21-P-WE-AG-035

A block with mass *m*-kg starts from rest and slides down a ramp angled at θ degrees above the horizontal. It hits a $k\ \frac{N}{m}$ spring and compresses it by *X* meters. How far up the slope (from the place where it hits the spring) did the block start out? Neglect friction.

ANSWER:

First, we write down the equation for conservation of energy and solve for the velocity of the block when it contacted the spring.

$$E_1 = E_2$$

$$\frac{1}{2}mv^2 - Fd = \frac{1}{2}ks^2$$

$$mv_f^2 + mg \cdot sin(\theta) = kx^2$$

$$v_f = \sqrt{\frac{kx^2 - mg \cdot sin(\theta)}{m}}$$

Then, we use the kinematics formulas to figure out how far away the block started.

$$v_f^2 = v_i^2 + 2ad$$

$$d = \frac{v_f^2 - v_i^2}{2a} = \frac{kx^2 - mg \cdot sin(\theta)}{m \cdot 2 \cdot 9.81\frac{m}{s^2} \cdot sin(\theta)}$$