Daily Tutorial Sheet - 14	Level-3

153.(B) $\ln k = \frac{\Delta S_r^\circ}{R} - \frac{\Delta H_r^\circ}{RT}$

$$\log K = \frac{\Delta S_r^\circ}{2.303\,R} - \frac{\Delta H_r^\circ}{2.303R} \cdot \frac{1}{T}$$

Comparing with $y = C + mx$

Slope $m = -\frac{\Delta H_r^\circ}{2.303\,R}$ So $-\frac{\Delta H_r^\circ}{2.303R} = 1 \Rightarrow \Delta H_r^\circ = -2.303\,R$

154.(A-P) (B-S) (C-Q) (D-R)

Let's take 1 mole reactant dissolve in 1 litre solution

(A) $2X(g) \rightleftharpoons Y(g) + Z(g)$

	$2X(g)$	$Y(g)$	$Z(g)$
	1	0	0
At equim.	$1-\alpha$	$\frac{\alpha}{2}$	$\frac{\alpha}{2}$

$$K_c = \frac{\frac{\alpha}{2} \cdot \frac{\alpha}{2}}{(1-\alpha)^2}$$

$$K_c = \frac{\alpha^2}{4} \Rightarrow 2\sqrt{K_c}$$

(B) $X(g) \rightleftharpoons Y(g) + Z(g)$

$X(g)$	$Y(g)$	$Z(g)$
1	0	0
$1-\alpha$	α	α

$$K_c = \frac{\alpha \cdot \alpha}{(1-\alpha)} \cdot V$$

If $V = 1\,\text{litre}$

$$\alpha = \sqrt{K_c}$$

(C) $3X \rightleftharpoons Y + Z$

$3X$	Y	Z
1	0	0
$1-\alpha$	$\frac{\alpha}{3}$	$\frac{\alpha}{3}$

$$K_c = \frac{\alpha^2 \cdot V}{9 \cdot (1-\alpha)^3} \Rightarrow \alpha = 3\sqrt{K_c}$$

(D) $2X(g) \rightleftharpoons Y(g) + 2Z(g)$

$2X(g)$	$Y(g)$	$2Z(g)$
1	0	0
$1-\alpha$	$\frac{\alpha}{2}$	α

$$K_c = \frac{\frac{\alpha}{2} \cdot \alpha^2}{(1-\alpha)^2} \Rightarrow K_c = \frac{\alpha^3}{2} \Rightarrow \alpha = (2K_c)^{1/3}$$

155. **[A-P] [B-R] [C-S] [D-Q]**

(A) $\frac{K_{T+10}}{K_T} = 2$ it means value of equilibrium constant increases with rise in temperature that is true for endothermic reaction.

(B) $\frac{K_{T+10}}{K_T} = \frac{1}{2}$ is true for exothermic reaction

(C) $A(g) + B(g) \rightleftharpoons C(g)$ is affected by change in pressure & volume.

(D) $X(s) + Y(g) \rightleftharpoons Z(g)$

Since number of moles of gaseous reactant and gaseous product are same in reactant & product side therefore, there will be no change in equilibrium by change in pressure or volume.

156. **[A-R] [B-Q] [C-P] [D-S]**

Generally on increasing pressure equilibrium shift in the direction where number of moles in reactant or product side are lesser.

157.(1) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

At equim. 2 2 2

Total moles at equilibrium = 6

Using $PV = nRT$ we can calculate total volume

$$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} \Rightarrow K_p = K_c (RT)^{\Delta ng}$$

158.(C) $M + Cl \longrightarrow MCl$

$MCl + Cl \longrightarrow MCl_2$

$\underline{MCl_2 + Cl \longrightarrow MCl_3}$

$\underline{M + 3Cl \longrightarrow MCl_3}$

$$\beta_1 = \frac{[MCl]}{[M][Cl]}; \quad \beta_2 = \frac{[MCl_2]}{[MCl][Cl]}; \beta_3 = \frac{[MCl_3]}{[MCl_2][Cl]}$$

$$\therefore \quad K = \frac{[MCl_3]}{[M][Cl]^3} = \beta_1\beta_2\beta_3$$

$$\log K = \log\beta_1 + \log\beta_2 + \log\beta_3$$