CLASS 11 CHEMISTRY EXTRA QUESTIONS

Class 11 Chemistry Chapter 5 Chemical Thermodynamics – Extra Questions with Answers

Extra practice questions for Class 11 Chemistry Chapter 5 (Chemical Thermodynamics), beyond the textbook. These Class 11 Chemistry Chapter 5 important questions are handy for last-minute exam practice.

Contents

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Very Short Answer Questions (1 mark)

Q1. Define an isolated system.
Ans: A system that exchanges neither matter nor energy with its surroundings.

Q2. What is the sign of ΔH for an exothermic reaction?
Ans: Negative.

Q3. Write the Gibbs free energy equation.
Ans: $\Delta G = \Delta H - T\Delta S$.

Q4. What is entropy a measure of?
Ans: The degree of disorder or randomness of a system.

Q5. State the condition for a reaction to be at equilibrium in terms of ΔG.
Ans: $\Delta G = 0$.

Short Answer Questions (2–3 marks)

Q6. A reaction has ΔH=−50 kJ/mol and ΔS=−100 J/(K·mol) at 300 K. Calculate ΔG and comment on spontaneity.
Ans: $\Delta G = \Delta H - T\Delta S = -50000 - 300(-100) = -50000 + 30000 = -20000$ J $= -20$ kJ/mol. Since $\Delta G < 0$, the reaction is spontaneous at 300 K.

Q7. If 100 J of heat is added to a system and the system does 40 J of work on the surroundings, find the change in internal energy.
Ans: $\Delta U = q + w = 100 + (-40) = 60$ J (work done BY the system is taken as negative in this convention).

Q8. Using Hess's law, if A→B has ΔH=−30 kJ and B→C has ΔH=−20 kJ, find ΔH for A→C.
Ans: $\Delta H(A \to C) = \Delta H(A \to B) + \Delta H(B \to C) = -30 + (-20) = -50$ kJ.

Higher-Order Thinking / Application Questions

Q9. A reaction has ΔH=+40 kJ/mol (endothermic) and ΔS=+120 J/(K·mol) (positive, increasing disorder). Explain, using the Gibbs free energy equation, whether this reaction can ever be spontaneous, and if so, under what temperature condition.
Ans: $\Delta G = \Delta H - T\Delta S = 40000 - T(120)$. For spontaneity, we need $\Delta G < 0$, i.e. $40000 < 120T$, so $T > 40000/120 \approx 333.3$ K. This means that although the reaction is endothermic (thermodynamically unfavourable from an enthalpy standpoint alone), the positive entropy change means that at sufficiently high temperatures (above approximately 333.3 K), the TΔS term becomes large enough to outweigh the positive ΔH, making ΔG negative and the reaction spontaneous. This illustrates that spontaneity depends on the balance between enthalpy and entropy contributions, weighted by temperature, not on enthalpy alone.

Q10. Explain why ice melting at room temperature is a spontaneous process even though it absorbs heat (ΔH>0, endothermic), using both entropy and Gibbs free energy reasoning.
Ans: When ice melts into liquid water, the more ordered, rigid crystalline structure of ice is converted into the more disordered, freely-flowing structure of liquid water, resulting in a significant increase in entropy

(ΔS>0) as the system becomes more random. Although melting requires heat absorption (ΔH>0, since breaking the hydrogen-bonded ice lattice requires energy), at room temperature (well above 0°C), the temperature T is high enough that the TΔS term (which is positive and grows with T) exceeds the positive ΔH term, making ΔG=ΔH−TΔS negative overall. Since ΔG<0 indicates a spontaneous process, this correctly predicts that ice will spontaneously melt at room temperature, demonstrating that the entropy increase, not just the enthalpy change, determines whether an endothermic process can still occur spontaneously at a given temperature.

Class 11 Chemistry Chapter 5 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 11 Chemistry Chapter 5 Solutions and Class 11 Chemistry Chapter 5 Revision Notes.

See also: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5

Practice more: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4

Quick revision: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4