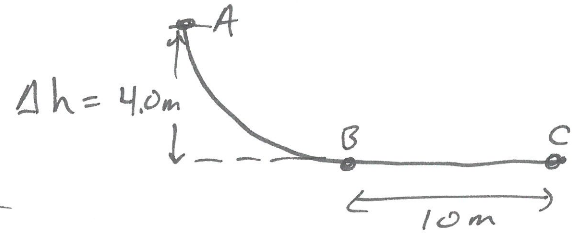
Chapter 7 Problem 62

$m = 200g = 0.20\ kg$

$v_A = 0\ m/s$

$v_B = 8.0\ m/s$

$\Delta x = 10\ m$



a) what is the work of friction on the curved surface

By the work-energy theorem

$$W_{total} = \Delta K = \tfrac{1}{2} m v_B^2 - \tfrac{1}{2} m v_A^2$$

$$W_{total} = W_{gravity} + W_{friction} = mg\Delta h + W_{friction}$$

Then $\tfrac{1}{2} m v_B^2 - \tfrac{1}{2} m v_A^2 = mg\Delta h + W_{friction}$

$v_A = 0 \longrightarrow \tfrac{1}{2} m v_B^2 = mg\Delta h + W_{friction}$

$\therefore W_{friction} = \tfrac{1}{2} m v_B^2 - mg\Delta h = \tfrac{1}{2}(0.20\ kg)(8\ m/s)^2$ ~~$(0.20\ kg)(9.8\ m/s^2)$~~ $- (0.20\ kg)(9.8\ m/s^2)(4.0\ m)$

$= $ ~~1.6 J~~ 6.4 $- 7.84\ J$

$W_{friction} = $ ~~$-6.24\ J$~~ $-1.44\ J$

b) What is the coefficient of friction along the horizontal surface?

Since the surface is horizontal, ~~So~~ the normal force equals the weight of the block.

The work by friction is then

$$W_{friction,\ B-C} = -F_f \Delta x = -\mu N \Delta x = -\mu mg\Delta x$$

Since this is the only work taking place between B + C, then

$$-\mu mg\Delta x = W_{total} = \Delta K = \tfrac{1}{2} m v_c^2 - \tfrac{1}{2} m v_B^2$$

$$-\mu mg\Delta x = \tfrac{1}{2} m v_c^2 - \tfrac{1}{2} m v_B^2$$

$v_c = 0\ m/s \therefore -\mu mg\Delta x = -\tfrac{1}{2} m v_B^2$

solving for μ gives

$$\mu = \frac{\tfrac{1}{2} m v_B^2}{mg\Delta x} = \frac{v_B^2}{2g\Delta x} = \frac{(8.0\ m/s)^2}{2(9.8\ m/s^2)(10\ m)}$$

$$\mu = \frac{64\ m^2/s^2}{196\ m^2/s^2} = \boxed{0.33}$$