Q1 - 2024 (29 Jan Shift 1)

For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, $K_p = 0.492$ atm at 300 K. K_c for the reaction at same temperature is _____ $\times 10^{-2}$.

(Given : $R = 0.082$ L atm mol^{-1} K^{-1})

Q2 - 2024 (29 Jan Shift 2)

The following concentrations were observed at 500 K for the formation of NH_3 from N_2 and H_2. At equilibrium : $[N_2] = 2 \times 10^{-2}$M, $[H_2] = 3 \times 10^{-2}$M and $[NH_3] = 1.5 \times 10^{-2}$M. Equilibrium constant for the reaction is _____

Q3 - 2024 (31 Jan Shift 1)

For the given reaction, choose the correct expression of K_C from the following :-

$Fe^{3+}_{(aq)} + SCN^-_{(aq)} \rightleftharpoons (FeSCN)^{2+}_{(aq)}$

(1) $K_C = \frac{\left[FeSCN^{2+}\right]}{\left[Fe^{3+}\right]\left[SCN^-\right]}$

(2) $K_C = \frac{\left[Fe^{3+}\right]\left[SCN^-\right]}{\left[FeSCN^{2+}\right]}$

(3) $K_C = \frac{\left[FeSCN^{2+}\right]}{\left[Fe^{3+}\right]^2\left[SCN^-\right]^2}$

(4) $K_C = \frac{\left[FeSCN^{2+}\right]^2}{\left[Fe^{3+}\right]\left[SCN^-\right]}$

Q4 - 2024 (31 Jan Shift 2)

$A_{(g)} \rightleftharpoons B_{(g)} + \frac{C}{2}(g)$ The correct relationship between K_P, α and equilibrium pressure P is

(1) $K_P = \frac{\alpha^{1/2}P^{1/2}}{(2+\alpha)^{1/2}}$

(2) $K_P = \frac{\alpha^{3/2}P^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$

(3) $K_P = \frac{\alpha^{1/2}P^{3/2}}{(2+\alpha)^{3/2}}$

(4) $K_P = \frac{\alpha^{1/2}P^{1/2}}{(2+\alpha)^{3/2}}$

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Answer Key

Q1 (2) **Q2** (417) **Q3** (1) **Q4** (2)

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Q1

$$K_P = K_C \cdot (RT)^{\Delta n_g}$$
$$\Delta n_g = 1$$
$$\Rightarrow K_c = \frac{K_P}{RT} = \frac{0.492}{0.082 \times 300} = 2 \times 10^{-2}$$

Q2

$$K_C = \frac{[NH_3]^2}{[N_2][H_2]^3}$$
$$K_C = \frac{\left(1.5 \times 10^{-2}\right)^2}{\left(2 \times 10^{-2}\right) \times \left(3 \times 10^{-2}\right)^3}$$
$$K_C = 417$$

Q3

$$K_C = \frac{\text{Products ion conc.}}{\text{Reactants ion conc.}}$$
$$K_C = \frac{\left[FeSCN^{2+}\right]}{\left[Fe^{3+}\right]\left[SCN^-\right]}$$

Q4

$$A_{(g)} \rightleftharpoons B_{(g)} + \frac{C}{2}(g)$$
$$t = t_{eq} \quad (1-\alpha) \qquad \alpha \qquad \frac{\alpha}{2}$$
$$P_B = \frac{\alpha}{\left(1+\frac{\alpha}{2}\right)} \cdot P, P_A = \frac{(1-\alpha)}{\left(1+\frac{\alpha}{2}\right)} \cdot P, P_C = \frac{\frac{\alpha}{2}}{\left(1+\frac{\alpha}{2}\right)} \cdot P$$
$$K_P = \frac{P_B \cdot P_C^{\frac{1}{2}}}{P_A}$$
$$= \frac{(\alpha)^{\frac{3}{2}}(P)^{\frac{1}{2}}}{(1-\alpha)(2+\alpha)^{\frac{1}{2}}}$$

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