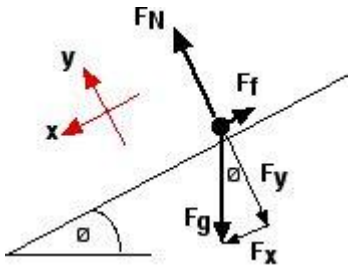
Answer on Question #63310, Physics / Mechanics | Relativity

A block of mass 20.0 kg slides from rest down a slope 2.00 meters long which is inclined at 37.6° to the horizontal. The coefficient of kinetic friction is 0.343. What is the speed of the block at the bottom of the slope?

Select one:
a. 4.33 m/sec
b. 5.57 m/sec
c. 2.86 m/sec
d. 3.14 m/sec
e. 3.64 m/sec

Solution:



F_x and F_y are components of weight, F_g; F_N is normal force; F_f is friction

$$ma = mgsin\theta - \mu mg\cos\theta$$

$$a = g(sin\theta - \mu\cos\theta) = 9.81 \cdot (sin37.6° - 0.343 \cdot \cos 37.6°) = 3.32\ \text{m/s}^2$$

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

$$v_f^2 = 0 + 2 \cdot 3.32 \cdot 2.00 = 13.28$$

$$v_f = \sqrt{13.28} = 3.64\ \text{m/s}$$

Answer: e. 3.64 m/sec