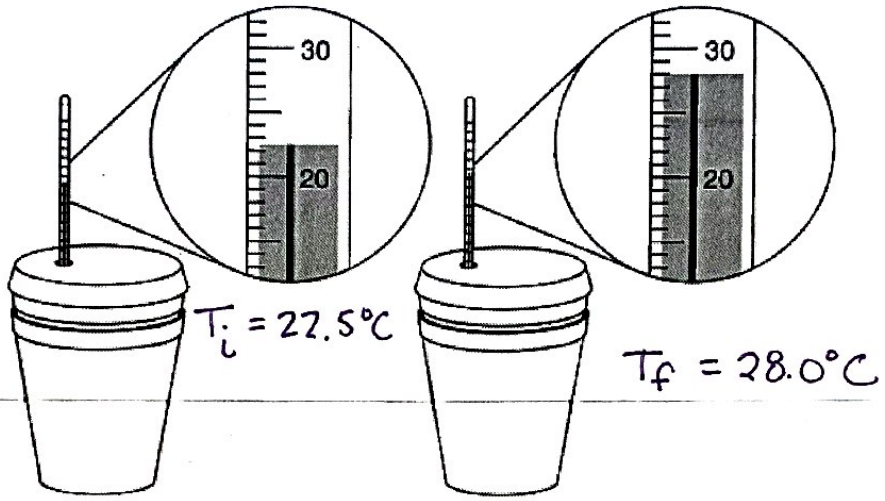
Name: A.K. Period:

AP Chem Unit 4 FRQ Practice [4 points: 8 minutes]

limiting!

$$HBr(aq) + KOH(aq) \rightarrow H_2O(l) + KBr(aq)$$

A student mixes 45 mL of 1.2 M HBr and 65 mL of 1.2 M KOH in a coffee-cup calorimeter and observes the temperature change as they react according to the balanced equation above until the mixture reaches thermal equilibrium. Each solution has a density of 1.00 g/mL and a specific heat of 4.18 J/g°C.



sig fig pt!

(a) The initial and final temperatures (°C) of the mixture are shown in the laboratory setup above. Based on the data shown, what is the change in temperature reported? **[1 POINT]**

$$\Delta T = 28.0 - 22.5 = \boxed{5.5\,°C}$$

(b) Calculate the molar enthalpy of this reaction, ΔH_{rxn}, in kJ/mol. **[2 POINTS]**

$$q_{rxn} = -q_{cal} = -(45+65)(4.18)(5.5\,°C) = -2{,}528.9\,J \times \frac{1\,kJ}{1000\,J} = -2.5289\,kJ$$

$$\text{mol HBr}_{\text{limiting reactant}} = 1.2\,M \times 0.045\,L = 0.054\,\text{mol HBr} \times \frac{1\,\text{mol}_{rxn}}{1\,\text{mol HBr}} = 0.054\,\text{mol}_{rxn}$$

$$\Delta H = \frac{q_{rxn}}{\text{mol}_{rxn}} = \frac{-2.5289\,kJ}{0.054\,\text{mol}_{rxn}} = \boxed{-47\,\frac{kJ}{mol}}$$

(c) After the experiment, the student discovered that the thermometer used was broken: all temperature readings were 1.2°C lower than the actual temperature. Would this lab error cause the calculated enthalpy of this reaction, ΔH_{rxn}, to increase, decrease, or remain the same? Explain. **[1 POINT]**

Remain the Same!

- If T_i and T_f were 1.2°C less, ΔT = same! ($26.8 - 21.3 = 5.5°C$ ← same as part (a))

⇒ no calculation results would be affected by this lab error.