Figure 13
The power of each of these bulbs tells you the rate at which energy is converted by the bulb. The bulbs in this photo have power ratings that range from 0.7 W to 200 W.

POWER (ALTERNATIVE FORM)

$$P = Fv$$

power = force × speed

The SI unit of power is the *watt*, W, which is defined to be one joule per second. The *horsepower*, hp, is another unit of power that is sometimes used. One horsepower is equal to 746 watts.

The watt is perhaps most familiar to you from your everyday experience with light bulbs (see **Figure 13**). A dim light bulb uses about 40 W of power, while a bright bulb can use up to 500 W. Decorative lights use about 0.7 W each for indoor lights and 7.0 W each for outdoor lights.

In Sample Problem F, the three motors would lift the curtain at different rates because the power output for each motor is different. So each motor would do work on the curtain at different rates and would thus transfer energy to the curtain at different rates.

SAMPLE PROBLEM F

Power

PROBLEM

A 193 kg curtain needs to be raised 7.5 m, at constant speed, in as close to 5.0 s as possible. The power ratings for three motors are listed as 1.0 kW, 3.5 kW, and 5.5 kW. Which motor is best for the job?

SOLUTION

Given: $m = 193\ \text{kg} \quad \Delta t = 5.0\ \text{s} \quad d = 7.5\ \text{m}$

Unknown: $P = ?$

Use the definition of power. Substitute the equation for work.

$$P = \frac{W}{\Delta t} = \frac{Fd}{\Delta t} = \frac{mgd}{\Delta t}$$

$$= \frac{(193\ \text{kg})(9.81\ \text{m/s}^2)(7.5\ \text{m})}{5.0\ \text{s}}$$

$$P = 2.8 \times 10^3\ \text{W} = 2.8\ \text{kW}$$

The best motor to use is the 3.5 kW motor. The 1.0 kW motor will not lift the curtain fast enough, and the 5.5 kW motor will lift the curtain too fast.