FIGURE 1 The direction of energy transfer is determined by the temperature differences between the objects within a system. The energy is transferred as heat from the hotter brass bar to the cooler water. This energy transfer will continue until the bar and the water reach the same temperature.

Heat *can be thought of as the energy transferred between samples of matter because of a difference in their temperatures*. Energy transferred as heat always moves spontaneously from matter at a higher temperature to matter at a lower temperature, as shown in **Figure 1.** The temperature of the cool water in the beaker increases as energy flows into it. Likewise, the temperature of the hot brass bar decreases as energy flows away from it. When the temperature of the water equals the temperature of the brass bar, energy is no longer transferred as heat within the system.

Specific Heat

The quantity of energy transferred as heat during a temperature change depends on the nature of the material changing temperature, the mass of the material changing temperature, and the size of the temperature change. One gram of iron heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions. The difference depends on the metals' differing capacities for absorbing this energy. A quantity called specific heat can be used to compare heat absorption capacities for different materials. **Specific heat** *is the amount of energy required to raise the temperature of one gram of a substance by one Celsius degree (1°C) or one kelvin (1 K)*(because the sizes of the degree divisions on both scales are equal). Values of specific heat can be given in units of joules per gram per Celsius degree, J/(g•°C), joules per gram per kelvin, J/(g•K), or calories per gram per Celsius degree, cal/(g•°C). **Table 1** gives the specific heats of some common substances. Notice the extremely high specific heat of water, one of the highest of most common substances.

Specific heat is usually measured under constant pressure conditions, so its symbol, c_p, contains a subscripted p as a reminder to the reader.