

Example of Heat Calculation - Solving for All Variable Except Temp

How many grams of water do you need to absorb 3.42 kcal of energy whereby the water temp raises from 26.2°C to 87.5°C

sys: H₂O

T_I = 26.2°C

T_F = 87.5°C

$\Delta T = T_F - T_I = 87.5^\circ\text{C} - 26.2^\circ\text{C} = 61.3^\circ\text{C}$

$\Delta H = +3.42 \text{ kcal} \left(\frac{1000 \text{ cal}}{1 \text{ kcal}} \right) = +3.42 \times 10^3 \text{ cal} \leftarrow \text{(Energy is "+" because system is absorbing energy)}$

$c = 1.00 \frac{\text{cal}}{\text{g} \cdot ^\circ\text{C}}$

$$\Delta H = m \cdot \Delta T \cdot c \Rightarrow m = \frac{\Delta H}{\Delta T \cdot c}$$

$$m = \frac{3.42 \times 10^3 \text{ cal}}{(61.3^\circ\text{C}) \left(1.00 \frac{\text{cal}}{\text{g} \cdot ^\circ\text{C}} \right)}$$

$$m = 55.79 \text{ g} = \boxed{55.8 \text{ g}}$$

3y Dimensional Analysis

sys: H₂O

T_I = 26.2°C

T_F = 87.5°C

$\Delta T = T_F - T_I = 87.5^\circ\text{C} - 26.2^\circ\text{C} = 61.3^\circ\text{C}$

$c = 1.00 \frac{\text{cal}}{\text{g} \cdot ^\circ\text{C}}$

$\Delta H = +3.42 \text{ kcal} \leftarrow \text{(Energy is "+" because system is absorbing energy)}$

$$(3.42 \text{ kcal}) \left(\frac{1}{61.3^\circ\text{C}} \right) \left(\frac{1 \text{ g} \cdot ^\circ\text{C}}{1.00 \text{ cal}} \right) \left(\frac{1000 \text{ cal}}{1 \text{ kcal}} \right) = 55.79 \text{ g} = \boxed{55.8 \text{ g}}$$