SAMPLE PROBLEM D

Coefficients of Friction

PROBLEM

A 24 kg crate initially at rest on a horizontal floor requires a 75 N horizontal force to set it in motion. Find the coefficient of static friction between the crate and the floor.

SOLUTION

Given: $F_{s,max} = F_{applied} = 75\ \text{N} \quad m = 24\ \text{kg}$

Unknown: $\mu_s = ?$

Use the equation for the coefficient of static friction.

$$\mu_s = \frac{F_{s,max}}{F_n} = \frac{F_{s,max}}{mg}$$

$$\mu_s = \frac{75\ \text{N}}{24\ \text{kg} \times 9.81\ \text{m/s}^2}$$

$$\boxed{\mu_s = 0.32}$$

TIP *Because the crate is on a horizontal surface, the magnitude of the normal force (F_n) equals the crate's weight (mg).*

PRACTICE D

Coefficients of Friction

1. Once the crate in Sample Problem D is in motion, a horizontal force of 53 N keeps the crate moving with a constant velocity. Find μ_k, the coefficient of kinetic friction, between the crate and the floor.
2. A 25 kg chair initially at rest on a horizontal floor requires a 165 N horizontal force to set it in motion. Once the chair is in motion, a 127 N horizontal force keeps it moving at a constant velocity.
   a. Find the coefficient of static friction between the chair and the floor.
   b. Find the coefficient of kinetic friction between the chair and the floor.
3. A museum curator moves artifacts into place on various different display surfaces. Use the values in **Table 2** to find $F_{s,max}$ and F_k for the following situations:
   a. moving a 145 kg aluminum sculpture across a horizontal steel platform
   b. pulling a 15 kg steel sword across a horizontal steel shield
   c. pushing a 250 kg wood bed on a horizontal wood floor
   d. sliding a 0.55 kg glass amulet on a horizontal glass display case