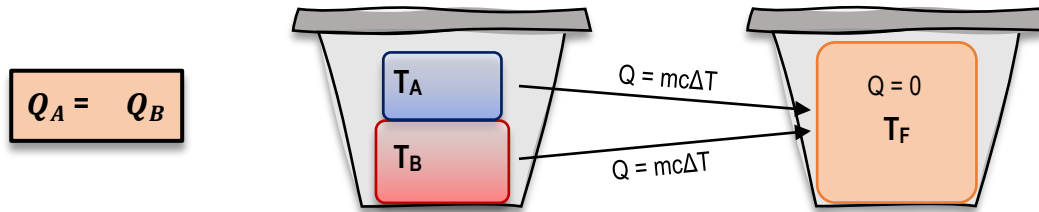
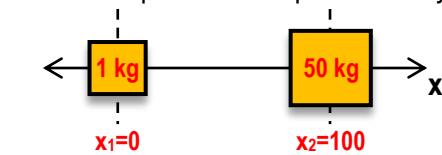


CONCEPT: SOLVING CALORIMETRY PROBLEMS

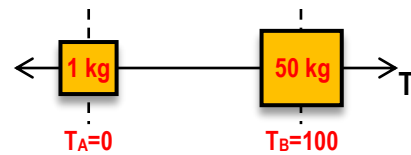
- **Calorimetry** problems involve ___ materials at different T's mixing in a container until they reach the _____ temperature.
- IF container is ISOLATED (no heat exchanged w/ outside), the heat lost by 1 material ___ heat gained by the other.



- The thermal equilibrium temperature *very similar* to the *Center-of-Mass*:



- X_{COM} closer to [0 | 100]



- If $m_1=1$, $T_A=0$, $m_2=50$, $T_B=100$, T_f close to [0 | 100]

EXAMPLE: You have 1kg of water at 20°C in an insulated styrofoam cup. You then add 5kg of water at 90°C. a) Calculate the final equilibrium temperature of the mixture.

CALORIMETRY

- 1) Write $Q_A = -Q_B$
- 2) Replace Q's with $mc\Delta T$
- 3) Solve for Target

SPECIFIC HEAT & CALORIMETRY

$$Q = mc\Delta T$$

$$c_{water} = 4186 \text{ J/(kg}\cdot\text{K)}$$

PROBLEM: You have a cup of 0.5kg of water at 15°C. How much boiling water at 100°C should you add to the cup to make final temperature of the water mixture exactly 80°C?

SPECIFIC/LATENT HEAT & CALORIMETRY
$Q = mc\Delta T$ (temp change) $Q = mL$ (phase change) $c_{\text{water}} = 4186 \text{ J/(kg}\cdot\text{K)}$

CONCEPT: EQUILIBRIUM TEMPERATURE IN CALORIMETRY PROBLEMS

- There's a useful equation to calculate equilibrium temperature for any # materials:

$$T_f = \frac{\sum m \cdot c \cdot T}{\sum m \cdot c} = \underline{\hspace{2cm}}$$

EXAMPLE: You have 0.4kg of water at 10°C in an insulated styrofoam cup. You then add a 0.2kg block of aluminum of water at 80°C. **a)** Derive an expression for the final equilibrium temperature of the mixture. **b)** Calculate the final equilibrium temperature using your expression from part A.

CALORIMETRY

- 1) Write $Q_a = -Q_b$
- 2) Replace Q's with $mc\Delta T$
- 3) Solve for Target

SPECIFIC HEAT & CALORIMETRY

$$Q = mc\Delta T$$

$$c_{\text{water}} = 4186 \text{ J/(kg}\cdot\text{K)}$$

$$c_{\text{Al}} = 900 \text{ J/(kg}\cdot\text{K)}$$

PROBLEM: 150g of water at 35°C are poured into a 65-g aluminum cup with an initial temperature of 11°C. Assuming no heat is exchanged with the surroundings, what is the final temperature of the system?

CALORIMETRY

- 1) Write $Q_a = -Q_b$
- 2) Replace Q's with $mc\Delta T$
- 3) Solve for Target

SPECIFIC/LATENT HEAT & CALORIMETRY

$$Q = mc\Delta T \text{ (temp change)}$$

$$Q = mL \text{ (phase change)}$$

$$T_f = \frac{\Sigma m \cdot c \cdot T}{\Sigma m \cdot c} = \frac{m_A c_A T_A + m_B c_B T_B}{m_A c_A + m_B c_B}$$

$$c_{\text{water}} = 4186 \text{ J/(kg}\cdot\text{K)}$$

$$c_{\text{Al}} = 910 \text{ J/(kg}\cdot\text{K)}$$