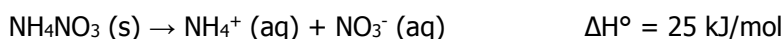


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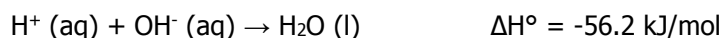
AP Chemistry: Thermodynamics Review

1. Consider the reaction:



- Predict the change in entropy when solid ammonium nitrate dissolves in water. Does ΔS favour a spontaneous reaction? Explain.
- Does the enthalpy factor favour the spontaneity of the reaction? Explain.

2. Consider the acid-base neutralization reaction:

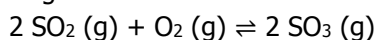


- Predict the change in entropy for the reaction. Does ΔS favour the spontaneity of the reaction? Explain.
- Does the enthalpy change favour the spontaneity of the reaction? Explain.
- Which factor (enthalpy or entropy) is the driving force for this reaction? Explain.

3. Predict whether the entropy change is greater or less than zero for each of the following processes and explain:

- Freezing hexane
- Dissolving sodium chloride in water
- Heating nitrogen from 10°C to 80°C
- $\text{N}_2 (\text{g}) + 3 \text{H}_2 (\text{g}) \rightleftharpoons 2 \text{NH}_3 (\text{g})$

4. Calculate the standard entropy change for the oxidation of sulfur dioxide at standard conditions:



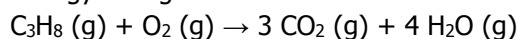
Given:

$$S^\circ_{\text{SO}_2} = 248 \text{ J/mol}\cdot\text{K}$$

$$S^\circ_{\text{O}_2} = 205 \text{ J/mol}\cdot\text{K}$$

$$S^\circ_{\text{SO}_3} = 256 \text{ J/mol}\cdot\text{K}$$

5. Calculate the standard free energy change for the reaction:



Given:

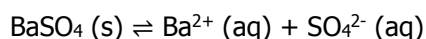
$$\Delta G^\circ_{\text{f, C}_3\text{H}_8} = -23 \text{ kJ/mol}$$

$$\Delta G^\circ_{\text{f, CO}_2} = -394.4 \text{ kJ/mol}$$

$$\Delta G^\circ_{\text{f, H}_2\text{O}} = -237.2 \text{ kJ/mol}$$

6. The molar heat of vaporization of water is 40.6 kJ/mol at 100.°C and 1 atm. What is the entropy of vaporization of water at this temperature and pressure?

7. Consider the following reaction at standard conditions:



- The ΔG° for this reaction is 56.8 kJ/mol. Determine the equilibrium constant for this reaction.
- Determine ΔG of the reaction if $[\text{Ba}^{2+}]$ is $3.2 \times 10^{-5} \text{ M}$ and $[\text{SO}_4^{2-}]$ is $2.4 \times 10^{-8} \text{ M}$. Is the forward or reverse reaction favoured at these conditions?