Law of equilibrium and Equilibrium constant

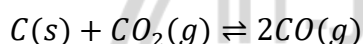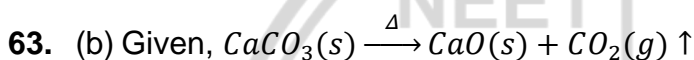**61.** (d) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

For $1dm^3$ $R = k[SO_2]^2[O_2]$

$$R = K \left[\frac{1}{T}\right]^2 \left[\frac{1}{1}\right] = 1$$

For $2dm^3$ $R = K \left[\frac{1}{2}\right]^2 \left[\frac{1}{2}\right] = \frac{1}{8}$
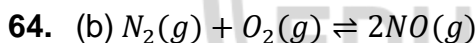
So, the ratio is 8 : 1

62. (d) $K = \frac{[C][D]}{[A][B]} = \frac{\frac{1}{3} \times \frac{1}{3}}{\frac{2}{3} \times \frac{2}{3}} = \frac{1}{4} = 0.25$
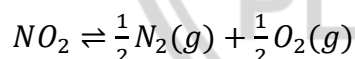
So, $K = 0.25$

63. (b) Given, $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g) \uparrow$

$C(s) + CO_2(g) \rightleftharpoons 2CO(g)$

$Kp_2 = \frac{[pCO]^2}{[pCO_2]}$; $pCO = \sqrt{[Kp_1 \times Kp_2]}$

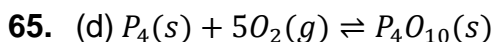$pCO = \sqrt{[8 \times 10^{-2} \times 2]} = \sqrt{16 \times 10^{-2}} = 4 \times 10^{-1} = 0.4$

64. (b) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

$Kc = \frac{[NO]^2}{[N_2][O_2]} = 4 \times 10^{-4}$

$NO_2 \rightleftharpoons \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$

$K_c' = \frac{[N_2]^{1/2}[O_2]^{1/2}}{[NO]} = \frac{1}{\sqrt{Kc}} = \frac{1}{\sqrt{4 \times 10^{-4}}}$

$= \frac{1}{2 \times 10^{-2}} = \frac{100}{2} = 50$

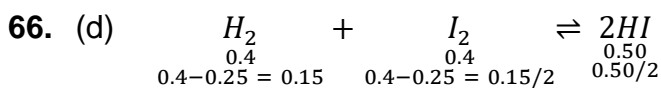**65.** (d) $P_4(s) + 5O_2(g) \rightleftharpoons P_4O_{10}(s)$

$$K_c = \frac{[P_4O_{10}(s)]}{[P_4(s)][O_2(g)]^5}$$

We know that concentration of a solid component is always taken as unity $K_c =$

$\frac{1}{[O_2]^5}$

66. (d)

$$H_2 \quad + \quad I_2 \quad \rightleftharpoons \quad 2HI$$

$$\underset{0.4-0.25 = 0.15}{\overset{0.4}{}} \quad \underset{0.4-0.25 = 0.15/2}{\overset{0.4}{}} \quad \underset{0.50/2}{\overset{0.50}{}}$$

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{\left[\frac{0.5}{2}\right]^2}{\left[\frac{0.15}{2}\right]\left[\frac{0.15}{2}\right]} = \frac{0.5 \times 0.5}{0.15 \times 0.15} = 11.11$$
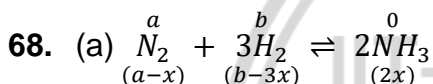
67. (d) $NH_2COONH_4 \rightleftharpoons 2NH_3 + CO_2$

$\alpha = \frac{D-d}{(n-1)d}$ where D is the density (initial)

$D = \frac{mol.wt}{2} = \frac{78}{2} = 39$

$n =$ no. of product $= 3$ $d =$ final density

$\alpha = \frac{39-13}{(3-1)13} = 1$, so $\alpha = 1$

68. (a)

$$\overset{a}{N_2} + \overset{b}{3H_2} \rightleftharpoons \overset{0}{2NH_3}$$
$$\underset{(a-x)}{} \quad \underset{(b-3x)}{} \quad \underset{(2x)}{}$$

50% Dissociation of N_2 take place so,

At equilibrium $\frac{2 \times 50}{100} = 1$; value of $x = 1$

$K_c = \frac{[2]^2}{[1][3]^3} = \frac{4}{27}$ so, $K_c = \frac{4}{27}$

69. (c) The equilibrium constant does not change when concentration of reactant is changed as the concentration of product also get changed accordingly.
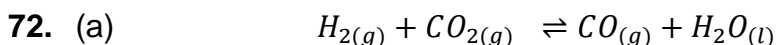
70. (d) We know that $PV = nRT$

P become $\frac{1}{2}P$ & V bcome $2V$ so,

$\frac{1}{2}P \times 2V = PV = nRT$

So there is no effect in equation.

71. (abcd) All options are true for that equilibrium.

72. (a)

$$H_{2(g)} + CO_{2(g)} \rightleftharpoons CO_{(g)} + H_2O_{(l)}$$

Initial conc.	1	1	0	0
At equili	(1− x)	(1 − x)	x	x

$$K_p = \frac{p_{CO} \cdot p_{H_2O}}{p_{H_2} \cdot p_{CO_2}} = \frac{x.x}{(1-x)(1-x)} = \frac{x^2}{(1-x)^2}$$

73   (d)

Explanation:
Let the moles of NH_3 dissociated = y.
From the equation, $2NH_3 \rightarrow 3H_2$
So, 3/2 y = 0.15 $\Rightarrow$ y = 0.10 mole of NH_3 dissociated.
Moles of NH_3 left = 0.60 – 0.10 = 0.50 mole
Moles of N_2 formed = ½ × 0.10 = 0.05 mole
Concentration of NH_3 = 0.50 / 2 = **0.25 mol per dm³**.

74   (b)

Explanation:
Reaction: $2SO_2 + O_2 \rightleftharpoons 2SO_3$
SO_2 used up = 60% of 5 = 3 moles
O_2 used = ½ × 3 = 1.5 moles
SO_3 formed = 3 moles

Remaining:
SO_2 = 5 – 3 = 2 moles
O_2 = 5 – 1.5 = 3.5 moles
SO_3 = 3 moles

Total = 2 + 3.5 + 3 = **8.5 moles**.