SPH4U

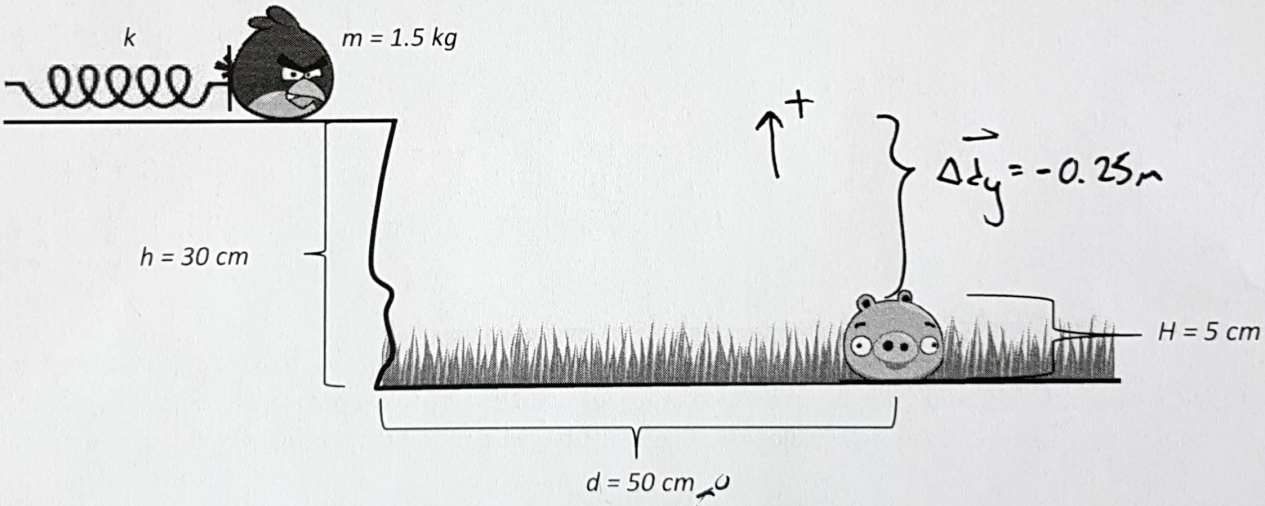
Spring Energy Example Problem

Name: _____ Date: _____

An angry bird is going to launch himself from a compressed, ideal, spring horizontally off of a cliff and directly onto an unsuspecting pig below. Assume a frictionless environment and no air resistance.

a) During calibration of the spring the angry bird performed the following calibration: Angry bird compressed himself by 7 cm and then released himself. He measured his speed at 5 cm/s when the spring had been uncompressed by 6 cm (was still compressed by 1 cm). Calculate the spring constant of the spring.

b) Given the dimensions in the diagram below, *calculate the compression required in the spring so that the angry bird hits the pig in the location indicated* in the diagram.



a) $E_{s1} = E_{s2} + E_K$

$\frac{K\Delta x_1^2}{2} = \frac{K\Delta x_2^2}{2} + \frac{mv^2}{2}$

$\frac{K\Delta x_1^2}{2} - \frac{K\Delta x_2^2}{2} = \frac{mv^2}{2}$

$K(\Delta x_1^2 - \Delta x_2^2) = mv^2$

$K = \frac{mv^2}{(\Delta x_1^2 - \Delta x_2^2)}$

$K = \frac{(1.5)(0.05)^2}{(0.07^2 - 0.01^2)}$

$K = \frac{0.00781}{0.78125}$ N/M

b) $v_{2y}^2 = v_{1y}^2 + 2a\Delta d_y$

$v_{2y} = \pm\sqrt{2a\Delta d_y}$ $v_{2y} = -2.21$ m/s

$\Delta t = \frac{v_{2y} - v_{1y}}{a} = \frac{-2.21 - 0}{-9.8} = 0.2255$ s

$v_x = \frac{\Delta d_x}{\Delta t} = \frac{0.5}{0.2255} = 2.22$ m/s.

all spring converted to E_K.

$E_s = E_K$

$\frac{K\Delta x^2}{2} = \frac{mv^2}{2}$

$\Delta x = \sqrt{\frac{mv^2}{K}} =$ 3.1 m ✓