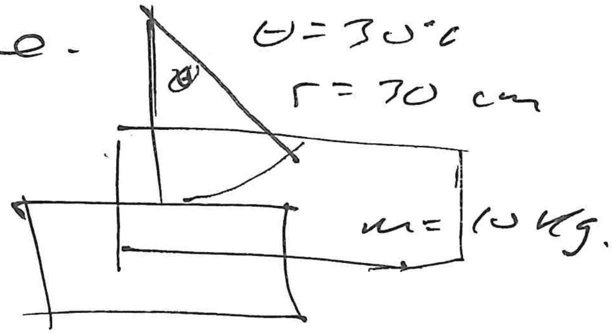
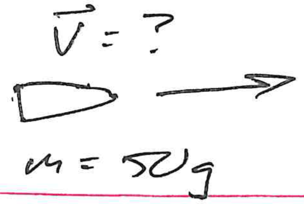
Ballistic Pendulum Problem

A bullet is fired into a ballistic pendulum as shown in the figure.

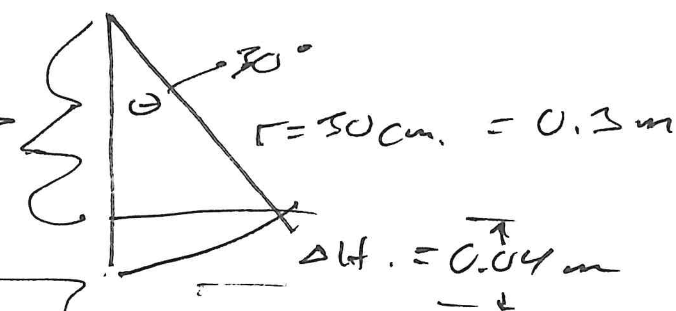




· Determine the velocity of the bullet before impact.

→ Observation: the string holding the block of wood swings through an ~~arc~~ arc of 30°.

① use $(\cos 30°)(30\text{cm}) =$
$= .26$ m.



~~ΔH = ...~~

$\Delta H = r - .26\text{m} = \boxed{0.04\text{m}}$

② $\Delta PE = mg\Delta H$.

note: m = mass of bullet + mass of block
$= 10.05$ kg

so.. $\Delta PE = m \cdot g \cdot \Delta H$

$\Delta PE = (10.05)(9.8)(0.04) = \boxed{3.92 \text{ Joules}}$

(3) note: the $\Delta PE = 3.92$ joules = the kinetic energy the system must have had immediately after impact.

then have: KE (at bottom) = ΔPE at top of arc

So .. $KE = \frac{1}{2}mv^2 = \Delta PE$

$\frac{1}{2}(10.05\,kg)(v^2) = 3.92\,J$

$\therefore v = .883\ m/sec$

★ this is the velocity of the system right after impact!

now we use conservation of momentum to determine velocity of bullet before it struck the block.

$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_f$

bullet ↑ block @ (rest) ↓ bullet in block

$(0.05)(v_1) + (\text{rest}) = (10.05)(.883\ m/sec)$

$\therefore v_1 = 177\ m/sec \approx 370\ mph.$

velocity of bullet before impact!