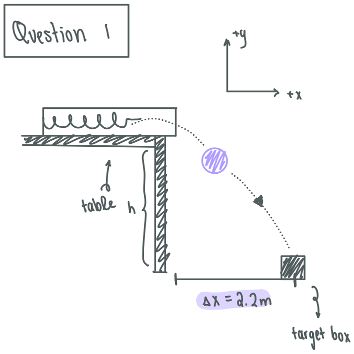
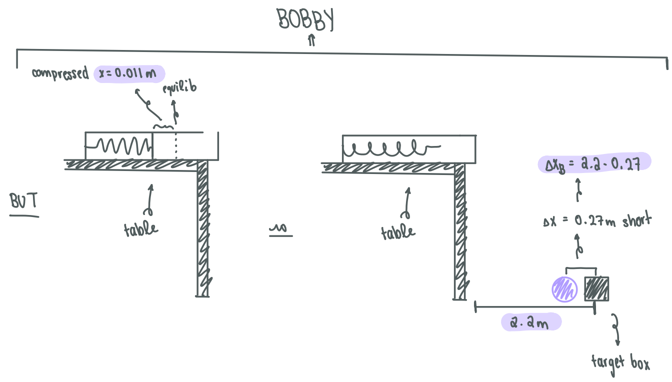
Madeline Price

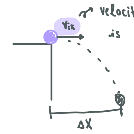
$\boxed{\text{Question 1}}$





→ no outside forces act upon system → : $W_s = E_k$

E_k → kinetic energy when launched →



→ velocity when launched is entirely in x-direction → $v_{iy} = 0$ m/s

→ $W_s = \frac{1}{2}kx^2 = \frac{1}{2}m(v_i)^2$ (x: amt compressed)

$kx^2 = m(v_i)^2$

$v_i = \sqrt{\frac{kx^2}{m}}$

AND horizontal mvmt: $\Delta x = v_{ix}(t)$ (v_{ix}: same as v_i)

$h = v_{iy}t + \frac{1}{2}at^2$ (v_{iy}: 0 m/s; a: g)

$h = \frac{1}{2}gt^2$ → $\sqrt{\frac{2h}{g}} = t$

→ $\Delta x = v_i\sqrt{\frac{2h}{g}}$ → $v_{ix} = \frac{\Delta x}{\sqrt{\frac{2h}{g}}}$

THEN $\sqrt{\frac{kx^2}{m}} = v_i = \frac{\Delta x}{\sqrt{\frac{2h}{g}}}$

→ $\sqrt{\frac{kx^2}{m}} = \frac{\Delta x}{\sqrt{\frac{2h}{g}}}$

$\Delta x = \sqrt{\frac{kx^2}{m}} \cdot \sqrt{\frac{2h}{g}}$

$\Delta x = x\left(\sqrt{\frac{k}{m}} \cdot \sqrt{\frac{2h}{g}}\right)$

horizontal displ. ← $\frac{\Delta x}{x}$ → amount compressed

$\frac{\Delta x}{x} = \underbrace{\sqrt{\frac{k}{m}} \cdot \sqrt{\frac{2h}{g}}}_{\text{all are const.}}$

→ $\frac{\Delta x}{x}$ must also be a constant ratio

→ $\underbrace{\frac{\Delta x_B}{x_B}}_{\text{BOBBY}} = \underbrace{\frac{\Delta x_R}{x_R}}_{\text{RHONDA}}$ where $\Delta x_R = 2.2$m; x_R: what we want to find

→ $x_R = \frac{\Delta x_R \, x_B}{\Delta x_B}$ → $x_R = \frac{(2.2)(0.011)}{(2.2 - 0.27)}$

$x_R = 0.0125$ m

$\boxed{x_R = 1.25 \text{ cm}}$