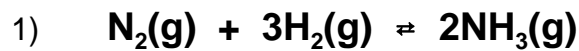


Calculate the equilibrium constants for the following equilibria.



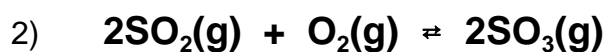
$$P_{\text{N}_2} = 0.60 \text{ atm}$$

$$P_{\text{H}_2} = 0.42 \text{ atm}$$

$$P_{\text{NH}_3} = 0.11 \text{ atm}$$

$$K = \frac{[\text{NH}_3]^2}{[\text{N}_2] [\text{H}_2]^3} = \frac{(0.11)^2}{(0.66) (0.42)^3} = 0.27$$

$$K = \underline{\quad \mathbf{0.27} \quad}$$



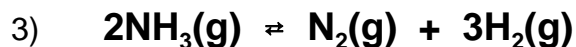
$$P_{\text{SO}_2} = 0.344 \text{ atm}$$

$$P_{\text{O}_2} = 0.172 \text{ atm}$$

$$P_{\text{SO}_3} = 0.056 \text{ atm}$$

$$K = \frac{[\text{SO}_3]^2}{[\text{O}_2] [\text{SO}_2]^2} = \frac{(0.056)^2}{(0.172) (0.344)^2} = 0.15$$

$$K = \underline{\quad \mathbf{0.15} \quad}$$



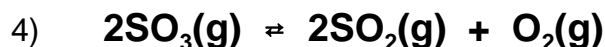
$$P_{\text{N}_2} = 0.60 \text{ atm}$$

$$P_{\text{H}_2} = 0.42 \text{ atm}$$

$$P_{\text{NH}_3} = 0.11 \text{ atm}$$

$$K = \frac{[\text{N}_2] [\text{H}_2]^3}{[\text{NH}_3]^2} = \frac{(0.60) (0.42)^3}{(0.11)^2} = 3.7$$

$$K = \underline{\quad \mathbf{3.7} \quad}$$



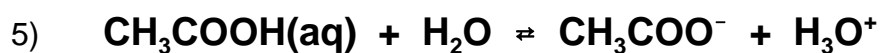
$$P_{\text{SO}_2} = 0.344 \text{ atm}$$

$$P_{\text{O}_2} = 0.172 \text{ atm}$$

$$P_{\text{SO}_3} = 0.056 \text{ atm}$$

$$K = \frac{[\text{SO}_2]^2 [\text{O}_2]}{[\text{SO}_3]^2} = \frac{(0.344)^2 (0.172)}{(0.056)^2} = 6.5$$

$$K = \underline{\quad \mathbf{6.5} \quad}$$



$$[\text{CH}_3\text{COOH}] = 0.10 \text{ M}$$

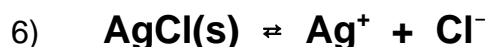
$$[\text{CH}_3\text{COO}^-] = 0.10 \text{ M}$$

$$[\text{H}_3\text{O}^+] = 1.8 \times 10^{-5} \text{ M}$$

and water is the solvent

$$K = \frac{[\text{CH}_3\text{COO}^-][\text{H}_3\text{O}^+]}{[\text{CH}_3\text{COOH}]} = \frac{(0.10)(1.8 \times 10^{-5})}{(0.10)} = 1.8 \times 10^{-5}$$

$$K = \underline{1.8 \times 10^{-5}}$$

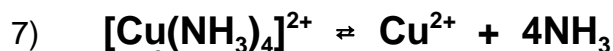


$$[\text{Cl}^-] = 1.0 \times 10^{-3} \text{ M}$$

$$[\text{Ag}^+] = 1.8 \times 10^{-7} \text{ M}$$

$$K = [\text{Ag}^+][\text{Cl}^-] = (1.0 \times 10^{-3})(1.8 \times 10^{-7}) = 1.8 \times 10^{-10}$$

$$K = \underline{1.8 \times 10^{-10}}$$



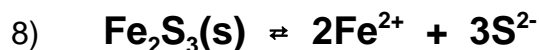
$$[\text{Cu}^{2+}] = 0.085 \text{ M}$$

$$[\text{Cu}(\text{NH}_3)_4]^{2+} = 0.10 \text{ M}$$

$$[\text{NH}_3] = 1.0 \times 10^{-3} \text{ M}$$

$$K = \frac{[\text{Cu}^{2+}][\text{NH}_3]^4}{[\text{Cu}(\text{NH}_3)_4]^{2+}} = \frac{(0.085)(1.0 \times 10^{-3})^4}{0.10} = 8.5 \times 10^{-13}$$

$$K = \underline{8.5 \times 10^{-13}}$$



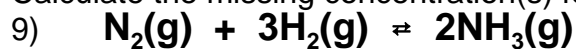
$$[\text{Fe}^{3+}] = 1.2 \times 10^{-8} \text{ M}$$

$$[\text{S}^{2-}] = 1.0 \times 10^{-26} \text{ M}$$

$$K = [\text{Fe}^{3+}]^2[\text{S}^{2-}]^3 = (1.2 \times 10^{-8})^2(1.0 \times 10^{-26})^3 = 1.4 \times 10^{-94}$$

$$K = \underline{1.4 \times 10^{-94}}$$

Calculate the missing concentration(s) for the following reactions:



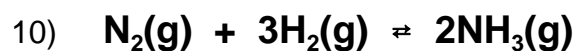
$$P_{\text{N}_2} = 0.10 \text{ atm}$$

$$P_{\text{H}_2} = 0.55 \text{ atm} \quad K = \text{value obtained in 1) above}$$

$$0.27 = K = \frac{P_{\text{NH}_3}^2}{P_{\text{N}_2} P_{\text{H}_2}^3} = \frac{P_{\text{NH}_3}^2}{(0.10) (0.55)^3}$$

$$P_{\text{NH}_3}^2 = (0.55)^3 (0.10) (0.27) = 4.5 \times 10^{-3} \quad \therefore P_{\text{NH}_3} = 6.7 \times 10^{-2} \text{ atm}$$

$$P_{\text{NH}_3} = \underline{6.7 \times 10^{-2} \text{ atm}}$$



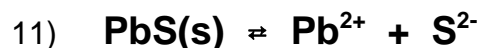
$$P_{\text{N}_2} = 0.10 \text{ atm}$$

$$P_{\text{NH}_3} = 0.55 \text{ atm} \quad K = \text{value obtained in 1) above}$$

$$0.27 = K = \frac{P_{\text{NH}_3}^2}{P_{\text{N}_2} P_{\text{H}_2}^3} = \frac{(0.55)^2}{(0.10) P_{\text{H}_2}^3}$$

$$P_{\text{H}_2}^3 = \frac{(0.55)^2}{(0.10) (0.27)} = 11.2 \quad \therefore P_{\text{H}_2} = 2.2$$

$$P_{\text{H}_2} = \underline{2.2 \text{ atm}}$$

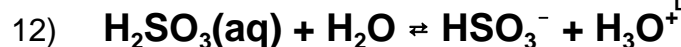


$$[\text{S}^{2-}] = 1.3 \times 10^{-23} \text{ M} \quad K = 8.4 \times 10^{-28}$$

$$8.4 \times 10^{-28} = K = [\text{Pb}^{2+}] [\text{S}^{2-}] = [\text{Pb}^{2+}] (1.3 \times 10^{-23})$$

$$[\text{Pb}^{2+}] = \frac{(8.4 \times 10^{-28})}{(1.3 \times 10^{-23})} = 6.5 \times 10^{-5}$$

$$[\text{Pb}^{2+}] = \underline{6.5 \times 10^{-5}}$$

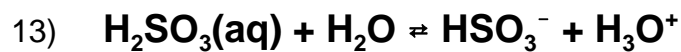


$$[\text{H}_2\text{SO}_3] = 0.10 \text{ M}$$

$$[\text{H}_3\text{O}^+] = 1.0 \text{ M} \quad K = 1.2 \times 10^{-2}$$

$$1.2 \times 10^{-2} = K = \frac{[\text{HSO}_3^-] [\text{H}_3\text{O}^+]}{[\text{H}_2\text{SO}_3]} = \frac{[\text{HSO}_3^-] (1.0)}{(0.10)}$$

$$[\text{HSO}_3^-] = \underline{1.2 \times 10^{-3}}$$

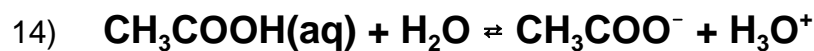


$$\begin{aligned} [\text{H}_2\text{SO}_3] &= 0.10 \text{ M} \\ [\text{H}_3\text{O}^+] &= [\text{HSO}_3^-] \\ K &= 1.2 \times 10^{-2} \end{aligned}$$

$$1.2 \times 10^{-3} = K = \frac{[\text{H}^+][\text{HSO}_4^-]}{[\text{H}_2\text{SO}_4]} = \frac{x^2}{0.10}$$

$$x^2 = 1.2 \times 10^{-3} \quad \therefore \quad x = 3.5 \times 10^{-2}$$

$$[\text{HSO}_3^-] = \underline{3.5 \times 10^{-2}}$$



$$\begin{aligned} [\text{CH}_3\text{COOH}] &= [\text{CH}_3\text{COO}^-] \\ K &= 1.8 \times 10^{-5} \end{aligned}$$

$$1.8 \times 10^{-5} = K = \frac{[\text{CH}_3\text{COO}^-][\text{H}^+]}{[\text{CH}_3\text{COOH}]} = \frac{x[\text{H}^+]}{x} = [\text{H}^+]$$

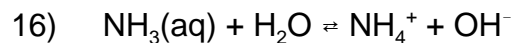
$$[\text{H}_3\text{O}^+] = \underline{1.8 \times 10^{-5}}$$



$$\begin{aligned} [\text{Cl}^-] &= [\text{Ag}^+] \\ K &= 1.8 \times 10^{-10} \end{aligned}$$

$$1.8 \times 10^{-10} = K = [\text{Ag}^+][\text{Cl}^-] = x^2$$

$$[\text{Ag}^+] = \underline{1.3 \times 10^{-5}}$$



$$\begin{aligned} [\text{NH}_3] &= [\text{NH}_4^+] \\ K &= 1.8 \times 10^{-5} \end{aligned}$$

$$1.8 \times 10^{-5} = K = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]} = \frac{x[\text{OH}^-]}{x} = [\text{OH}^-]$$

$$[\text{OH}^-] = \underline{1.8 \times 10^{-5}}$$

**STOP** - Obtain a quiz from your instructor.