21-P-MOM-AG-044

A block of mass m kg is travelling at $V \frac{m}{s}$, θ degrees from the x-direction. The block goes down a smooth slope. If the angle from the x-direction increases by X degrees, how high was the slope?

ANSWER:

First, we must determine the final velocity of the block by using the principle of impulse and momentum for this system.

$$mv_1 \sin(\theta_1) = mv_2 \sin(\theta_2)$$

$$v_2 = \frac{v_1 \sin(\theta_1)}{\sin(\theta_2)} = \frac{V \sin(\theta)}{\sin(\theta + X)}$$

Then, since there's no added impulse, we use the equation for conservation of energy to find the height of the slope.

$$T_1 + V_1 = T_2 + V_2$$

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2$$

$$gh + \frac{1}{2}V^2 = \frac{1}{2}v_2^2$$

$$h = \frac{v_2^2 - V^2}{2g}$$