CHEMISTRY

BOOKS - FULL MARKS CHEMISTRY (TAMIL ENGLISH)

PHYSICAL AND CHEMICAL EQUILIBRIUM

Textual Evaluation Solved Multiple Choice Questions

1. If K_b and K_f for a reversible reactions are 0.8×10^{-5} and 1.6×10^{-4} respectively, the value of the equilibrium constant is,

A. 20

B. 0.2×10^{-1}

C. 0.05

D. None of these

Answer: A

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2. At a given temperature and pressure, the equilibrium constant values for the equilibria

$$3A_2 + B_2 + 2C \overset{K_1}{\Longleftrightarrow} 2A_3BC \text{ and } A_3BC \overset{K_2}{\Longleftrightarrow} \frac{3}{2}[A_2] + \frac{1}{2}B_2 + C$$

The relation between K_1 and K_2 is

A. $k_1 = \dfrac{1}{\sqrt{K_2}}$

B. $K_2 = K_1^{\frac{-1}{2}}$

C. $K_1^2 = 2k_2$

D. $\dfrac{K_1}{2} = K_2$

Answer: B

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3. The equilibrium constant for a reaction at room temperature is K_1 and that at 700 K is K_2. If $K_2 > K_2$, then

A. The forward reaction is exothermic

B. The forward reaction is endothermic

C. The reaction does not attain equilibrium

D. The reverse reaction is exotermic

Answer: A

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4. The formation of ammonia from $N_2(g)$ and $H_2(g)$ is a reversible reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g) + \text{Heat}$

What is the effect of increase of temperature on this equilibrium reaction

A. equilibrium is unaltered

B. formation of ammonia is favoured

C. equilibrium is shifted to the left

D. reaction rate does not change

Answer: C

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5. Solubility of carbon dioxide gas in cold water can be increased by ..... .

A. increase in pressure

B. decrease in pressure

C. increase in volume

D. none of these

Answer: A

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6. Which one of the following is incorrect statement ?

A. for a system at equilibrium, Q is always less than the equilibrium constant

B. equilibrium can be attaned from either side of the reaction

C. presence of catalyst affects both the forward reaction and reverse reaction to the same extent

D. Equilibrium constant varied with temperature

Answer: A

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7. K_1 and K_2 are the equilibrium constants for the reactions respectively.

$N_2(g) + O_2(g) \overset{K_1}{\Longleftrightarrow} 2NO(g)$

$2NO(g) + O_2(g) \overset{K_2}{\Longleftrightarrow} 2NO_2(g)$

What is the equilibrium constant for the required reaction $NO_2(g) \Leftrightarrow \frac{1}{2}N_2(g) + O_2(g)$

A. $\frac{1}{\sqrt{K}_1 K_2}$

B. $(K_1 = K_2)^{\frac{1}{2}}$

C. $\frac{1}{2K_1K_2}$

D. $\left(\frac{1}{K_1K_2}\right)^{\frac{3}{2}}$

Answer: A

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8. In the equilibrium, $2A(g) \Leftrightarrow 2B(g) + C_2(g)$

the equilibrium concentrations of A, B and C_2 at 400 K are $1 \times 10^{-4}M, 2.0 \times 10^{-3}M, 1.5 \times 10^{-4}M$ respectively. The value of K_C for the equilibrium at 400 K is ..... .

A. 0.06

B. 0.09

C. 0.62

D. 3×10^{-2}

Answer: A

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9. An equilibrium constant of 3.2×10^{-6} for a reaction means, the equilibrium is ..... .

A. largely towards forward direction

B. largely towards reverse direction

C. never established

D. none of these

Answer: B

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10. $\frac{K_C}{K_P}$ for the reaction, $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is ..... .

A. $\frac{1}{RT}$

B. $\sqrt{RT}$

C. RT

D. $(RT)^2$

Answer: D

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11. For the reaction, $AB(g) \Leftrightarrow A(g) + B(g)$, at equilibrium, AB is 20% dissociated at a total pressure of P. The equilibrium constant K_p is related to the total pressure by the expression..... .

A. $P = 24K_P$

B. $P = 8K_P$

C. $24P = K_P$

D. none of these

Answer: A

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12. In which of the following equilibrium, K_P and K_C are not equal ?

A. $2NO(g) \Leftrightarrow N_2(g) + O_2(g)$

B. $SO_2(g) + NO_2(g) \Leftrightarrow SO_3(g) + NO(g)$

C. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

D. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

Answer: D

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13. If x is the fraction of PCl_5 dissociated at equilibrium in the reaction, $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ then starting with 0.5 mole of PCl_5, the total number of moles of reactants and products at equilibriumis .....

.

A. $0.5 - x$

B. $x + 0.5$

C. $2x + 0.5$

D. $x + 1$

Answer: B

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14. The values of K_{P1} and K_{P2} for the reactions : $X \Leftrightarrow Y + Z$ and $A \Leftrightarrow 2B$ are in the ratio 9 : 1 if degree of dissociation and initial concentration of X and A be equal then total pressure at equilibrium P_1, and P_2 are in the ratio

A. $36:1$

B. $1:1$

C. $3:1$

D. $1:9$

Answer: A

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15. In the reactio, $Fe(OH)_3(s) \Leftrightarrow Fe^{3+}(aq) + 3OH^-(aq)$, if the concentration of OH^- ions is decreased by $\frac{1}{4}$ times , then the equilibrium concentrationof Fe^{3+} will ..... .

A. not changed

B. also decreased by $\frac{1}{4}$ times

C. increase by 4 times

D. increase by 64 times

Answer: D

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16. Consider the reaction where $K_P = 0.5$ at a particular temperature

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

if the three gases are mixed in a container so that the partial pressure of each gas is initially 1 atm,then which one of the following is true?

A. more PCl_3 will be produced

B. more Cl_2 will be produced

C. more PCl_5 will be produced

D. None of these

Answer: C

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17. Equimolar concentraions of H_2 and I_2 are heated to equilibriumin a 1 litre flask. What percentage of initial concentration of H_2 has reacted at equilibrium if rate constant for both farward and reverse reactions are equal

A. 0.33

B. 0.66

C. $(33)^2\ \%$

D. 0.165

Answer: A

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18. Ina chemical equilibrium,the rate constant for the forward reaction is 2.5×10^2 and the equilibrium constant is 50 . The rate constant for the reverse reaction is ..... .

A. 11.5

B. 5

C. 2×10^2

D. 2×10^{-3}

Answer: B

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19. Which of the following is not a general characteristic of equilibriuminvolving physical process

A. Equilibrium is possible only in a closed system at a given temperature

B. The opposing process occur at the same rate and there is a dynamic but stable condition

C. All the physical processes stop at equilibrium

D. All measurable properties of the system remains constant

Answer: C

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20. For the formation of two moles of $SO_3(g)$ from SO_2 and O_2 the equilibrium constant is K_1. The equilibrium constant for the dissociation of one mole of SO_3 into SO_2 and O_2 is ..... .

A. $\frac{1}{K_1}$

B. K_1^2

C. $\left(\frac{1}{K_1}\right)^{\frac{1}{2}}$

D. $\frac{K_1}{2}$

Answer: C

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21. Match the equilibria with the corresponding conditions ..... .

(*i*) Liquid $\rightleftharpoons$ Vapour	1. Melting point
(*ii*) Solid $\rightleftharpoons$ Liquid	2. Saturated solution
(*iii*) Solid $\rightleftharpoons$ Vapour	3. Boiling point
(*iv*) Solute (s) $\rightleftharpoons$ Solute (Solution)	4. Sublimation point
	5. Unsaturated solution

A.

(i)	(ii)	(iii)	(iv)
1	2	3	4

B.

(i)	(ii)	(iii)	(iv)
3	1	4	2

C.

(i)	(ii)	(iii)	(iv)
2	1	3	4

D.

(i)	(ii)	(iii)	(iv)
3	2	4	5

Answer: B

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22. Consider the following reversible reaction at equilibrium, $A + B \Leftrightarrow C$, If the concentration of the reactants A and B are doubled,then the equilibrium constant willl ..... .

A. be doubled

B. become one fourth

C. be halved

D. remain the same

Answer: D

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23.

$\left[Co(H_2O)_6\right]^{2+}(aq)\ \ (\text{pink})\ \ + 4Cl^-(aq) \Leftrightarrow [COCl_4]^{2-}(aq)(\text{blue}) + 6H_2$

In the above reaction at equilibrium, the reaction mixture is blue in colour at room temperature. On cooling this mixture,it becomes pink in colour. On the basis of this information, which one of the following is true ?

A. $\Delta > 0$ for the forward reaction

B. $\Delta H = 0$ for the reverse reaction

C. $\Delta < 0$ for the forward reaction

D. Sign of the ΔH cannot be predicted based on this information.

Answer: A

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24. The equilibrium constant of the following reactions are :

$N_2 + 3H_2 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO : K_2$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O : K_3$

The equilibrium constant (K) for the reaction:

$2NH_3 + \frac{5}{2}O_2 \overset{K}{\Longleftrightarrow} 2NO + 3H_2O$, will be

A. $K_2^3 \frac{K_3}{K_1}$

B. $K_1 \frac{K_3^3}{K_2}$

C. $K_2 \frac{K_3^3}{K_1}$

D. $K_2 \frac{K_3}{K_1}$

Answer: C

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25. A 20 litre container at 400 K contains CO_2(g) at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the container is now decreased by moving the mavable piston fitted in the container. The maximum volume of the conatiner, when pressure of CO_2 attains its maximum value will be :

Give that : $SrCO_3(s) \Leftrightarrow SrO(s) + CO_2(g)$

$K_p = 1.6atm$

A. 2 litre

B. 5 litre

C. 10 litre

D. 4 litre

Answer: B

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Textual Evaluation Solved Short Answer Questions

1. If there is no change in concentration, why is the equilibrium state considered dynamic ?

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2. For a given reaction at a particular temprature, the equilibrium constant value. Is the value of Q also constnat ? Explain.

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3. What is the relation between K_p and K_C. Give one example for which K_p is equal to K_C.

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4. For a gaseous homogeneous reaction at equilibrium, number of moles of products are greater than the number of moles of reactants. Is K_C is larger or smaller than K_P ?

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5. When the numerical value of the reaction quotient (Q) is greater than the equilibrium constant (K), in which direaction does the reaction proceed to reach equilibrium ?

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6. For the reaction: $A_2(g) + B_2(g) \Leftrightarrow 2AB(g) : \Delta H$ is -ve.

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7. State Le - Chaterlier principle.

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8. Consider the following reactions,

(a) $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ (b) $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$ (c) $S(s) + 3F_2(g) \Leftrightarrow SF_6(g)$

In each of the above reaction find out whether you have in increase (or) decrease the volume to increase th yield of the product.

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9. State law of mass action.

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10. Explain how will you predict the direaction of an equilibrium reaction.

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Textual Evaluation Solved Long Answer Questions

1. Derive a general expression for the equilibrium constant K_P and K_C for the reaction.

$3H_2(g) + N_2(g) \Leftrightarrow 2NH_3(g)$

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2. Write a balanced chemical equation for an equilibrium reaction for which the equilibrium constant is given by expression ?

$$K_C = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$$

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3. What is the effect of added inert gas on the reaction at equilibium at constant volume ?

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4. Derive the ralation between K_P and K_C.

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5. One mole of PCl_5 is heated in one litre closed container. If 0.6 mole of chlorine is found at equilibium, calculate the value of equilibrium constant.

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6. For the reaction : $SrCO_3(s) \Leftrightarrow SrO(s) + CO_2(g)$, the value of equilibrium constnat $K_P = 2.2 \times 10^{-4}$ at $1002K$. Calculate K_C for the reaction.

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7. To study the decomposition of hydrogen iodide, a student fills an evacuated 3 litre flask with 0.3 mole of HI gas and allows the reaction to proceed at $500^{\circ}C$. At equilibrium he found the concentratin of HI which is equal to 0.05 M. Calculate K_C and K_P for this reaction.

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8. Oxidation of nitrogen monoxide was strudied at $200^{\circ}C$ with initial pressure of 1 atm NO and 1 atm of O_2. At equilibrium partial pressure of oxygen is found to be 0.52 atm. Calculate K_P value.

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9. 1 mol of CH_4, 1 mole of CS_2 and 2 mole of H_2S are 2 mol of H_2 are mixed in a 500 mL flask.

The equilibrium constant for the reaction $K_C = 4 \times 10^{-2} mol^2 lit^{-2}$. In which direaction will the reaction proceed to reach equilibrium ?

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10. At particular temperature $K_C = 4 \times 10^{-2}$ for the reaction

$H_2S(g) \Leftrightarrow H_2(g) + \frac{1}{2}S_2(g)$

Calculate K_C for each of the following reaction

(i) $2H_2S(g) \Leftrightarrow 2H_2(s) + S_2(g)$

(ii) $3H_2S(g) \Leftrightarrow 3H_2(g) + \frac{3}{2}S_2(g)$

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11. 28 g of nitrogen and 6 g hydrogen were mixed in a 1 litre closed container. At equilibrim 17 g NH_3 was produced. Calculate the weight of weight of nitrogen, hydrogen at equilibrium.

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12. The equilibtium for the dissociation of XY_2 is given as,

$2XY_2(g) \Leftrightarrow 2XY(g) + Y_2(g)$

if the degree of dissociation x is so small compared to one. Show that $2K_P = Px^3$ where P is the total pressure and K_P is the dissociation equilibrium constant of XY_2.

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13. A sealed container was filled with 1 mol of $A_2(g)$, 1 mol B_2(g) at 800 K and total pressure 1.00 bar. Calculate the amounts of the components in the mixture at equilibrium given that K = 1 for the reaction :

$A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$

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14. Deduce the Vant Hoff's equation.

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15. The equilibrium constant K_P for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is 8.19×10^2 at $298K$ and 4.6×10^{-1} at 498K. Calculate ΔH^0 for the reaction.

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16. The partial pressure of carbon dioxide in the reaction

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$ is 1.017×10^{-3} atm at $500^\circ C$. CalculateK_P at $600^\circ C$ for the reaction. ΔH for the reaction is $181 kJmol^{-1}$ and does not change in the given range of temperature.

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17. Consider the following reaction ,

$Fe^{3+}(aq) + SCN^-(aq) \Leftrightarrow [Fe(SCN)]^{2+}(aq)$

A solution is made with initial Fe^{3+}, SCN^- concentration of $1 \times 10^{-3} M$ and $8 \times 10^{-4} M$ respectively . At equilibrium $[Fe(SCN)]^{2-}$

concentration is $2 \times 10^{-4} M$. Calculate the value of equilibrium constant.

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18. The atmospheric oxidation of NO $2NO(g) + O_2(g) \Leftrightarrow 2NO_2(g)$ was studied with initial pressure of 1 atm of NO and 1 atm of O_2 . At equilibrium , partial pressure of oxygen is 0.52 atm . Calculate K_p of the reaction.

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19. The following water gas shift reaction is an important industrial process for the production of hydrogen gas .

$CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

At a given temperature $K_p = 2.7$. If 0.13 mol of CO , 0.56 mol of water , 0.78 mol of CO_2 and 0.28 mol of H_2 are introduced into a 21 . flask , find out in which direction must the reaction proceed to reach equilibrium .

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20. 1 mol of PCl_5 , kept in a closed container of volume of $1dm^3$ and was allowed to attain equilibrium at 423 K . Calculate the equilibrium composition of reaction mixture .

(The K_C value for PCl_5 dissociation at 423 K is 2)

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21. The equilibrium constant for the following reaction is 0.15 at 298 K and 1 atm pressure .

$N_2O_4(g) \Leftrightarrow 2NO_2(g), \Delta H_f^\circ = 57.32kJmol^{-1}$

The reaction conditions are altered as follows .

(a) The reaction temperature is altered to $100^\circ C$ keeping the pressure at 1 atm , Calculate the equilibrium constant .

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22. One mole of H_2 and mole of I_2 are allowed to attain equilibrium in 1 lit container . If the equilibrium mixture contains 0.4 mole of HI . Calculate the equilibrium constant .

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23. The equilibrium concentration of NH_3, N_2 and H_2 are $1.8 \times 10^{-2} M, 1.2 \times 10^{-2}$ M and $3 \times 10^{-2} M$ respectively . Calculate the equilibrium constant for the formation of NH_3 and N_2 and H_2 . [Hint : M= mol lit^{-1}]

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24. The equilibrium constant at 298 K for a reaction is 100 ,

$A + B \Leftrightarrow C + D$

If the initial concentration of all the four species is 1 M , the equilibrium concentration of D (in mol lit^{-1}) will be

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25. For an equilibrium reaction $K_p = 0.0260$ at $25^\circ C$ and $\Delta H = 32.4 kJ mol^{-1}$. Calculate K_p at $37^\circ C$.

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Additional Questions Solved Choose The Correct Answer

1. Which of the following represents physical equilibrium ?

A. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

B. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

C. $H_2O(I) \Leftrightarrow H_2O(g)$

D. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

Answer: C

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2. Which one of the following is an example of chemical equilibrium ?

A. $2NO(g) + O_2(g) \Leftrightarrow 2NO_2(g)$

B. $I_2(s) \Leftrightarrow I_2(g)$

C. $H_2O(s) \Leftrightarrow H_2O(I)$

D. $NH_2Cl(s) \Leftrightarrow NH_4Cl(g)$

Answer: A

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3. Which one of the following does not undergo sublimation ?

A. Iodine

B. water

C. Camphor

D. Ammonium chloride

Answer: B

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4. At chemical equilibrium ,

A. rate of forward reaction = rate of backward reaction

B. rate of forward reaction $>$ rate of backward reaction

C. rate of forward reaction $<$ rate of backward reaction

D. rate of forward reaction $\propto$ rate of backward reaction

Answer: A

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5. Which of the following is an example of homogeneous equilibrium ?

A. $H_2O(l) \Leftrightarrow H_2O(g)$

B. $CaCO_3(s) \Leftrightarrow CaO(s) + CO(g)$

C. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

D. $2CO(g) \Leftrightarrow CO_2(g) + C(s)$

Answer: C

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6. Which of the following is an example of heterogeneous equilibrium ?

A. Synthesis of HI

B. Dissociation of PCl_5

C. `Acid hydrolysis of ester

D. Decomposition of limestone

Answer: D

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7. Statement I : In dissociation of PCl_5 to PCl_3 and Cl_2, $K_P > K_C$

Statement II : In dissociation of PCl_5, $\Delta n_g = -$ ve and so $K_P > K_C$

A. Statement I & II are correct and statement II is the correct explanation of statement I.

B. Statement I & II are correct but statement II is not the correct explanation of statement I.

C. Statement I is correct but statement II is wrong .

D. Statement I is wrong but statement II is correct .

Answer: C

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8. In the reaction , $2NH_3(g) \Leftrightarrow N_2(g) + 3H_2(g)$

A. $K_P = K_C$

B. $K_P < K_C$

C. $K_P > K_C$

D. $K_P = \frac{1}{K_C}$

Answer: C

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9. In which of the following reaction K_p is equal to K_C ?

A. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

B. $2NH_3(g) \Leftrightarrow N_2(g) + 3H_2(g)$

C. $2H_2(g) + O_2(g) \Leftrightarrow 2H_2O(g)$

D. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2$

Answer: A

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10. In the equilibrium reaction $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$ whose concentration remains constant at a given temperature ?

A. CaO

B. CO_2

C. $CaCO_3$

D. Both (a) and (c)

Answer: D

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11. Consider the following equilibrium reaction and relate their equilibrium constants ....

(i) $N_2 + O_2 \Leftrightarrow 2NO, K_1$

(ii) $2NO + O_2 \Leftrightarrow 2NO_2, K_2$

(iii) $N_2 + 2O_2 \Leftrightarrow 2NO_2, K_3$

A. $K_3 = K_2 = K_1$

B. $K_1 \times K_3 = K_2$

C. $K_1 \times K_2 = K_3$

D. $\frac{K_1}{K_2} = K_3$

Answer: C

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12. Statement I : A pure solid in an equilibrium reaction has the same concentration at a given temperature .

Statement II : The solid does not expand to fill its container and it has same number of moles of its volume .

A. Statement I and II are correct and statement II is the correct explanation of statement of I.

B. Statement I and II are correct but II is not the correct explanation of I.

C. Statement I and II are not correct

D. Statement I is wrong but II is correct

Answer: A

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13. Find the Q value of the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ at an instant where concentration of H_2, I_2 and HI are found to be 0.2 mol L^{-1}, $0.2molL^{-1}$ and $0.6molL^{-1}$ respectively .

A. 48

B. 9

C. 0.9

D. 90

Answer: B

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14. For the reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g) K_C = 0.21$ at 373 K . The concentration of N_2O_4 and NO_2 are found to be 0.125 $moldm^{-3}$ and 0.5 mol dm^{-3} respectively at a given temperature . Predict the direction of the reaction.

A. At equilibrium

B. reverse direction

C. forward direction

D. Both reverse and forward direction

Answer: B

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15. Which of the following does not alter the equilibrium ?

A. catalyst

B. concentration

C. temperature

D. pressure

Answer: A

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16. Statement I . In Haber's process , NH_3 is liquefied and removed . Statement II . In manufacture of NH_3 , liquefied and removal of NH_3 , keeps the reaction moving in forward direction

A. Statement I and II are correct and II is the correct explanation of I .

B. Statement I and II are correct but II is not the correct explanation of I.

C. Statement I is wrong but statement II is correct .

D. Statement I is correct but statement II is wrong .

Answer: A

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17. In which of the following reaction , pressure has no effect ?

A. $N_2 + 3N_2 \Leftrightarrow 2NH_3(g)$

B. $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

C. $N_2O_4(g) \Leftrightarrow 2NO_2(g)$

D. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

Answer: D

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18. Among the following reactions which one has $K_P = K_C$?

A. $N_2O_4 \Leftrightarrow 2NO_2(g)$

B. $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

C. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

D. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

Answer: C

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19. Statement I . Addition of an inert gas at constant volume has no effect on equilibrium .

Statement II . When an inert gas is added , the total number of moles of gases present in the container increases and total pressure also increases , the partial pressure of the products and reactants are unchanged .

A. Statement I and II are correct but statement II is not the correct explanation of I.

B. Statement I and II are correct and Statement II is the correct explanation of I.

C. Statement I is correct but statement II is not correct

D. Statement I is wrong but statement II is correct .

Answer: B

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20. Which one of the following equation is not correct ?

A. $\Delta G^{\circ} = -RT\ln K$

B. $\Delta G^{\circ} = \Delta H^{\circ} - T\Delta S$

C. $-RT\ln K = \Delta H^{\circ} - T\Delta S^{\circ}$

D. $\ln k = \frac{\Delta H^{\circ}}{T} - \frac{\Delta S^{\circ}}{R}$

Answer: D

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21. The equilibrium expressions , $K_C = [CO_2]$ represents the reaction .

A. $C(s) + O_2(g) \Leftrightarrow CO_2(g)$

B. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

C. $2CO(g) + O_2(g) \Leftrightarrow 2CO_2(g)$

D. $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s)$

Answer: B

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22. Hydrogen molecule (H_2) can be dissociated into hydrogen atoms (H) . Which one of the following changes will not increase the number of atoms present at equilibrium ?

A. adding H atoms

B. increasing the temperature

C. increasing the total pressure

D. increasing the volume of the container

Answer: C

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23. What is the expression for K_{eq} for the reaction , $2N_2O(g) + O_2(g) \Leftrightarrow 4NO(g)$?

A. $\frac{[N_2][O_2]}{[NO]}$

B. $\frac{[NO]^4}{[N_2O]^2}$

C. $\frac{[NO]^4}{[N_2O]^2[O_2]}$

D. $\frac{[N_2O]^2[O_2]}{[NO]^4}$

Answer: B

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24. What is the correct expression for the representation of the solubility product constant of Ag_2CrO_4 ?

A. $\left[Ag^+\right]^2\left[CrO_4^{2-}\right]$

B. $\left[2Ag^+\right]\left[CrO_4^2\right]$

C. $\left[Ag^+\right]\left[CrO_4^{2-}\right]$

D. $\left[2Ag^+\right]^2\left[CrO_4^{2-}\right]$

Answer: A

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25. $H_2 + S \Leftrightarrow H_2S$ + energy

In this reversible reaction , select the factor which will shift the equilibrium to the right .

A. adding heat

B. adding H_2S

C. blocking hydrogen gas reaction

D. removing hydrogen sulphide gas

Answer: A

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26. What effect does a catalyst have on the equilibrium position of a reaction ?

A. a catalyst favours the formation of products

B. a catalyst favours the formation of reactants

C. a catalyst does not change the equilibrium position of a reaction

D. a catalyst may favour reactants or product formation , depending upon the direction in which the reaction is written.

Answer: C

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27. A chemist dissolves an excess of $BaSO_4$ in pure water at $25^\circ C$ if its $K_{sp} = 1 \times 10^{-10}$. What is the concentration of barium in the water ?

A. 10^{-4} M

B. 10^{-5} M

C. 10^{-15} M

D. 10^{-6} M

Answer: C

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28. If in a mixture where Q = K , then what happens ?

A. the reaction shift towards products

B. the reaction shift towards reactants

C. nothing appears to happen , but forward and reverse reactions are continuing at the same rate

D. nothing happens

Answer: C

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29. If dissociation for reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ is 20% at 1 atm pressue . Calculate the value of K_C.

A. 0.04

B. 0.05

C. 0.07

D. 0.06

Answer: B

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30. What would be the value of Δn_g for the reaction $NH_4Cl(s) \Leftrightarrow NH_4(g) + HCl(g)$?

A. 1

B. 0.5

C. 2

D. 1.5

Answer: C

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31. Which of the following is not a general characteristic of equilibrium involving physical processes ?

A. Equilibrium is possible only in a close system at a given temperature

B. All measurable properties of the system remains constant

C. All the physical processes stop at equilibrium

D. The opposing processes occur at the same rate and there is dynamic but stable condition

Answer: C

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32. At 500 K , equilibrium constant K_C for the following reaction is 5 ,

$$\frac{1}{2}H_2(g) + \frac{1}{2}t_2(g) \Leftrightarrow HI(g)$$

what would be the equilibrium constant K_C for the reaction

$$2HI(g) \Leftrightarrow H_2(g) + I_2(g)$$

A. 0.44

B. 0.04

C. 25

D. 2.5

Answer: B

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33. For the reaction $2NO_2(g) \Leftrightarrow 2NO(g) + O_2(g)$, $K_C = 1.8 \times 10^{-6}$ at $185^\circ C$. At the same temperature the value of K_C for the reaction . $NO(g) + \frac{1}{2}O_2 \Leftrightarrow NO_2(g)$ is .....

A. 0.9×10^6

B. 7.5×10^2

C. 1.95×10^{-3}

D. 1.95×10^3

Answer: B

View Text Solution

34. Which of the following reaction will be favoured at low pressure ?

A. $N_2 + O_2 \Leftrightarrow 2NO$

B. $H_2 + I_2 \Leftrightarrow 2HI$

C. $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

D. $N_2 + 3H_2 \Leftrightarrow 2NH_3$

Answer: C

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35. Consider the reaction $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$ is a closed container at equilibrium . What would be the effect of addition of $CaCO_3$ on the equilibrium ?

A. increases

B. remains unaffected

C. decreases

D. unpredictable

Answer: B

View Text Solution

36. For the reaction $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ the forward reaction at constant temperature is favoured by .....

A. introducing an inert gas at constant volume

B. introducing PCl_3 (g) at constant volume

C. introducing $PCl_5(g)$ at constant volume

D. introducing $Cl_2(g)$ at constant volume

Answer: C

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37. The equilibrium of the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ will shift to product side when .....

A. $K_p > 1$

B. $Q < K_p$

C. $Q = K_p$

D. $Q = 2K_p$

Answer: B

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38. NO_2 is involved in the formation of smog and acid rain. A reaction that is important in the formation of NO_3 is $O_3(g) + NO(g) \Leftrightarrow O_2(g) + NO_2(g) K_C = 6.0 \times 10^{34}$. If the air over a section of New Delhi contained $1.0 \times 10^6 M$ of $O_3, 1.0 \times 10^{-5} M$ of $NO, 2.5 \times 10^{-4}$ M of NO_2 and $8.2 \times 10^{-3} M$ of O_2 , what can we conclude ?

A. there will be tendency to form more NO and O_2

B. there will be tendency to form more NO_2 and O_2

C. there will be tendency to form more NO_2 and O_3

D. there will no tendency for chane because the reaction is at equilibrium

Answer: B

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39. Haemoglobin (Hb) forms bond with oxygen and given oxyhaemoglobin (HbO_2). This process is partially regulated by the concentration of $H_3O(+)$ and dissolved CO_2 in blood as

$$HbO_2 + H_3O^+ + CO_2 \Leftrightarrow H^+ - Hb - CO_2 + O_2 + H_2O$$

If there is production of lactic acid and and CO_2 during a muscular exercise , then .....

A. more HbO_2 is formed

B. more O_2 is released

C. CO_2 is released

D. both (b) and (c)

Answer: B

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40. In the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3 + xkCal$, one mole of N_2 reacts with 3 moles of H_2 at equilibrium. . Then the value of α (degree of dissociation) is approximately ..... . P is the pressure at equilibrium

A. $\frac{p\left(\sqrt{27K_p}\right)}{8}$

B. $\frac{8P}{K_p\sqrt{27}}$

C. $\frac{p\sqrt{27}}{8K_p}$

D. $\frac{n}{v}$

Answer: A

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Additional Questions Solved Match The Following

1. **Match the following.**

List-I	List-II
A. $I_2(s) \rightleftharpoons I_2(g)$	1. Liquid-vapour equilibrium
B. $H_2O(l) \rightleftharpoons H_2O(g)$	2. Solid-vapour equilibrium
C. $H_2O(s) \rightleftharpoons H_2O(l)$	3. Solid in liquids
D. Sugar (s) $\rightleftharpoons$ Sugar (solution)	4. Solid-liquid equilibrium

A.

A	B	C	D
2	1	4	3

B.

A	B	C	D
1	4	3	2

C.

A	B	C	D
3	2	1	4

D.

A	B	C	D
4	3	2	1

Answer: A

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2.

List-I		List-II
A.	$H_2(g) + I_2(g) \rightleftharpoons 2HI$	1. $\Delta n_g = 1$
B.	$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$	2. $\Delta n_g = 0$
C.	$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$	3. $\Delta n_g = -1$
D.	$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$	4. $\Delta n_g = 2$

A.
A	B	C	D
4	2	1	3

B.
A	B	C	D
2	3	4	1

C.
A	B	C	D
3	1	2	4

D.
A	B	C	D
1	4	3	2

Answer: B

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3.

List-I		List-II
A.	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	1. $\Delta n_g = 2$
B.	$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$	2. $\Delta n_g = -1$
C.	$2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$	3. $\Delta n_g = 1$
D.	$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$	4. $\Delta n_g = 0$

A. $\begin{matrix} A & B & C & D \\ 4 & 1 & 2 & 3 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 3 & 2 & 4 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 3 & 1 & 4 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 1 & 4 & 3 & 2 \end{matrix}$

Answer: A

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4.

	List-I	List-II
A.	Decomposition of water at 500K	1. $K_C = 5$
B.	Oxidation of nitrogen at 1000K	2. $K_C = 57.0$
C.	Dissociation of bromine monochloride at 1000 K	3. $K_C = 4.1 \times 10^{-48}$
D.	Formation of HI at 700K	4. $K_C = 1 \times 10^{-30}$

A. $\begin{matrix} A & B & C & D \\ 3 & 4 & 1 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 2 & 3 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 1 & 4 & 3 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 1 & 3 & 2 & 4 \end{matrix}$

Answer: A

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List-I		List-II	
A.	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	1.	$K_P = p_{CO_2}$
B.	$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$	2.	$K_P = \frac{4x^2}{(a-x)(b-x)}$
C.	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	3.	$K_P = \frac{x^2 \cdot P}{(a-x)(a+x)}$
D.	$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$	4.	$K_P = \frac{4x^2 (a+b-2x)^2}{P^2(a-x)(b-3x)^3}$

5.

A.

A	B	C	D
1	4	2	3

B.

A	B	C	D
2	3	4	1

C.

A	B	C	D
3	2	1	4

D.

A	B	C	D
4	1	3	2

Answer: B

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Additional Questions Solved Fill In The Blanks

1. Transport of oxygen by Hemoglobin in our body is ..... a reaction .

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2. The temperature at which the solid and liquid phases of a substance are at equilibrium is called .....

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3. The temperature at which the liquid and vapour phases are at equilibrium is called .....

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4. ..... law is used to explain gas-solution equilibrium processes.

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View Text Solution

5. In the reaction $2H_2(g) + O_2(g) \Leftrightarrow 2H_2O(g)$, the K_p value is equal to .....

View Text Solution

6. The expression of K_C for the reaction $CO_2(g) + H_2O(l) \Leftrightarrow H^+(aq) + HCO_3^-$ (aq) is equal to .....

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7. The expression of K_p for the reversible reaction $2CO(g) \Leftrightarrow CO_2(g) + C(s)$

View Text Solution

8. The Δn_g value for the reaction $2NO(g) + O_2(g) \Leftrightarrow 2NO_2$ (g) is .....

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9. The correct differential form of van't Hoff equation is .....

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10. For the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$, the equilibrium constant K_C is .....

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11. PCl_5 is kept in a closed container at a temperature of 250 K the equilibrium concentrations . PCl_5, PCl_3 and Cl_2 are 0.045 moles L^{-1} , 0.096 moles L^{-1} , 0.096 moles L^{-1} respectively . The value of equilibrium constant for the reaction $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ will be .....

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12. Equilibrium constant changes with .....

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13. For the reaction $2HI(g) \Leftrightarrow H_2(g) + I_2(g)$ at 720 K , the equilibrium constant value is 50 . The equilibrium constant for the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ at the same temperature will be .....

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14. If equilibrium constant for the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 298 K is 2.54 , the value of equilibrium constant for the reaction $\frac{1}{2}N_2 + \frac{3}{2}H_2 \Leftrightarrow NH_3$ will be .....

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15. The chemical system at equilibrium is not affected by addition of .....

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16. A catalyst will increase the rate of a chemical reaction by lowering the .....

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17. In a closed system $A(S) \Leftrightarrow 3B(g) + 3C(g)$

If partial pressure of C is doubled, then partial pressuer of B will be .....

Time the original value.

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18. Cosider the following gasecous equilbria with equilibria with equilibrium constants K_1 and K_2 respectively

$SO_2 + \frac{1}{2}O_2(g) \Leftrightarrow SO_3(g) - K_1$

$2SO_3(g) \Leftrightarrow 2SO_2 + O_2(g) - K_2$

The equilibrium constants are related as.....

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19. K_p of the following reaction at 700 K is $1.3 \times 10^{-3} atm^{-1}$. The $K_C$at same tempertaure for the reaction $2SO_2(g) + O_2(g) \Rightarrow 2SO_3(g)$ will be.....

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20. For the reaction $PCl_3(g) + Cl_2(g) \Rightarrow PCl_5(g) at 250^\circ C,$ then value of K_c is 26 then the value of K_p on the same temperature wil be .....

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21. In the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$, the value of the eqilibrium constant depends on .....

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22. K_1 and K_2 are velocity constant of forward and backward reaction. The equilibrium constant K_c of the reaction is.....

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23. The equlibirium constant of the reaction $3C_2H \Leftrightarrow C_6H_6$ is 4.0 at temperature of T.K if the equilbrium concentration of C_2H_2 is 0.5 mole L^{-1}, the concentration of C_6H_6 is.....

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24. The equilibrium constant for the reaction $2SO_2 + O_2(g) \Leftrightarrow 2SO_3(g)$ is 5. If the euilibrium constant mixture contains equal moles of SO_3 and SO_2 the equilibrium partial pressure of O_2 gas is .....

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25. In the rection $NH_4(s) \Leftrightarrow (g) + HCl(g)$ the value of Δn_g is .....

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Additional Questions Solved Choose The Odd One Out

1. Choose the odd one out .

A. see -saw

B. tuh of war

C. sublimation of camphor

D. Acid hydrolysis of an ester

Answer: A::C::D

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2. Choose the odd one out .

A. Synthesis of hydrogen iodide

B. Decomposition of calcium carbonate

C. sublimation of iodine

D. dissociation of PCl_5

Answer: A::B::D

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3. Choose the odd one out .

A. synthesis of HI

B. Dissociation of PCl_5

C. Sunthesis of NH_3

D. Decomposition of $CaCO_3$

Answer: A::C::D

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4. Choose the odd one out .

A. $2CO_{(g)} \Leftrightarrow CO_{2(g)} + C_{(s)}$

B. $Ag_2O_s + 2NH_{3(aq)} \Leftrightarrow 2AgNO_{3(aq)} + H_2O_i$

C. $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

D. $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

Answer: A::B::C

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5. Choose the odd one out .

A. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_g$

B. $2CO_g \Leftrightarrow CO_{2(g)} + C_{(s)}$

C. $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

D. $H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}$

Answer: A::B::C

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Additional Questions Solved Choose The Correct Pair

1. Choose the corrent pair.

A. $Q = K_c$: Reaction is in equilibrium state

B. $Q < K_c$: Reaction proceed in reverse direction

C. $Q > K_c$: Reaction proceed in both directions

D. $Q = K_C$: Reaction proceed in both directions

Answer: A::B::C

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2. Choose the corrent pair.

A. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)} : \Delta n_g = -ve$

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)} : \Delta n_g = -ve$

C. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)} : \Delta n_g = +ve$

D. $2NH_{3(g)} \Leftrightarrow N_{2(g)} + 3H_{2(g)} : \Delta n_g = +ve$

Answer: A::B::C::D

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3. Choose the corrent pair.

A. $K_p = K_c$: Sythensis of HI

B. $K_p > K_c$, Dissociation of PCl_5

C. $K_p < K_c$: sythesis of SO_3

D. $K_p < K_c$: Synthesis of NH_3

Answer: C

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Additional Questions Solved Choose The Incorrect Pair

1. Choose the incorret pair.

A. Acid hydrolysis of an ester : Homogeneous equilbrium

B. Synthesis of Ammonia : Homogeneous equilibrium

C. Decomposition of $CaCO_3$: Homogeneous equilbrium

D. Synthesis of HI : Homogeneous equilibrium

Answer: A::B::C::D

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2. Choose the incorret pair.

A. $\Delta n_g = 0 : H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$

B. $Det < an_g = 2 : 2NH_{3(g)} \Leftrightarrow N_{2(g)} + 3H_{2(g)}$

C. $\Delta n_g = 0 : PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

D. $\Delta n_g = 0 : PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

Answer: A::B::C::D

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Additional Questions Solved Assertion And Reason

1. Assertion (A): Chemical equilibrium is in a state of dynamic equilibrium. Reason (R): At equilibrium the forward and backward reactions are proceeding at the same rate and no macroscopic change is observed.

A. Both (A) and (R) are correct and (R) is the correct explanation of (A),

B. Both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. (A) is correct but (R) is wrong

D. (A) is wrong but (R) is correct

Answer: A

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2. Assertion (A): In Haber's process, NH_3 is liquefied and removed.

Reason (R): Because of the reaction keeps moving in the backward direction

A. Both (A) and (R) are correct and (R) is the correct explanation of (A),

B. Both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. (A) is correct but (R) is wrong

D. (A) is wrong but (R) is correct

Answer: B

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3. Assertion (A): In the dissociation of PCI_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCI_5

Reason (R) : Helium remove Cl_2 from the field of aciton.

A. Both (A) and (R) are correct and (R) is the correct explanation of (A),

B. Both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. (A) is correct but (R) is wrong

D. (A) is wrong but (R) is correct

Answer: D

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Additional Questions Solved Choose The Incorrect Statement

1. Choose the incorret statement.

A. In equilbirium mixture of ice and water kept in perfectly in perfectly insuled flask. Mass of ice and water does not change with time

B. The intensity of red colour increase when oxalic acid is added to a solution containing iron (III) nitrate and potassium thiocyanate

C. On addition of catalyst the equilibrium constant value is not affected

D. Equilibrium constant for a reaction with negative ΔH value decrease as the timperature increases.

Answer: A::C::D

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Additional Questions Solved 2 Mark Questions

1. Define the state of equilibrium.

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2. What are the different types of equilibrium? Explain with example?

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3. Explain about the equilibrium involving dissolution of solid in liquid with suitable example,

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4. How is a gas-solution equilibrium exist?

View Text Solution

5. What is meant by active mass? Give its unit.

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6. Show that $K_p = K_c$ with two examples

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7. Give two example of equilibrium reactions where $K_p > K_c$.

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8. When will be $K_p < K_C$? Give two example

View Text Solution

9. Write the K_c for the reaction $CO_2(g) + H_2O(l) \Leftrightarrow H^+_{(aq)} + HCO_3^-$

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10. If $A \overset{K_1}{\Longleftrightarrow} B, B \overset{K_2}{\Longleftrightarrow} C, C \overset{K_3}{D}$ What is the value of K_4 in $A \Leftrightarrow D$

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11. Write the K_p and K_c for the following reactions.

$(i) 2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

(ii) $2CO(g) \Leftrightarrow CO_2 + C(s)$

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12. Explain how the equilibrium constant K_c predict the extent of a reaciton.

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13. $2H_2O(g) \Leftrightarrow 2H_2(g) + O_2(g) K_C = 4.1 \times 10^{-48}$ At 599 K

$N_2(g) + O_2(g) \Leftrightarrow \Leftrightarrow 2NO(g) K_c = 1 \times 10^{-30}$ at 1000 K

Predict the extent of the above two reactions.

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14. Expolain about the extent of reaction of dissociation of bromine mono chloride at 1000 K.

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15. What is the K_c value for formation of HI at 700 K ? Predict the extent of the reaction ?

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16. What is the K_c value of formation of HCl at 300 K ? Explain it.

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17. $2CO(g) + O_2(g) \Leftrightarrow 2CO_2(g)$ at 1000 K . What is theK_C for this reaction ? Predict the extent of this reaction.

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18. Define Q value for a chemical equilibrium reaction.

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19. Explain the diagrammatic expression about the direction of reaction.

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20. Explain about the effect of catalyst in an equilibrium reaction ?

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21. For the following equilibrium , $K_c = 6.3 \times 10^{14}$ at 1000 K

$NO(g) + O_3(g) \Leftrightarrow NO_2(g) + O_2(g)$

Both the forward and reverse reactions in the equilbrium are elementary bimolecular reactions what is K_C for the reverse reaction?

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22. Explain : Why pure liquids and solids can be ignored while writing the value of equilibrium constants.

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23. A sample of HI(g) is placed in a flask a pressure of 0.2 atm. At equilibrium partial pressure of HI(g) is 0.04 atm. What is K_p for the given equilibrium ?

$2HI(g) \Leftrightarrow H_2(g) + I_2(g)$

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24. The equilibrium constant expression for a gass reaciton is

$$K_C = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$$

Write the balaced chemical equation corresponding to this expression.

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25. Predict which of the following will have appreciable concentration of reactions and produst:

$(a) Cl_2(g) \Leftrightarrow 2Cl(g), K_c = 5 \times 10^{-39}$

(b) $Cl_2(g) + 2NO(g) \Leftrightarrow 2NOCl(g) : K_c = 3.7 \times 108$

(c) $Cl_2(g) + 2NO_2Cl(g), K_c = 1.8$

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26. Write the equilibrium constant (K_c) expression for the following reactions.

$(i) Cu^{2+}(aq) + 2Ag(s) \Leftrightarrow Cu(s) + 2Ag^+(aq)$

(ii) $4Hcl(g) + O_2(g) \Leftrightarrow 2Cl_2(g) + 2H_2O(g)$

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27. The value of Ke for the raction $2A \Leftrightarrow B + C$ is 2×10^3 . At a given time . The composition of reaction mixture is $[A] = [B] = [c] = 3 \times 10^{-4} M$. In which direciton the reaction will proceed ?

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28. Dihydrogen gas is obtained from natural gas by partial oxidation with steam as per following endothermic reaction:

$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) \Leftrightarrow CO(g) + 3H_2(g)$

(a) Write an expression for K_p for the above reaction.

(b) How will the values of K_p and composition of equilibrium mixture bge affected by (i) increasing the pressure (ii) increasing the temperature (iii) using a catalyst ?

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Additional Questions Solved 3 Mark Questions

1. Explain about the formation of solid-liquid equilibrium with suitable example.

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2. How is liquid -vapour equilibrium exist ?

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3. What is meant by boiling point and condensation point of the liquid?

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4. Define melting point (or) freezing point of the substance

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5. Illustrate the formation of solid-vapour equilibrium with suitable example

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6. Give threee examples for solid vapour equilbrium.

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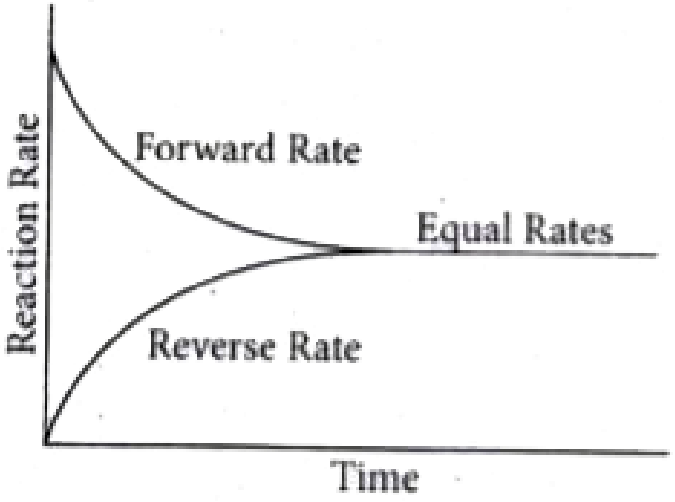
7. Explain the following diagrams.



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8. What are the types of chemical equilibrium? Explain with suitable example.

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9. Write the value of K_p and K_C equation for $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

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10. Cosider the following equilibrium reaction and relate their equilibrium constants

$(i) N_2 + O_2 \Leftrightarrow 2NO, K_1$

(ii) $2NO + O_2 \Leftrightarrow 2NO_2, K_2$

$(iii) N_2 + 2O_2 \Leftrightarrow 2NO_2, K_3$

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11. Explain the effect of concentration in an equilibrium state?

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12. Consider the reaction, $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$. Explain the effect of pressure on this equilibrium reaction.

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13. Why pressure has no effect on the synthesis of HI?

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14. Explain the effect of temperature on the following equilbrium reaction

.

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_2(g) \Delta H = -92.2Kj.$

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15. How does oxygen exchanges between maternal and fetal is provided by the maternal blood in the placenta woman ?

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16. What is K_c for the follwoing reaction in state of equilibrium ?

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

Given $[SO_2] = 0.6M, [O_2] = 0.82M,$ and $[SO_3] = 1.90M$

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17. At a certain temperature and total pressure of 10^5 Pa. iodine vapours conatain 40% by volume of idine atoms in the equilibrium $I_2(g) \Leftrightarrow 2I(g)$ Calculate K_p for the equilibrium.

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18. A mixture of 1.57 mol of N_2 1.92 mol of H_2 and 8.13 mol of NH_3 is introduced into a 20 L reaction vessel at 500 K . At this temperature, the equilibrium constant K_c for the reactin.

$N_2(g) + 3H_2(g)j \Leftrightarrow 2NH_3(g)is1.7 \times 10^{-2}$

Is this reaction at equilibriuim ? if not , what is the direction of net rection ?

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19. What is effect of :

(i) addition of H_2 (ii) addition of CH_3OH (iii) removal of CO (iv) removal of CH_3OH On the euilibrium $2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

A. Equilibrium will be shifted in the forward direction.

B. Equilibrium will be shifted in the backward direction.

C. Equilibrium will be shifted in the backward direction.

D. Equilibrium will be shifted in the forward direction

Answer: A

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20. At 473 K, the equilibrium constant K_c for the decomposition of phosphorus pentachloride $(PCl_5) is 8.310^{-3}$

.If decomposition proceeds as :

$PCl_5(g) \Leftrightarrow PCl_3 + PCl_3(g) + Cl_2(g), \Delta H = +124.0 Kjmol^{-1}$

(a) Write an expression for K_C for the reaction.

(b) What is the value of K for the reverse reaction at the same temperature.

(c) What would be the effect on K_C if(i) More of PCl_3 is added (ii) Temperature is increased

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21. Dihydrogen gas. used in Haber's process is produced by reacting methane from natural gas with high temperature stam. The first stage of

two stage reaction involves the formation of CO and H. In second stage, CO formed in first stage is reacted with more steam in water gas shift reaction.

$CO(g) + H_2O(g) \Leftrightarrow CO_2 + H_2(g)$

If a rection vessel at 400° is charged with an equimolar mixture of CO and steam so that $P_{CO} = P_{H_2O} = 4.0$ bar , what will be the partial pressure of H_2 at equilibrium ? $K_p = 0.1$ at 400°

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22. The value of K_c for the reaction $3O_2(g) is 2.0 \times 10^{-50}$ and $25^\circ C$. If equilbrium concentration of O_2 in $25^\circ C$ is 1.6×10^{-2} . What is the concentration of O_3 ?

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23. The reaction $CO(g) + 3H_2(g) \Leftrightarrow CH_4(g) + H_2O(g)$ is at equilibrium at 1300 K in a 1K flask. It also contain 0.30 mol of CO, 0.10 mol of H_2 and 0.02 mol of H_2O and unknown amount of CH_4 in the flask.

Determine the cocentration of CH_4 in the mixture . The equilbrium constant, K_C for the reaction at the given temperature is 3.90.

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24. The following concentration were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at 500 K .

$[N_2(g)] = 1.5 \times 10^{-2} M$

$[H_2(g)] = 3.0 \times 10^{-2} M$

$[NH_3] = 1.2 \times 10^{-2} M.$

Calculate equilibrium constant.

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25. In the reaction $A + B \Rightarrow C + D$, what will happen to the equilibrium is concentration of A is increased ?

The equilibrium constant for a reaction is 2×10^{-23} at $25^\circ C$ and 2×10^{-2} at 50°. Is the reaction endothermic or exothermic ?

(c) Mention at least three ways by which the concetration of SO_3 can be

increased in the following reaction in a state of equilibrium.

$2SO_2(g) + O_2(g) \Leftrightarrow (g)$

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26. $PCl_5, PCl_3 \text{and } Cl_2$ are at eqilibrium at 500 K and having concentration 1.59 M PCl_3, 1. 59 M Cl_2 and 1.41 M PCl_5 Calculate K_C for the reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

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27. Give the equilibrium

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$ wih $K_p = 0.15$ atm at 298 K

(a) What is K_p using pressure in torr ?

(b) What is K_C using units of moles per litre.

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Additional Questions Solved 5 Mark Questions

1. Derive the value of equilibrium constants K_p and K_c for a general reaction

$xA + yB \Leftrightarrow lC + mD$

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2. Derive the values of K_C and K_P for the synthesis of HI.

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3. Derive the values of K_p and K_C for dissociation of PCl_5 .

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4. At certain temperature and under a pressure of 4 atm , PCl_5 is 10 % dissociated . Calculate the pressure at which PCl_5 will be 20 % dissociated at temperature remaining constant .

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Additional Questions Solved Numerical Problems

1. Find the value of K_c for each of the following equilibria from the value of K_p

(a) $2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g), K_P = 1.8 \times 10^{-2}$ atm at 500 K

(b) $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g), K_P = 167$ atm at 1073 K

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2. What is the equilibrium concentration of each of the substances in the equilibrium when the initial concentration of 1Cl was 0.78 M ?

$2ICl(g) \Leftrightarrow I_2(g) + Cl_2(g), K_C = 0.14$

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3. Equilibrium constant K_c for the reaction , $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 500 K is 0.061, At particular time ,the analysis shows that the composition of the reaction mixture is 3.0 mol L^{-1} of H_2, 0.50 mol L^{-1} of NH_3 . Is the reaction at equilibrium ?

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