



DPP –3 (Gibbs Free Energy)[Theoretical]

“Tumhe pata bhi nahi, tum kis level ke insaan ban sakte ho—bas ek assignment karne ki himmat chahiye. — Weird Chemist.”

Q1. Identify the correct statement for change of Gibbs energy for a system (ΔG_{system}) at constant temperature and pressure.

- (1) If $\Delta G_{system} > 0$, the process is spontaneous.
- (2) If $\Delta G_{system} = 0$, the system has attained equilibrium.
- (3) If $\Delta G_{system} = 0$, the system is still moving in a particular direction.
- (4) If $\Delta G_{system} < 0$, the process is not spontaneous.

Q2. At equilibrium which is correct :

- (1) $\Delta G = 0$
- (2) $\Delta S = 0$
- (3) $\Delta H = 0$
- (4) $\Delta G^\circ = 0$

Q3. Which of the following always increases for spontaneous process –

- (1) ΔH_{system}
- (2) ΔS_{system}
- (3) $\Delta S_{universe}$
- (4) $\Delta G_{system} = \Delta H_{system} - T\Delta S_{system}$

Q4. For the process, $\text{CO}_2(\text{s}) \rightarrow \text{CO}_2(\text{g})$:

- (1) Both ΔH and ΔS are *+ve*
- (2) ΔH is negative and ΔS is *+ve*
- (3) ΔH is *+ve* and ΔS is *-ve*
- (4) Both ΔH and ΔS are *-ve*

Q5. Following reaction occurring in an automobile :



The sign of ΔH , ΔS and ΔG would be :

- (1) $-, +, +$
- (2) $+, +, -$
- (3) $-, -, -$
- (4) $-, +, -$

Q6. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is –

- (1) $\Delta H > 0$ and $\Delta S > 0$
- (2) $\Delta H < 0$ and $\Delta S < 0$
- (3) $\Delta H < 0$ and $\Delta S > 0$
- (4) $\Delta H > 0$ and $\Delta S < 0$

Q7. When ΔH and $T\Delta S$ both are negative, then for spontaneous process which option is true?

- (1) $\Delta H > T\Delta S$

(2) $\Delta H < T\Delta S$

(3) $\Delta H = T\Delta S$

(4) $\Delta H = \Delta U$

Q8. The favourable conditions for a spontaneous reaction are :

(1) $T\Delta S > \Delta H$, $\Delta H = +ve$, $\Delta S = +ve$

(2) $T\Delta S < \Delta H$, $\Delta H = -ve$, $\Delta S = -ve$

(3) $T\Delta S > \Delta H$, $\Delta H = -ve$, $\Delta S = +ve$

(4) $T\Delta S < \Delta H$, $\Delta H = +ve$, $\Delta S = -ve$

Q9. If temperature of a system is T, then the process will be spontaneous at all temperature only if :

(1) $\Delta H < 0$ and $\Delta S > 0$

(2) $\Delta H > 0$ and $\Delta S < 0$

(3) $\Delta H > 0$ and $\Delta S > 0$

(4) $\Delta H < 0$ and $\Delta S < 0$

Q10. If $\Delta H > 0$ and $\Delta S > 0$, the reaction proceeds spontaneously when :

(1) $\Delta H > 0$

(2) $\Delta H < T\Delta S$

(3) $\Delta H = T\Delta S$

(4) None

Q11. The spontaneous nature of a reaction is impossible if :

(1) ΔH is $+ve$, ΔS is also $+ve$

(2) ΔH is $-ve$, ΔS is also $-ve$

(3) ΔH is $-ve$, ΔS is $+ve$

(4) ΔH is $+ve$, ΔS is $-ve$

Q12. For a reaction to be non-spontaneous :

(1) $T\Delta S < \Delta H$ and both ΔH & ΔS are $+ve$

(2) $T\Delta S > \Delta H$ and both ΔH & ΔS are $+ve$

(3) $T\Delta S > \Delta H$ and both ΔH & ΔS are $-ve$

(4) None of these

Q13. It is impossible for a reaction to take place if :

(1) ΔH is $+ve$ and ΔS is $+ve$

(2) ΔH is $-ve$ and ΔS is $+ve$

(3) ΔH is $+ve$ and ΔS is $-ve$

(4) ΔH is $-ve$ and ΔS is $-ve$

Q14. A reaction occurs spontaneously if :

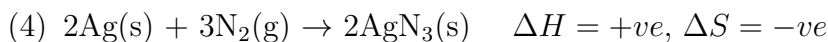
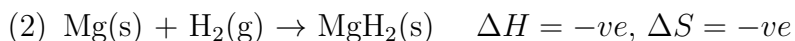
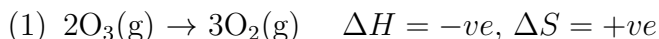
(1) $T\Delta S < \Delta H$ and both ΔH and ΔS are $+ve$

(2) $T\Delta S > \Delta H$ and both ΔH and ΔS are $+ve$

(3) $T\Delta S = \Delta H$ and both ΔH and ΔS are $+ve$

(4) $T\Delta S > \Delta H$ and ΔH is $+ve$ and ΔS is $-ve$

Q15. Which of the following reactions is expected never to be spontaneous :



Q16. Identify the correct statement regarding a spontaneous process :

- (1) For a spontaneous process in an isolated system, the change in entropy is positive
- (2) Endothermic processes are never spontaneous
- (3) Exothermic processes are never spontaneous
- (4) Lowering of energy in the reaction is never a criterion for spontaneity

Q17. Which of the following pairs of a chemical reaction is certain to result in spontaneous reaction?

- (1) Endothermic and decreasing disorder
- (2) Exothermic and increasing disorder
- (3) Exothermic and decreasing disorder
- (4) Endothermic and increasing disorder

Q18. For a reaction to occur spontaneously :

- (1) ΔH must be negative
- (2) ΔS must be negative
- (3) $(\Delta H - T\Delta S)$ must be negative
- (4) $(\Delta H + T\Delta S)$ must be negative

Q19. For an endothermic reaction to be spontaneous :

- (1) ΔG must be *+*ve
- (2) ΔS must be > 0
- (3) $T\Delta S$ must be *-*ve
- (4) ΔS must be equal to ΔG

Q20. For a endothermic process for which net change in entropy is negative, the reaction is –

- (1) Not possible at any temperature
- (2) Possible only at low temperature
- (3) Possible only at high temperature
- (4) Possible at high temperature

Q21. $2A + B \rightarrow C + D - q$

Where ΔS is *-*ve, then which of the following is correct?

- (1) Reaction is possible at any temperature
- (2) Reaction is possible only at high temperature
- (3) Reaction is possible only at low temperature
- (4) Reaction is not possible at any temperature

Q22. A reaction $A + B \rightarrow C + D + q$ is found to have a positive entropy change, the reaction will be –

- (1) Possible at high temperature
- (2) Possible only at low temperature
- (3) Not possible at any temperature
- (4) Possible at any temperature

Q23. The value of ΔG for the process $H_2O_{(s)} \rightarrow H_2O_{(l)}$ at 1 atm and 260 K is :

- (1) < 0
- (2) $= 0$
- (3) > 0
- (4) Unpredictable

Q24. Which of the following is true for the reaction $H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$ at 100°C and 1 atm?

- (1) $\Delta S = 0$
- (2) $\Delta G = 0$
- (3) $\Delta H = \Delta E$
- (4) $\Delta H = T\Delta S$

Q25. What is the sign of ΔG for the process of ice melting at 283 K?

- (1) $\Delta G = 0$
- (2) $\Delta G = \infty$
- (3) $\Delta G < 0$
- (4) None of these

Q26. For a phase change $\text{H}_2\text{O}(l) \rightleftharpoons \text{H}_2\text{O}(s)$ at 0°C and 1 bar :

- (1) $\Delta G = 0$
- (2) $\Delta S = 0$
- (3) $\Delta H = 0$
- (4) $\Delta U = 0$

Q27. For the process $\text{H}_2\text{O}(l)$ (1 bar, 373 K) \rightarrow $\text{H}_2\text{O}(g)$ (1 bar, 373 K), the correct set of thermodynamic parameters is :

- (1) $\Delta G = 0, \Delta S = -ve$
- (2) $\Delta G = 0, \Delta S = +ve$
- (3) $\Delta G = +ve, \Delta S = -ve$
- (4) $\Delta G = -ve, \Delta S = +ve$

Q28. The process of evaporation of a liquid is accompanied by :

- (1) Increase in enthalpy
- (2) Decrease in free energy
- (3) Increase in entropy
- (4) All

Q29. A gas is allowed to expand under reversible adiabatic conditions then what is zero for such a process:

- (1) $\Delta G = 0$
- (2) $\Delta T = 0$
- (3) $\Delta S = 0$
- (4) None of these

Q30. For the precipitation of AgCl by Ag^+ ions and HCl :

- (1) $\Delta G = 0$
- (2) $\Delta G = -ve$
- (3) $\Delta H = \Delta G$
- (4) None