Law of equilibrium and Equilibrium constant

41. (d) $\underset{(3-0.75)}{A} + \underset{(1-0.75)}{B} \rightarrow \underset{1.5}{2C}$

$$K = \frac{[C]^2}{[A][B]} = \frac{(1.5)^2}{2.25\times0.25} = \frac{2.25}{2.25\times0.25} = 4.0.$$

42. (d) $6HCHO \overset{K_1}{\rightleftharpoons} C_6H_{12}O_6$ forward reaction

$C_6H_{12}O_6 \overset{K_1}{\rightleftharpoons} 6HCHO$ backward reaction

$K_2 = \left[\frac{1}{K_1}\right]^{1/6}$; $K_2 = \left[\frac{1}{6\times10^{22}}\right]^{1/6}$

$K_2 = 1.6 \times 10^{-4}M$

43. (b) $K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{[0.7]^2}{[0.1][0.1]} = 49$

44. (c) $K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$

$2.37 \times 10^{-3} = \frac{x^2}{[2][3]^3} = x^2 = 0.12798$

$x = 0.358\ M$.

45. (d) $\boldsymbol{A} + \boldsymbol{B} \rightleftharpoons 2C$

$K_c = \frac{[C]^2}{[A][B]} = \frac{[0.6]^2}{[0.2][0.2]} = 9$

46. (a)

H_2	+ I_2	$\rightleftharpoons$ $2HI$
15	5.2	0
(15–5)	(5.2–5)	10

$K_C = \frac{[HI]^2}{[H_2][I_2]} = \frac{10\times10}{10\times0.2} = 50$

47. (c) Rate of backward reaction = Rate of forward reaction

48. (b) $K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(28)^2}{8\times3} = 32.66$

49. (a) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$; $\Delta n = 2 - 2 = 0$

50. (b) The rate of forward reaction is two times that of reverse reaction at a given temperature and identical concentration $K_{\text{equilibrium}}$ is 2 because the reaction is reversible. So $K = \frac{K_1}{K_2} = \frac{2}{1} = 2$.

52. (b) $K_c = \frac{K_f}{K_b} \therefore K_b = \frac{K_f}{K_c} = \frac{10^5}{100} = 10^3$

53. (c) $K_c = \frac{[NO_2]^2}{[N_2O_4]} = \frac{4\times(0.05)^2}{0.05} = 4 \times 0.05 = 0.2$

54. (d) $\underset{at.equil.}{initial} \underset{\substack{2\\1}}{2NH_3} \rightleftharpoons \underset{\substack{0\\1}}{N_2} + \underset{\substack{0\\3}}{3H_2}; K \frac{[N_2][H_2]^3}{[NH_3]^2} = \frac{1\times3^3}{1} = 27$

56. (c) $K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{0.2\times x}{0.4} = 0.5, x = 1$

57. (c) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

30 30 0

30-*x* 30-3*x* 2*x*

2*x* = 10 ; *x* =$\frac{10}{2}$ = 5

$N_2 = 30 - 5 = 25$*litre*

$H_2 = 30 - 3 \times 5 = 15$*litre*

$NH_3 = 2 \times 5 = 10$*litre*

58. (c) $K = \frac{[NO_2]^2}{[N_2O_4]} = \frac{[1.2\times10^{-2}]^2}{[4.8\times10^{-2}]} = 0.3 \times 10^{-2} = 3 \times 10^{-3}$

59. (a) $\frac{22}{100} \times \mathbf{3.2} = \mathbf{0.704}$

∴at equil. moles of HI =3.2–0.704 = 2.496

60. (c) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ ….. (i)

at $t = 0$ $56gm$ $8gm$ $0gm$

= $2mole$ $4mole$ $0mole$

at equilibrium $2 - 1$ $4 - 3$ $34gm$

=1$mole$ = 1$mole$ = 2$mole$

According to eq. (i) 2 mole of ammonia are present & to produce 2 mole of NH_3, we need 1 mole of N_2 and 3 mole of H_2 hence $2 - 1 = 1$ mole of N_2 and $4 - 3 = 1$ mole of H_2 are present at equilibrium in vessel.