PREVIOUS YEARS' QUESTIONS — EXERCISE-II

1. When two reactants A and B are mixed to give products C and D, the reaction quotient Q, at the initial stages of the reaction : **[JEE 2000]**

(1) is zero
(2) decrease with time
(3) independent of time
(4) increases with time

2. For the reversible reaction :

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at 500°C. The value of K_p is 1.44×10^{-5}, when partial pressure is measured in atmospheres. The corresponding value of K_c with concentration in mol L^{-1} is : **[JEE 2000]**

(1) $1.44 \times 10^{-5} / (0.082 \times 500)^2$
(2) $1.44 \times 10^{-5} / (8.314 \times 773)^2$
(3) $1.44 \times 10^{-5} / (0.082 \times 500)^2$
(4) $1.44 \times 10^{-5} / (0.082 \times 773)^{-2}$

3. At constant temperature, the equilibrium constant (K_P) for the decomposition reaction. $N_2O_4 \rightleftharpoons 2NO_2$ is expressed by $K_P = 4x^2P/(1 - x^2)$ where P is pressure, x is extent of decomposition. Which of the following statement is true ? **[JEE 2001]**

(1) K_P increases with increase of P
(2) K_P increases with increase of x
(3) K_P increases with decrease of x
(4) K_P remains constant with change in P or x

4. One of the following equilibrium is not affected by change in volume of the flask - **[AIEEE-2002]**

(1) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(2) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(3) $N_2(g) + O_2 \rightleftharpoons 2NO(g)$
(4) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

5. Consider the following equilibrium in a closed container : $N_2O_4(g) \rightleftharpoons 2NO_2(g)$.

At a fixed temperature, the volume of the reaction container is halved. For this change, which of the following statements holds true regarding the equilibrium constant (K_P) and degree of dissociation (α) :

(1) Neither K_P nor α changes **[JEE 2002]**
(2) Both K_P and α change
(3) K_P changes, but α does not change
(4) K_P does not change, but α changes

6. For the reaction equilibrium,

N_2O_4 (g) $\rightleftharpoons$ $2NO_2$(g) the concentration of N_2O_4 and NO_2 at equilibrium are 4.8×10^{-2} and 1.2×10^{-2} mol L^{-1} respectively. The value of K_C for the reaction is- **[AIEEE-2003]**

(1) 3×10^{-3} mol L^{-1}
(2) 3×10^{3} mol L^{-1}
(3) 3.3×10^{2} mol L^{-1}
(4) 3×10^{-1} mol L^{-1}

7. What is the equilibrium expression for the reaction

$P_{4(s)} + 5O_{2(g)} \rightleftharpoons P_4O_{10(s)}$? **[AIEEE-2004]**

(1) $K_C = [P_4O_{10}] / [P_4] [O_2]^5$
(2) $K_C = [P_4O_{10}] / 5 [P_4] [O_2]$
(3) $K_C = [O_2]^5$
(4) $K_C = 1 / [O_2]^5$

8. For the reaction $CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$ the $\frac{K_P}{K_C}$ is equal to - **[AIEEE-2004]**

(1) $\frac{1}{RT}$ (2) RT
(3) $\sqrt{RT}$ (4) 1.0

9. The equilibrium constant for the reaction $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ at temperature T is 4×10^{-4}. The value of K_C for the reaction

$NO_{(g)} \rightleftharpoons \frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)}$ **[AIEEE-2004]**

(1) 2.5×10^{2} (2) 50
(3) 4×10^{-4} (4) 0.02

10. For the reaction $2NO_{2(g)} \rightleftharpoons 2NO_{(g)} + O_{2(g)}$, ($K_c = 1.8 \times 10^{-6}$ at 184° C) (R = 0.831 kJ(mol.K)) When K_p and k_c are compared at 184°C it is found that **[AIEEE-2005]**

(1) K_p is less than K_c
(2) K_p is greater than K_c
(3) Whether K_p is greater than, less than or equal to K_c depends upon the total gas pressure
(4) $K_p = K_c$

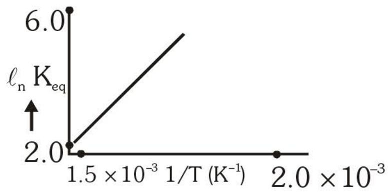
11. The exothermic formation of ClF_3 is represented by the equation **[AIEEE-2005]**

$Cl_{2(g)} + 3F_{2(g)} \rightleftharpoons 2ClF_{3(g)}$; $\Delta H_r = -329$ kJ

Which of the following will increase the quantity of ClF_3 in an equilibrium mixture of Cl_2, F_2 and ClF_3?

(1) Removing Cl_2
(2) Increasing the temperature
(3) Adding F_2
(4) Increasing the volume of the container

12. A schematic plot of $\ell n\ K_{eq}$ verus inverse of temperature for a reaction is shown below. The reaction must be **[AIEEE-2005]**



(1) endothermic
(2) exothermic
(3) highly spontaneous at ordinary temperature
(4) one with negligible enthalpy change

13. Phosphorus pentachloride dissociates as follows, in a closed reaction vessel, **[AIEEE-2006]**

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

If total pressure at equilibrium of the reaction mixture is P and degree of dissociation of PCl_5 is x, the partial pressure of PCl_3 will be-

(1) $\left(\frac{2x}{1-x}\right)P$ (2) $\left(\frac{x}{x-1}\right)P$
(3) $\left(\frac{x}{1-x}\right)P$ (4) $\left(\frac{x}{x+1}\right)P$

14. The equilibrium constant for the reaction $SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$ is $K_C = 4.9\times10^{-2}$.
The value of K_C for the reaction **[AIEEE-2006]**
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ will be
(1) 2.40×10^{-3} (2) 9.8×10^{-2}
(3) 4.9×10^{-2} (4) 416

15. If $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+$; $K_1 = 1.6 \times 10^3$ and $[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$; $K_2 = 6.8 \times 10^3$
The formation constant of $[Ag(NH_3)_2]^+$ is : **[JEE 2006]**
(1) 6.08×10^{-6} (2) 6.8×10^{-6}
(3) 1.6×10^3 (4) 1.088×10^7

16. The equlibrium constants K_{p_1} and K_{p_2} for the reaction $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1 : 9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is **[AIEEE-2008]**
(1) 1 : 36 (2) 1 : 1
(3) 1 : 3 (4) 1 : 9

17. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is :- **[AIEEE-2011]**
(1) 0.3 atm (2) 0.18 atm
(3) 1.8 atm (4) 3 atm

18. The equilibrium constant (K_C) for the reaction $N_2(g) + O_2(g) \longrightarrow 2NO(g)$ at temperature T is 4×10^{-4}. The value of K_C for the reaction.
$NO(g) \longrightarrow \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$ at the same temperature is :- **[AIEEE-2012]**
(1) 50.0 (2) 0.02
(3) 2.5×10^2 (4) 4×10^{-4}

19. One mole of $O_2(g)$ and two moles of $SO_2(g)$ were heated in a closed vessel of one litre capacity at 1098 K. At equilibrium 1.6 moles of $SO_3(g)$ were found. The equilibrium constant K_C of the reaction would be :- **[JEE-MAINS(online)-12]**
(1) 60 (2) 80
(3) 30 (4) 40

20. K_1, K_2 and K_3 are the equilibrium constants of the following reactions (I), (II) and (III), respectively
(I) $N_2 + 2O_2 \rightleftharpoons 2NO_2$
(II) $2NO_2 \rightleftharpoons N_2 + 2O_2$
(III) $NO_2 \rightleftharpoons \frac{1}{2}N_2 + O_2$
The correct relation from the following is : **[JEE-MAINS(online)-12]**
(1) $K_1 = \sqrt{K_2} = K_3$ (2) $K_1 = \frac{1}{K_2} = \frac{1}{K_3}$
(3) $K_1 = \frac{1}{K_2} = K_3$ (4) $K_1 = \frac{1}{K_2} = \frac{1}{(K_3)^2}$

21. The value of Kp for the equilibrium reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ is 2. The percentage dissociation of $N_2O_4(g)$ at a pressure of 0.5 atm is **[JEE-MAINS(online)-12]**
(1) 71 (2) 50
(3) 88 (4) 25

22. 8 mol of $AB_3(g)$ are introduced into a 1.0 dm^3 vessel. If it dissociates as $2AB_3(g) \rightleftharpoons A_2(g) + 3B_2(g)$
At equilibrium, 2mol of A_2 are found to be present. The equilibrium constant of this reaction is :- **[JEE-MAINS(online)-12]**
(1) 36 (2) 3
(3) 27 (4) 2

23. The thermal dissociation equilibrium of $CaCO_3(s)$ is studied under different conditions.
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ **[JEE 2013]**
For this equilibrium, the correct statement(s) is(are)
(1) ΔH is dependent on T
(2) K is independent of the initial amount of $CaCO_3$
(3) K is dependent on the pressure of CO_2 at a given T
(4) ΔH is independent of the catalyst, if any

24. In reaction $A + 2B \rightleftharpoons 2C + D$, initial concentration of B was 1.5 times of $|A|$, but at equilibrium the concentrations of A and B became equal. The equilibrium constant for the reaction is : **[JEE-MAINS(online)-13]**

(1) 4 (2) 6
(3) 12 (4) 8

25. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g), K_1$ (1)

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g), K_2$ (2)

$H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(g), K_3$ (3)

The equation for the equilibrium constant of the reaction

$2\,NH_3(g) + \frac{5}{2}O_2(g) \rightleftharpoons 2NO(g) + 3H_2O(g), (K_4)$

in terms of K_1, K_2 and K_3 is : **[JEE-MAINS(online)-13]**

(1) $\frac{K_1K_3^2}{K_2}$ (2) $\frac{K_2K_3^3}{K_1}$ (3) $\frac{K_1K_2}{K_3}$ (4) $K_1K_2K_3$

26. For the reaction $SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$, if $K_p = K_C(RT)^x$ where the symbols have usual meaning then the value of x is : (Assuming ideality) **[JEE-MAINS-14]**

(1) $\frac{1}{2}$ (2) 1 (3) –1 (4) $-\frac{1}{2}$

27. For the decomposition of the compound, represented as

$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

the $K_P = 2.9 \times 10^{-5}$ atm^3.

If the reaction is started with 1 mol of the compound, the total pressure at equilibrium would be **[JEE-MAINS(online)-14]**

(1) 38.8×10^{-2} atm (2) 1.94×10^{-2} atm
(3) 5.82×10^{-2} atm (4) 7.66×10^{-2} atm

28. The equilibrium constants at 298 K for a reaction $A + B \rightleftharpoons C + D$ is 100. If the initial concentration of all the four species were 1 M each, then equilibrium concentration of D (in mol L^{-1}) will be **[JEE-MAINS-16]**

(1) 1.182 (2) 0.182
(3) 0.818 (4) 1.818

29. The following reaction occurs in the Blast Furnace where iron ore is reduced to iron metal:

$Fe_2O_3(s) + 3CO(g) \rightleftharpoons 2\,Fe(l) + 3CO_2(g)$ **[JEE-MAINS(online)-17]**

Using the Le Chatelier's principle, predict which one of the following will **not** disturb the equilibrium?

(1) Removal of CO_2
(2) Addition of Fe_2O_3
(3) Addition of CO_2
(4) Removal of CO

30. For a reaction taking place in a container in equilibrium with its surroundings, the effect of temperature on its equilibrium constant K in terms of change in entropy is described by **[JEE 2017]**

(1) With increase in temperature, the value of K for exothermic reaction decreases because the entropy change of the system is positive
(2) With increase in temperature, the value of K for endothermic reaction increases because unfavourable change in entropy of the surroundings decreases
(3) With increase in temperature, the value of K for exothermic reaction decreases because favourable change in entropy of the surroundings decreases
(4) With increase in temperature, the value of K for endothermic reaction increases because the entropy change of the system negative

PREVIOUS YEARS QUESTIONS — **ANSWER KEY** — **Exercise-II**

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	4	4	3	4	1	4	1	2	2
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	3	2	4	4	4	1	3	1	2	4
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	1	3	1,2,4	1	2	4	3	4	2	2,3