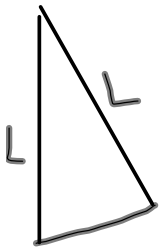

Ballistic Pendulum

Purpose: To calculate the velocity of the dart using Conservation of Momentum and Conservation of Energy.

Pendulum

Dart

Conservation of moment

$m_d v_d + m_p v_p = m_d v_d' + m_p v_p'$

$m_d v_d + m_p v_p = v'(m_d + m_p)$

$m_d v_d = v'(m_d + m_p)$

$v_d = v'(m_d + m_p)$

m_d

conservation of energy

$KE = PE$

$\frac{1}{2}mv^2 = mgh$

$v' = \sqrt{2gh}$

$L^2 = h^2 + x^2 = L^2$

$(L-h)(L-h)$

$L^2 - 2Lh + h^2 + x^2 = L^2$

$h^2 - 2Lh + x^2 = 0$

$h = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$a = 1$

$b = 2L$

$c = x^2$

$h = \frac{2L \pm \sqrt{4L^2 - 4x^2}}{2(1)}$

$h = \frac{2L \pm \sqrt{4L^2 - 4x^2}}{2}$

$h = L - \sqrt{L^2 - x^2}$

$\frac{2L \pm 2\sqrt{L^2 - x^2}}{2}$

$x = 4.5\,cm$

$x = .045\,m$

$L = 76.5\,cm$

$L = .765\,m$

Finish

$m_d = 2g$

$m_p = 104\,g$