

CALORIMETRY

Name _____

Section _____

1. Define each of the quantities in the equation

$$q = m \cdot C_s \cdot \Delta T$$

q is the symbol for heat;

m is the symbol for mass;

C_s is the symbol for specific heat;

ΔT is the symbol for change in temperature;

2. What is the unit on each quantity?

q _____joules_____

m _____ grams _____

ΔT _____ °C _____

- 3a. Rearrange the equation given in Question 1 and solve for C_s .

$$q = m \cdot C_s \cdot \Delta T$$

$$C_s = \frac{q}{m \cdot \Delta T}$$

- b) What are the units for C_s ?

$$\text{Units on } C_s \text{ are } \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$$

4. A 175 g sample of water, initially at 23.45 °C absorbs some heat. The final temperature of the sample after absorbing the heat is 26.85 °C. Calculate the amount of heat absorbed by the sample of water. (NOTE: The specific heat for water is 4.184 J g⁻¹ °C⁻¹.)

$$\begin{aligned} q &= m \cdot C_s \cdot \Delta T \\ &= (175 \text{ g})(4.184 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}})(26.85 ^\circ\text{C} - 23.45 ^\circ\text{C}) \\ &= 2.49 \times 10^3 \text{ J or } 2.49 \text{ kJ} \end{aligned}$$

5. A piece of iron weighing 80.0 g initially at a temperature of 92.6 °C released the same amount of heat to the 175 g sample of water in DCI17.4. Assume the final temperature of the metal is the same as the final temperature of the water in DCI17.4. What is the specific heat for iron?

$$C_s = \frac{q}{m \cdot \Delta T}$$

$$C_s = \frac{2.49 \times 10^3 \text{ J}}{80.0 \text{ g} \cdot (92.6 - 26.85)} = 0.473 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$$

6. The four pictures shown below summarize an experiment. A zinc cylinder of mass 57.968 g was placed in boiling water at 100 °C then plunged into a beaker containing 169.340 g of water at 24.64 °C. The temperature of the water and zinc cylinder finally levels off at 26.91 °C. Calculate the specific heat of zinc metal.

$$q_{\text{lost by metal}} = -q_{\text{gain by H}_2\text{O}}$$

$$q = m \cdot C_s \cdot \Delta T$$

$$(m \cdot C_s \text{ metal} \cdot \Delta T)_{\text{metal}} = -(m \cdot C_s \cdot \Delta T)_{\text{H}_2\text{O}}$$

$$(57.968 \text{ g} \cdot C_s \text{ metal} \cdot (26.91 ^\circ\text{C} - 100.0 ^\circ\text{C})) = -(169.340 \text{ g} \cdot \left(4.184 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}\right) \cdot (26.91 - 24.64))_{\text{H}_2\text{O}}$$

$$(-4.24 \times 10^3 \text{ g} \cdot ^\circ\text{C} \cdot \text{SH}_{\text{metal}}) = -1.61 \times 10^3 \text{ J}$$

$$C_s \text{ metal} = 0.380 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$$

