

**Problem**

A 0.550-kg glass of water is slid on a horizontal surface. The initial speed is 0.958 m/s. If the glass comes to rest with a constant acceleration of  $0.640 \text{ m/s}^2$ , what is the coefficient of kinetic friction between the glass and the table?

**Solution**

The free body diagram shows:

The net force on the  $x$ -axis is

$$\sum F_x = -f_k = ma \quad (1)$$

The net force on the  $y$ -axis is

$$\sum F_y = n - mg = 0 \quad (2)$$

The force of kinetic friction is expressed as

$$f_k = \mu_k n \quad (3)$$

Therefore we have two equations from (1), (2), and (3):

$$\begin{cases} -\mu_k n = ma \\ n = mg \end{cases} \quad (4)$$

Eliminate  $n$  to substitute.

$$-\mu_k mg = ma \quad (5)$$

Solve for the coefficient of kinetic friction.

$$\mu_k = -\frac{a}{g} \quad (6)$$

Since the object is decelerated,  $a$  is  $-0.640 \text{ m/s}^2$ . Thus, it will be calculated as

$$\mu_k = -\frac{-0.640 \text{ m/s}^2}{9.80 \text{ m/s}^2} = 0.0653$$

Note that the coefficient does not have units.

