Specific Heat Capacity Problems

$Q = mc\Delta T$

1. How much heat is required to raise the temperature of 8.0 g of water by 3.0 °C ?

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T = 3^\circ C$ $m = 8.0\,g$ $c = 4.184\ \frac{J}{g^\circ C}$	$Q = m \cdot c \cdot \Delta T$	$Q = 8\,g \times 3^\circ C \times 4.184\ \frac{J}{g^\circ C}$ $= 100.42\ J$

2. How many joules of heat are removed from a 21.0 g sample of water if it is cooled from 34.0 °C to 28.0 °C?

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T = 6^\circ C$ $m = 21.0\,g$ $c = 4.184\ \frac{J}{g^\circ C}$	$Q = m \cdot c \cdot \Delta T$	$Q = 21\,g \times 6^\circ C \times 4.184\ \frac{J}{g^\circ C}$ $= 527.2\ J$

3. 30.0 grams of Aluminum at 80.0 °C is added to 30.0 g of water at 10 °C. Predict the final temperature of the water and explain your reasoning.

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T_w = x - 10$ $m_w = 30\,g$ $c_w = 4.184\ J/g^\circ C$ $\Delta T_{Al} = x - 80$ $m_{Al} = 30\,g$ $C_{Al} = 0.89\ J/g^\circ C$	$Q_w = m_w \cdot C_w \cdot \Delta T_w$ $Q_{Al} = m_{Al} \cdot C_{Al} \cdot \Delta T_{Al}$ $Q_w = -Q_{Al}$	$30g \times 4.184\ \frac{J}{g^\circ C} \times (x-10)^\circ C = -(30g \times 0.89\ \frac{J}{g^\circ C} \times (x-80)^\circ C)$ $4.184x - 41.84 = -0.89x + 71.2$ $x = 22.3^\circ C$

4. The specific heat of silver is 0.24 J/g°C. If 15.4 g of silver absorbs 332 J heat, how much will the temperature of the silver increase?

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T = x$ $m = 15.4\,g$ $c = 0.24 \frac{J}{g \cdot C}$ $Q = 332\,J$	$Q = m \cdot c \cdot \Delta T$	$332\,J = 15.4\,g \times 0.24 \frac{J}{g \cdot C} \times \Delta T$ $\Delta T = 89.82^{\circ}C$

5. If 135.7 J of heat are added to 54.0 g of water initially at 25.0 °C . What is the final temperature of the water?

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T = (x - 25)$ $m = 54\,g$ $c = 4.184 \frac{J}{g \cdot C}$ $Q = 135.7\,J$	$Q = m \cdot c \cdot \Delta T$	$135.7\,J = 54\,g \cdot 4.184 \frac{J}{g \cdot C} (x - 25)$ $x = 25.6^{\circ}C$

6. How much heat is absorbed by a 112.5 g sample of water when it is heated from 12.5 °C to 92.1 °C?

A. List data	B. Write Equation	C. Solution – show work including units!
$\Delta T = 79.6^{\circ}C$ $m = 112.5\,g$ $c = 4.184 \frac{J}{g \cdot C}$	$Q = m \cdot c \cdot \Delta T$	$Q = 112.5\,g \cdot 4.184 \frac{J}{g \cdot C} \times 79.6^{\circ}C$ $Q = 37{,}467.72\,J$ (or) $37.5\,kJ$

7. An 18.7 g sample of platinum metal increases in temperature by 3.3 °C when 5.7 J of heat are added. What is the specific heat of the platinum?

A. List data	B. Write Equation	C. Solution – show work including units!

ΔT = 3.3°C m = 18.7 g c = ? Q = 5.7 J	$Q = m \cdot c \cdot \Delta T$ $c = \frac{Q}{m \Delta T}$	$c = \frac{5.7}{(18.7 \times 3.3)}$ $c = 0.09 \frac{J}{g°c}$

8. A sample of water absorbs 347 J of heat when its temperature is raised 14.6 °C. What is the mass of the water?
9. If 874 J of heat are added to 75.0 g of water initially at 15.0 °C . What is the final temperature of the water?

8) $Q = 347 J$

$c = 4.184 \frac{J}{g°c}$

$\Delta T = 14.6°C$

$Q = m \cdot c \cdot \Delta T$

$m = \frac{Q}{c \cdot \Delta T}$

$m = \frac{347}{4.184 \times 14.6} = 5.68 g$

9) $Q = 874 J$

$m = 75 g$

$T_i = 15°C$

$T_f = ?$

$c = 4.184 \frac{J}{g°c}$

$Q = m \cdot c \cdot \Delta T$

$874 = 75 \times 4.184 \times (x - 15)$

$x = 17.8°C$