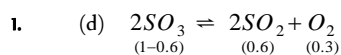


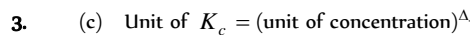
Chemical Equilibrium

SET Self Evaluation Test -8

1. One mole of SO_3 was placed in a litre reaction vessel at a certain temperature. The following equilibrium was established $2SO_3 \rightleftharpoons 2SO_2 + O_2$
- At equilibrium 0.6 moles of SO_2 were formed. The equilibrium constant of the reaction will be [MP PMT 1991]
- (a) 0.36 (b) 0.45
(c) 0.54 (d) 0.675
2. For the following homogeneous gas reaction $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$, the equilibrium constant K_c has the dimension of [CPMT 1990; MP PET/PMT 1998]
- (a) $Conc^{+10}$ (b) $Conc^{+1}$
(c) $Conc^{-1}$ (d) It is dimensionless
3. Consider the imaginary equilibrium
- $$4A + 5B \rightleftharpoons 4X + 6Y$$
- The equilibrium constant K_c has the unit [RPMT 2000]
- (a) Mole litre (b) Litre mole
(c) Mole litre (d) Litre mole
4. For the reaction $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$, true condition is
- (a) $K_p = K_c$ (b) $K_p > K_c$
(c) $K_p < K_c$ (d) $K_c = 0$ but $K_p \neq 0$
5. For the reaction $CO(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO_2(g)$; $\frac{K_p}{K_c}$ is equivalent to [MP PET/PMT 1998; AIEEE 2002]
- (a) 1 (b) RT
(c) $\frac{1}{\sqrt{RT}}$ (d) $(RT)^{1/2}$
6. $2N_2O_5 \xrightarrow{(g)} 4NO_2 + O_2$ what is the ratio of the rate of decomposition of N_2O_5 to rate of formation of NO_2 [DCE 2003]
- (a) 1 : 2 (b) 2 : 1
(c) 1 : 4 (d) 4 : 1
7. The reaction quotient (Q) for the reaction
- $$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$
- is given by $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$. The reaction will proceed from right to left is [CBSE PMT 2003]
- (a) $Q = 0$ (b) $Q = K_c$
(c) $Q < K_c$ (d) $Q > K_c$
8. In the thermal dissociation of PCl_5 , the partial pressure in the gaseous equilibrium mixture is 1.0 atmosphere when half of PCl_5 is found to dissociate. The equilibrium constant of the reaction (K_p) in atmosphere is [JIPMER 2002]
- (a) 0.25 (b) 0.50
(c) 1.00 (d) 0.3
9. HI was heated in a closed tube at $440^\circ C$ till equilibrium is obtained. At this temperature 22% of HI was dissociated. The equilibrium constant for this dissociation will be [MP PET 1988, 92; MNR 1987; UPSEAT 2000]
- (a) 0.282 (b) 0.0796
(c) 0.0199 (d) 1.99
10. The following equilibrium exists in aqueous solution $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$. If dilute HCl is added without a change in temperature, then the [MNR 1987]
- (a) Concentration of CH_3COO^- will increase
(b) Concentration of CH_3COO^- will decrease
(c) Equilibrium constant will increase
(d) Equilibrium constant will decrease
11. Which of the following is not favourable for SO_3 formation
- $$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g); \Delta H = -45.0 \text{ kcal}$$
- [IIT 1984; MP PET 1997]
- (a) High pressure
(b) High temperature
(c) Decreasing SO_3 concentration
(d) Increasing reactant concentration
12. 120 gm of urea are present in 5 litre solution, the active mass of urea is [MP PMT 1994]
- (a) 0.2 (b) 0.06
(c) 0.4 (d) 0.08
13. For the system $2A(g) + B(g) \rightleftharpoons 3C(g)$, the expression for equilibrium constant K is [NCERT 1973; DCE 1999]
- (a) $\frac{[2A] \times [B]}{[3C]}$ (b) $\frac{[A]^2 \times [B]}{[C]^3}$
(c) $\frac{[3C]}{[2A] \times [B]}$ (d) $\frac{[C]^3}{[A]^2 \times [B]}$
14. If concentration of reactants is increased by 'x', then K becomes [AFMC 1997]
- (a) $\ln(K/x)$ (b) K/x
(c) $K+x$ (d) K



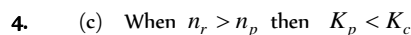
$$K_c = \frac{[SO_2]^2 [O_2]}{[SO_3]^2} = \frac{0.6 \times 0.6 \times 0.3}{0.4 \times 0.4} = 0.675.$$



$$= (\text{mole litre}^{-1})^{\Delta n}$$

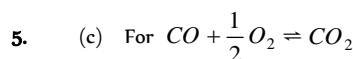
$$\Delta n = 10 - 9 = 1$$

$$\therefore K_c = \text{mol Litre}^{-1}.$$

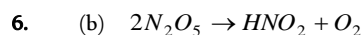


where n_r = no. of moles of reactant

n_p = no. of moles of product.



$$K_p = K_c(RT)^{1-\frac{1}{2}} = K_c(RT)^{-\frac{1}{2}}; \quad \frac{K_p}{K_c} = \sqrt{\frac{1}{RT}}$$

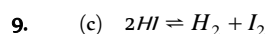
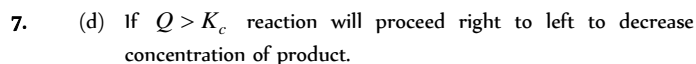


Rate of decomposition of N_2O_5

$$= -\frac{1}{2} \cdot \frac{K[N_2O_5]}{dt}$$

$$\text{Rate of formation of } NO_2 = \frac{1}{4} \cdot \frac{d[NO_2]}{dt}$$

$$\therefore \text{Ratio} = 2 : 1$$

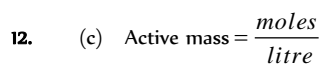
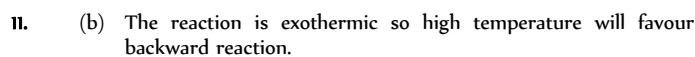
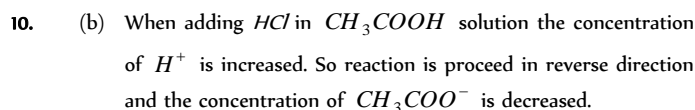


Initial conc. 2 moles 0 0

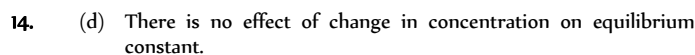
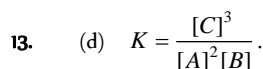
at equilibrium $\frac{22}{100} \times 2$ 0.22 0.22

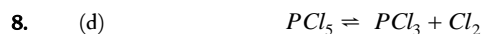
$$= 2 - 0.44 = 1.56$$

$$K = \frac{[H_2][I_2]}{[HI]^2} = \frac{0.22 \times 0.22}{[1.56]^2} = 0.0199.$$



$$= \frac{\text{wt. in gm/molecular wt.}}{V \text{ in litre}} = \frac{120/60}{5} = \frac{2}{5} = .4$$





Initial conc. 1 0 0

At equilibrium 0.5 0.5 0.5

$$K_p = \frac{Px^2}{(1-x^2)} = \frac{1 \times 0.5 \times 0.5}{[1-(0.5)^2]} = \frac{0.5 \times 0.5}{0.75} = \frac{1}{3} = 0.3$$