

Determining ΔH_{rxn} of $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NH}_3 + \text{NaCl} + \text{H}_2\text{O}$

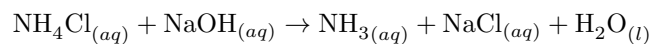
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1 Abstract

1.1 Purpose

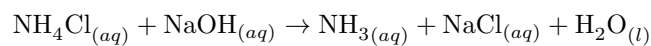
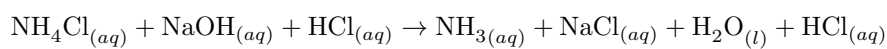
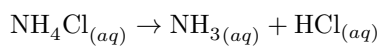
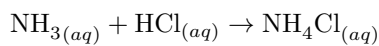
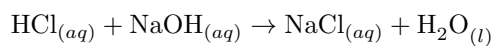
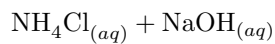
Using the reactants listed in the materials, determine the ΔH_{rxn} for the reaction that occurs when these reactants are mixed:



1.2 Materials

- 50 ml 2.0 M $\text{NH}_{3(aq)}$
- 100 ml 2.0 M $\text{HCl}_{(aq)}$
- 50 ml 2.0 M $\text{NaOH}_{(aq)}$
- 50 ml Graduated Cylinder
- Calorimeter and Lid
- Deionized/Distilled $\text{H}_2\text{O}_{(l)}$
- Thermometer

2 Model



3 Data

- $\text{HCl}_{(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$ has a ΔH_f of $-94.98 \text{ kJ mol}^{-1}$
- $\text{NH}_4\text{Cl}_{(aq)} \rightarrow \text{NH}_{3(aq)} + \text{HCl}_{(aq)}$ has a ΔH_f of $52.80 \text{ kJ mol}^{-1}$

Adding $-94.98 \text{ kJ mol}^{-1}$ and $52.80 \text{ kJ mol}^{-1}$ gives a total enthalpy of reaction of $-42.18 \text{ kJ mol}^{-1}$

$$\Delta H_{rxn} = \Delta H_{f_1} + \Delta H_{f_2}$$

4 Conclusion

Adding the two reactions above yields the proper equation for the reaction. Thus, adding the respective ΔH_f of the two reactions is equivalent to the ΔH_{rxn} of $\text{NH}_4\text{Cl}_{(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{NH}_{3(aq)} + \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$