Chemistry - Thermodynamics and Chemical Equilibrium

Topic: Exothermic and Endothermic Reactions

Problem Analysis:

This task involves understanding how temperature affects the equilibrium constants K_c and K_p to identify the nature of the reaction.

Key Concept:
For an **exothermic reaction**:
- As temperature T increases, the equilibrium constants K_c and K_p decrease.

For an **endothermic reaction**:
- As temperature T increases, the equilibrium constants K_c and K_p increase.

Step-by-Step Solution:

1. **Identify Temperature Effect on Equilibrium Constant:**
   Given the phrase "As T increases", determine whether K_c and K_p increase or decrease for the reaction.

   Explanation: An exothermic reaction will shift equilibrium towards the reactants when temperature increases, lowering K_c and K_p. Conversely, an endothermic reaction shifts towards the products raising K_c and K_p.

2. **Insert Appropriate Terms in the Blanks:**
   Based on the relationship,
   - **For K_c:** Choose "decreases" or "increases" based on the nature of the reaction. For an exothermic reaction, K_c decreases.
   - **For K_p:** Choose "decreases" or "increases" accordingly. For an exothermic reaction, K_p also decreases.
   - **For the nature of the reaction:** Choose "exothermic" or "endothermic". If K_c and K_p decrease as temperature increases, the reaction is exothermic.

Final Solution:

As T increases, $K_c \; \text{decreases}, $ and $K_p \; \text{decreases}, $ so the reaction is \textit{exothermic}.

Supporting Statements:

- **Given Approach:** Understanding how temperature affects equilibrium constants based on Le Chatelier's principle helps determine the reaction nature.
- **Explanation:** This principle states that increasing temperature for exothermic reactions shifts equilibrium to reduce temperature, thus reactants are favored.
- **Formula:** N/A specific formula applied here; conceptual understanding applied.