32. When a driver brakes an automobile, friction between the brake disks and the brake pads converts part of the car's translational kinetic energy to internal energy. If a 1500 kg automobile traveling at 32 m/s comes to a halt after its brakes are applied, how much can the temperature rise in each of the four 3.5 kg steel brake disks? Assume the disks are made of iron (c_p = 448 J/kg•°C) and that all of the kinetic energy is distributed in equal parts to the internal energy of the brakes.

MIXED REVIEW

33. Absolute zero on a temperature scale called the *Rankine* scale is T_R = 0°R, and the scale's unit is the same size as the Fahrenheit degree.

- **a.** Write a formula that relates the Rankine scale to the Fahrenheit scale.
- **b.** Write a formula that relates the Rankine scale to the Kelvin scale.

34. A 3.0 kg rock is initially at rest at the top of a cliff. Assuming the rock falls into the sea at the foot of the cliff and that its kinetic energy is transferred entirely to the water, how high is the cliff if the temperature of 1.0 kg of water is raised 0.10°C? (Neglect the heat capacity of the rock.)

35. The freezing and boiling points of water on the imaginary "Too Hot" temperature scale are selected to be exactly 50 and 200 degrees TH.

- **a.** Derive an equation relating the Too Hot scale to the Celsius scale. (Hint: Make a graph of one temperature scale versus the other, and solve for the equation of the line.)
- **b.** Calculate absolute zero in degrees TH.

36. A hot-water heater is operated by solar power. If the solar collector has an area of 6.0 m^2 and the power delivered by sunlight is 550 W/m^2, how long will it take to increase the temperature of 1.0 m^3 of water from 21°C to 61°C?

Graphing Calculator Practice

Specific Heat Capacity

Specific heat capacity (c_p), as you learned earlier in this chapter, is equal to the amount of energy required to change the temperature of 1 kg of a substance by 1°C. This relationship is expressed by the following equation:

$$\Delta T = \frac{Q}{mc_p}$$

In this equation, ΔT is the change in temperature, Q is the amount of energy absorbed by the substance as heat, c_p is the specific heat capacity of the substance, and m is the mass of the substance.

This equation can be represented on a graphing calculator as follows:

$$Y_1 = T + (X/(MC))$$

A graph of this equation will illustrate the relationship between energy absorbed as heat and temperature.

In this graphing calculator activity, you will enter various values for the energy absorbed and will determine the resulting temperature. Then, you can explore how changing the specific heat capacity, mass, and initial temperature changes your results.

Visit go.hrw.com and type in the keyword **HF6HATX** to find this graphing calculator activity. Refer to **Appendix B** for instructions on downloading the program for this activity.