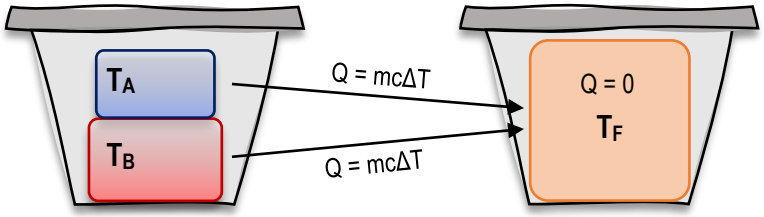
CONCEPT: SOLVING CALORIMETRY PROBLEMS

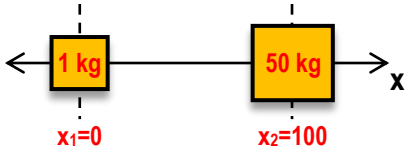
● **Calorimetry** problems involve __ materials at different T's mixing in a container until they reach the _____ temperature.

- IF container is ISOLATED (no heat exchanged w/ outside), the heat *lost* by 1 material ___ heat *gained* by the other.

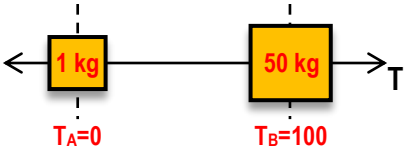
$Q_A = Q_B$



- 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 mcΔT **3)** Solve for Target

SPECIFIC HEAT & CALORIMETRY
$Q = mc\Delta T$ c_{water} = 4186 J/(kg·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_{water} = 4186 J/(kg·K)

CONCEPT: EQUILIBRIUM TEMPERATURE IN CALORIMETRY PROBLEMS

● There's a useful equation to calculate equilibrium temperature for any # materials: $T_f = \frac{\Sigma m \cdot c \cdot T}{\Sigma m \cdot c} =$ _____

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 mcΔT **3)** Solve for Target

SPECIFIC HEAT & CALORIMETRY
$Q = mc\Delta T$ c_{water} = 4186 J/(kg·K) c_{Al} = 900 J/(kg·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 mcΔT
3) Solve for Target

SPECIFIC/LATENT HEAT & CALORIMETRY

$Q = mc\Delta T$ (temp change)
$Q = mL$ (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_{water} = 4186 J/(kg·K)
c_{Al} = 910 J/(kg·K)