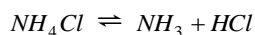## Activation energy, Standard free energy and Degree of dissociation and Vapour density

1. (b) $\dfrac{\text{Normal molecular weight}}{\text{experiment al molecular wt.}} = 1 + \alpha$

$NH_4Cl \rightleftharpoons NH_3 + HCl$

$\because \alpha = 1 \quad \therefore$ Experimental Molecular wt $= \dfrac{\text{nor.mol.wt .}}{2}$

2. (b) If $\Delta G^o = 0$

$\Delta G^o = -2.303 \ RT \ \log K_p$

$\log K_p = 0 \qquad (\because \log 1 = 0)$

$K_p = 1$.

3 (a) Temperature and pressure

Explanation (word-friendly):
At **constant temperature and pressure**, the change in Gibbs free energy (ΔG) determines the spontaneity of a reaction.
When ΔG = 0, the system is at **equilibrium** — meaning there is no net change in composition.

4 (b) Zero

Explanation (word-friendly):
A reaction continues until the **free energy change (ΔG)** becomes **zero**.
At that point, the forward and backward reactions balance each other — the system is at **equilibrium**.

5. (d) $\Delta G^o = -2.303 \times 8.314 \times 10^{-3} \times 298 \ \log K_p$

$1.7 = -2.303 \times 8.314 \times 10^{-3} \times 298 \times \log K_p$

$K_p = 0.5$

6. (a) Equilibrium shifts backward by Le-chatelier's principle.

7. (c) Decreases the activation energy of both forward and backward reaction.

8. (d) Equilibrium constant changes with temperature, pressure and the concentration of either reactant or product.

9. (a) As we know that, $\Delta G^o = -2.303 \, RT \log K_p$

Therefore, $\Delta G^o = -2.303 \times (8.314) \times (298)$

$(\log 2.47 \times 10^{-29})$

$\Delta G^o = 16,3000 \; J \, mol^{-1} = 163 \; KJ \, mol^{-1}$