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Topic: Specific Heat Capacity
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Table 4 Specific Heat Capacities

Substance	c_p (J/kg•°C)	Substance	c_p (J/kg•°C)
aluminum	8.99×10^2	lead	1.28×10^2
copper	3.87×10^2	mercury	1.38×10^2
glass	8.37×10^2	silver	2.34×10^2
gold	1.29×10^2	steam	2.01×10^3
ice	2.09×10^3	water	4.186×10^3
iron	4.48×10^2		

transferred from the substance. **Table 4** lists specific heat capacities that have been determined for several substances.

Calorimetry is used to determine specific heat capacity

calorimetry
an experimental procedure used to measure the energy transferred from one substance to another as heat

To measure the specific heat capacity of a substance, it is necessary to measure mass, temperature change, and energy transferred as heat. Mass and temperature change are directly measurable, but the direct measurement of heat is difficult. However, the specific heat capacity of water (4.186 kJ/kg•°C) is well known, so the energy transferred as heat between an object of unknown specific heat capacity and a known quantity of water can be measured.

If a hot substance is placed in an insulated container of cool water, energy conservation requires that the energy the substance gives up must equal the energy absorbed by the water. Although some energy is transferred to the surrounding container, this effect is small and will be ignored in this discussion. Energy conservation can be used to calculate the specific heat capacity, $c_{p,x}$, of the substance (indicated by the subscript x), as follows:

$$\text{energy absorbed by water} = \text{energy released by the substance}$$

$$Q_w = -Q_x$$

$$c_{p,w} m_w \Delta T_w = -c_{p,x} m_x \Delta T_x$$

For simplicity, a subscript w will always stand for "water" in problems involving specific heat capacities. As discussed earlier, the energy gained by a substance is expressed as a positive quantity, and the energy released is expressed as a negative quantity. The first equation above can be rewritten as $Q_w + Q_x = 0$, which shows that the net change in energy transferred as heat equals zero. Note that ΔT equals the final temperature minus the initial temperature.

This approach to determining a substance's specific heat capacity is called **calorimetry,** and devices that are used for making this measurement are called *calorimeters.* A calorimeter also contains both a thermometer to measure the final temperature of substances at thermal equilibrium and a stirrer to ensure the uniform mixture of energy throughout the water. See **Figure 13.**

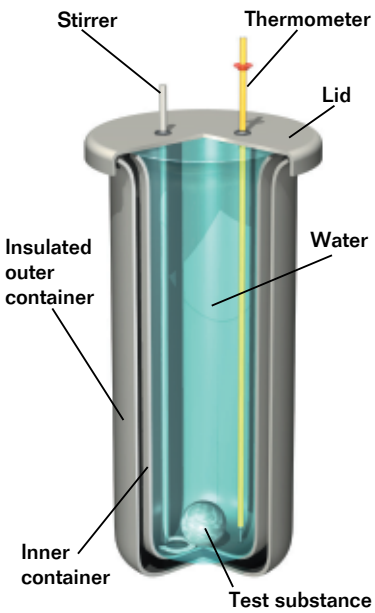

Figure 13
A simple calorimeter allows the specific heat capacity of a substance to be determined.