

$$q = m C \Delta T$$

heat mass specific heat

$\Delta T = T_f - T_i$

A review

1. 100. g of H_2O at $37.00^\circ C$ is cooled until it reaches $4.00^\circ C$. The heat capacity is $4.184 J/g^\circ C$. Calculate the heat involved. Is the process endothermic or exothermic?

$$q = m C \Delta T$$

$$q = ?$$

$$\begin{aligned} m &= 100. g \\ C &= 4.184 J/g^\circ C \\ \Delta T &= 4.00^\circ C \\ &\quad - 37.00^\circ C \\ &= -33.00^\circ C \end{aligned}$$

$$q = (100. g)(4.184 J/g^\circ C)(-33.00^\circ C)$$

$$q = -13807.2 J = (-13800 J)$$

2. A 50.00 g piece of glass (heat capacity is $.50 J/g^\circ C$) absorbs $5275 J$ of heat.

(A) Find ΔT (B) If T_i is $20.0^\circ C$, what is T_f ?

$$q = m C \Delta T$$

$$\begin{aligned} q &= 5275 J \\ m &= 50.00 g \\ C &= .50 J/g^\circ C \\ \Delta T &=? \end{aligned}$$

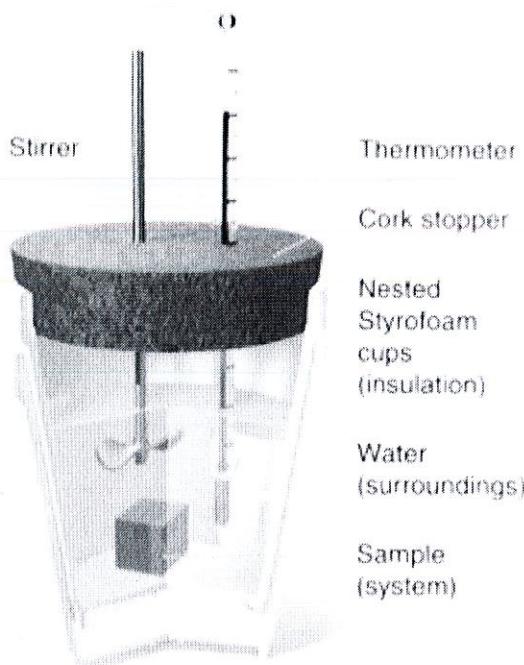
$$\begin{aligned} 5275 J &= (50.00 g)(.50 J/g^\circ C) \Delta T \\ \frac{5275 J}{25 J^\circ C} &= (\cancel{25 J^\circ C}) \Delta T \\ &= 211^\circ C \end{aligned}$$

(A) $\begin{cases} 211^\circ C = \Delta T \\ 210^\circ C = \Delta T \end{cases}$

(B) $T_i = 20.0^\circ C$ $\Delta T = T_f - T_i$

$$\begin{aligned} 210^\circ C &= T_f - 20.0^\circ C \\ + 20.0^\circ C &+ 20.0^\circ C \\ \{ 230^\circ C &= T_f \end{aligned}$$

Coffee-cup calorimeter.



This device measures the heat transferred at constant pressure (q_p).

$$-q_{\text{block}} = q_{\text{H}_2\text{O}}$$
$$q = mC\Delta T \quad q = mC\Delta T$$

Ex(1) A coffee-cup calorimeter contains $150. \text{ g}$ of H_2O at 24.6°C . A $110. \text{ g}$ block of molybdenum is heated to $100.^\circ\text{C}$ and placed in the calorimeter. The H_2O & Mo are allowed to reach thermal equilibrium at 28.0°C . $T_f = T_p$ $C_{\text{H}_2\text{O}} = 4.184 \text{ J/g}^\circ\text{C}$

(A) How much heat is absorbed by the H_2O ?

(B) How much heat is released by the Mo?

(C) Calculate the specific heat capacity of Mo?



$$\text{H}_2\text{O} - 150. \text{ g} \quad (\text{A}) \quad Q_{\text{H}_2\text{O}} = m_{\text{H}_2\text{O}} C_{\text{H}_2\text{O}} \Delta T_{\text{H}_2\text{O}}$$

$$\text{Mo} - 110. \text{ g}$$

$$Q_{\text{H}_2\text{O}} = ?$$

$$m_{\text{H}_2\text{O}} = 150. \text{ g}$$

$$C_{\text{H}_2\text{O}} = 4.184 \text{ J/g}^\circ\text{C}$$

$$\begin{array}{r} \Delta T_{\text{H}_2\text{O}} = 28.0^\circ\text{C} \\ - 24.6^\circ\text{C} \\ \hline 3.4^\circ\text{C} \end{array}$$

$$Q_{\text{H}_2\text{O}} = (150. \text{ g})(4.184 \text{ J/g}^\circ\text{C})(3.4^\circ\text{C})$$

$$Q_{\text{H}_2\text{O}} = 2133.84 \text{ J}$$

$$\{ Q_{\text{H}_2\text{O}} = 2100 \text{ J}$$

$$(\text{B}) \quad Q_{\text{Mo}} = -Q_{\text{H}_2\text{O}}$$

$$\{ Q_{\text{Mo}} = -2100 \text{ J}$$

(c)

$$Q_{\text{Mo}} = -2100 \text{ J}$$

$$Q_{\text{Mo}} = m_{\text{Mo}} C_{\text{Mo}} \Delta T_{\text{Mo}}$$

$$m_{\text{Mo}} = 110. \text{ g}$$

$$C_{\text{Mo}} = ?$$

$$\begin{array}{r} \Delta T_{\text{Mo}} = 28.0^\circ\text{C} \\ - 100.^\circ\text{C} \\ \hline - 72^\circ\text{C} \end{array}$$

$$-2100 \text{ J} = (110. \text{ g}) C_{\text{Mo}} (-72^\circ\text{C})$$

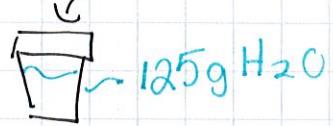
$$\begin{array}{r} -2100 \text{ J} = (-7920 \text{ g}^\circ\text{C}) C_{\text{Mo}} \\ \hline -7920 \text{ g}^\circ\text{C} \end{array}$$

$$\{ .27 \text{ J/g}^\circ\text{C} = C_{\text{Mo}}$$

2. A coffee cup calorimeter contains 125 g of H₂O at 24.2 °C. 10.5 g KBr is dissolved and the final temperature is 21.1 °C.

(a) Calculate the ~~heat~~ of the resulting solution, assuming $C = 4.184 \text{ J/g}^\circ\text{C}$. 10.5 g KBr

$$q = mC\Delta T$$



$$q = ?$$

$$m_{\text{solution}} = 125 \text{ g} + 10.5 \text{ g} = 135.5 \text{ g}$$

$$C = 4.184 \text{ J/g}^\circ\text{C}$$

$$\Delta T = 21.1^\circ\text{C}$$

$$- 24.2^\circ\text{C}$$

$$= -3.1^\circ\text{C}$$

$$q = (135.5 \text{ g})(4.184 \text{ J/g}^\circ\text{C})(-3.1^\circ\text{C})$$

$$q = -1757.4892 \text{ J}$$

$$\begin{cases} q = -1757.4892 \text{ J} \\ q = -1800 \text{ J} \end{cases}$$