CHEMISTRY

CLASS XI

COMPETENCY BASED EXAM – OCTOBER 2025

Thermodynamics MCQs

Q1. Which of the following is a state function?
A. Work
B. Heat
C. Internal energy
D. Path length

Answer: C. Internal energy
Reasoning: State functions depend only on initial and final states, not on the path.

Q2. The enthalpy change for a reaction at constant pressure is equal to:
A. Heat absorbed or released
B. Work done
C. Internal energy change
D. Gibbs free energy

Answer: A
Reasoning: At constant pressure, $\Delta H = q_p$ (heat at constant pressure).

Q3. Assertion–Reason

Assertion (A): Work done in reversible expansion is greater than in irreversible expansion.
Reason (R): In reversible expansion, external pressure is infinitesimally less than internal pressure, so maximum work is obtained.

A. Both A and R are true, and R is the correct explanation of A
B. Both A and R are true, but R is not the correct explanation of A
C. A is true, R is false
D. A is false, R is true

Answer: A

Q4. The entropy of the universe always:
A. Increases for spontaneous processes
B. Decreases for spontaneous processes
C. Remains constant
D. Depends on enthalpy change

Answer: A
Reasoning: Second law of thermodynamics → $\Delta S_{universe} > 0$ for spontaneous processes.

Q5. The Gibbs free energy change (ΔG) is negative when:
A. The process is non-spontaneous
B. The process is spontaneous
C. The process is at equilibrium
D. The process is reversible

Answer: B
Reasoning: $\Delta G < 0$ indicates spontaneity.

Q6. For an ideal gas, the work done in isothermal reversible expansion is:
A. $W = -nRT \ln \frac{V_f}{V_i}$
B. $W = -P\Delta V$
C. $W = -\Delta U$
D. $W = -q$

Answer: A
Reasoning: Derived from integration of PdV under isothermal conditions.

Q7. Assertion–Reason
Assertion (A): At equilibrium, $\Delta G = 0$.
Reason (R): At equilibrium, the forward and backward reactions occur at equal rates, so no net change in free energy.

A. Both A and R are true, and R is the correct explanation of A
B. Both A and R are true, but R is not the correct explanation of A
C. A is true, R is false
D. A is false, R is true

Answer: A

Q8. The enthalpy of neutralization of a strong acid with a strong base is always:
A. –57 kJ/mol
B. –100 kJ/mol
C. –25 kJ/mol
D. Variable

Answer: A
Reasoning: It is constant because reaction is essentially $H^+ + OH^- \longrightarrow H_2O$.

Q9. The relation between ΔG and equilibrium constant K is:
A. $\Delta G = -RT \ln K$
B. $\Delta G = RT \ln K$
C. $\Delta G = \Delta H - T\Delta S$
D. $\Delta G = -nFE$

Answer: A
Reasoning: At equilibrium, $\Delta G^\circ = -RT \ln K$.

Q10. Assertion–Reason
Assertion (A): Heat capacity at constant pressure (C_p) is greater than heat capacity at constant volume (C_v).
Reason (R): At constant pressure, part of heat supplied is used for expansion work.

A. Both A and R are true, and R is the correct explanation of A
B. Both A and R are true, but R is not the correct explanation of A
C. A is true, R is false
D. A is false, R is true

Answer: A