ILM – KI-DUNYA

CH NO.9

CLASS-10TH

CHEMISTRY
Time allowed: 15 Minutes

Paper: (Objective Type)
Maximum Marks: 12

Note: You have four choices for each objective type questions as A, B, C and D. The choice which you think is correct fill that circle to front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

Q.1	QUESTIONS	(A)	(B)	(C)	(D)
1	At dynamic equilibrium.	The reaction stops to proceed	The amounts of reactants and products are equal.	The speed of the for ward and reverse reactions are equal	The reactions can no larger be reversal.
2	For a reaction between PCl_3 and Cl_2 to from PCl_5 the units of K_c are.	Mol dm^{-3}	Mol^{-1} dm^{-3}	Mol^{-1} dm^3	Mol dm^3
3	A reverse reaction is one that	Which proceeds from left to right	In which reaction reacts to form Products.	Which slow down gradually	Which speeds up gradually
4.	In an irreversible reaction dynamic equilibrium.	Never establishes	Establish before the completion of reaction.	Establishes after the completion of reactions.	Establishes readily.
5	Equilibrium mixture will contain. $N_2O_4 \rightleftharpoons 2NO_2$ $Kc = 0.211$	Only N_2O_4	Only NO_2	NO_2 and N_2O_4 is reasonable amount	NO_2 is large amount.
6	Who proposed 'Law of mass action'?	Newton	Boyles	Guldberg and waage	Lavoisier
7.	In the lime kiln the reaction $CaCO_3$ ☐ CaO $+CO_3$. Go to completion because.	Of high temperature	CaO is more stable than $CaCO_3$	CO_2 escapes continuously	CaO is not dissociated.
8.	The characteristics of reversible reactions are the following accept.	Products never recombine to form reactor.	They proceed in both ways.	The have a double arrow between reactants and Products.	They never complete.
9.	When the magnitude of Kc is very small it indicates.	Equilibrium will never establish	All reactants will be converted to products.	Reactions will go to Completion.	The amount of products will be negligible.
10.	When a system is at equilibrium states.	The concentration of reactants and products becomes equal	The opposing reactions	The rate of the reverse reaction becomes very low	The rates of the forward and reverse reaction become equal.
11.	Which one of the following statements is not correct about action mass?	Rate of reaction is directly proportional	Active mass is taken in molar concentration	Active mass is represented by	Active mass means total mass of substance
12.	Reactions which have comparable amounts of reactants and products at equilibrium state have	Very small Kc value	Very large Kc value	Moderate Kc value	None of these

	A B C D		A B C D		A B C D		A B C D		A B C D
1	A B ● D	4	● B C D	7	A B ● D	10	A B C ●	13	A B C D
2	A B ● D	5	A B ● D	8	● B C D	11	A B C ●	14	A B C D
3	A B C ●	6	A B ● D	9	A B C ●	12	A B ● D	15	A B C D

نوٹ: معروضی سوال نامے کو توجہ سے پڑھیں اور ہر MCQ کی درست آپشن A,B,C,D کو پین کی سیاہی یا مار کر سے اس طرح پُر کریں کہ سیاہی دائرے سے باہر نہ نکلے۔ ایک سے زیادہ دائروں کو پُر کرنے یا کاٹ کر پُر کرنے کی صورت میں مذکورہ جواب غلط تصور ہوگا۔

ILM – KI-DUNYA

TEST NO. 1
CH NO. 9

CLASS-10TH

CHEMISTRY

Time Allowed: 1:45 hours

Paper. (Essay Type)
Maximum Marks:48

(PART – I)

2. Write any five short parts of the following. 10

(i) How direction of a reaction can be predicted?
(ii) What is relationship between active mass and rate of reaction?
(iii) Define chemical equilibrium state.
(iv) How is dynamic equilibrium established?
(v) What is large numerical value of Kc.
(vi) Compare macroscopic properties of forward reaction and Reverse Reaction.
(vii) Define irreversible reaction. With examples.
(viii) Define reversible reactions. With examples.

3. Write any five parts of the following. 10

(i) Write down the use of Nitrogen?
(ii) How can you know that a reaction has achieved an equilibrium state?
(iii) Define dynamic equilibrium state.
(iv) Why at equilibrium state reaction does not stop?
(v) Derive equilibrium constant expression for the synthesis of ammonia from nitrogen and hydrogen.
(vi) Define equilibrium constant.
(vii) Derive equilibrium constant expression for ionization of hydrochloric acid?
(viii) Define law of mass action.

4. Write any five parts of the following. 10

(i) Write two characteristics of dynamic equilibrium?
(ii) If reaction quotient Qc of a reaction is more than Kc. What will be the direction of the reacting?
(iii) Write down the use of oxygen.
(iv) How the active mass is represented?
(v) Write down the component of atmosphere and its % age.
(vi) Why is equilibrium state attainable from either way?
(vii) An industry was established based upon a reversible reaction. It failed achieve products on commercial level. Can you point out the basic reasons its failure being a chemist?
(viii) If a reaction has large value of K_c will it go to completion and why?

(PART – II)

Note:- Attempt any Two questions.

5. (a) Describe a reversible reaction. With the help of an examples and graph. 5

(b) For a reaction between PCl_3 and Cl_2 to form PCl_5, the equilibrium constant is 0.13 $mol^{-1}dm^3$ at apar ticular temperature. When the equilibrium concentrations of PCl_3 and Cl_2 are 10.0 and 9.0 mol dm^{-3},respectively, what is the equilibrium concentration of PCl_5? 4

6. (a) State the Law of mass action and derive the expression for equilibrium. Constant for general reactions. 5

(b) Write two macroscopic characteristics of dynamic equilibrium. 4

7. (a) How can you predict the direction of a reaction by knowing the numerical value of a chemical chemical equilibrium constant of a reaction? 5

(b) Hydrogen Iodide decomposes to form hydrogen and iodine. If the equilibrium concentration of HI is 0.078 mol dm^{-3}. H_2 and I_2 is same 0.011 mol dm^{-3}. Calculate the equilibrium constant Value for this reversible reaction. 4

CHEMISTRY

(PART - I)

Question : 2

Write any five short parts of the following.

(i) **How direction of a reaction can be predicted ?**

Direction of chemical reaction at any particular moment can be predict by knowing the numerical values of equilibrium constant of a chemical reaction and comparing this with reaction qutient.

(ii) **What is relationship between active mass and rate of reaction ?**

The rate of reaction is directly proportional to the active mass of a substance. Generally active mass is considered as the molar concentration having units of mole dm^{-3} expressed as square brackets [].

(iii) **Define chemical equilibrium state.**

Chemical Equilibrium State :-

When the rate of forward reaction takes place at the rate of reverse reaction, the composition of reaction mixture remains constants, it is called chemical equilibrium state.

(iv) **How is dynamic equilibrium established?**

If a reversible reaction is allowed to continue for considerable time without changing the conditions and rates of forward reaction and rate of reverse reaction becomes equal but take place in opposite directions this is called dynamic equilibrium.

(v) **What is large numerical value of K_c?**

The large numerical value of K_c indicates that at equilibrium

position the reaction mixture consists of almost all products and reactants are negligible.

$$2CO + O_2 \rightleftharpoons 2CO_2$$

$$K_c = 2.2 \times 10^{22}$$

(vi) Compare microscopic properties of forward reaction and Reverse reaction.

	Forward Reaction	Reverse Reaction
1-	It slows down gradually.	It speeds up gradually.
2-	It takes place from left to right.	It takes place from right to left.

(vii) Define irreversible reactions. With examples.

Irreversible Reactions:-

The reactions in which products do not recombine to form reactants are called irreversible reactions.

For example:

$$2H_2 + O_2 \longrightarrow 2H_2O$$

(viii) Define reversible reactions. With examples.

Reversible Reactions:-

The reactions in which products can recombine to form reactants are called reversible reactions.

For example:

$$H_2 + I_2 \rightleftharpoons 2HI$$

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Question : 3

Write any five parts of the following.

(i) Write down the use of Nitrogen?

Nitrogen can be used to replace air and eliminate oxidation of materials. Its most important use is in creating ammonia, which in turn is used to make fertilizer and explosives.

(ii) **How can you know that a reaction has achieved an equilibrium state?**

If the value of forward becomes equal to reverse the, reaction is said to in equilibrium state thus, $Q_c = K_c$ such reactions have comparable amounts of reactants and products at equilibrium position. Another indication is free energy change is zero.

(iii) **Define dynamic equilibrium state?**

Dynamic Equilibrium State:-

The state at which reaction does not stop, only the rate of forward and reverse reactions become equal to each other but takes place in opposite direction. It is called dynamic equilibrium state.

(iv) **Why at equilibrium state reaction does not stop?**

at equilibrium state reaction does not stop, because forward and reverse reactions keep on taking place at the same rate but in opposite direction.

(v) Derive equilibrium constant expression for the synthesis of ammonia from nitrogen and hydrogen.

The reaction for synthesis of ammonia is as:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

$$R_f = k_f[N_2][H_2]^3$$

$$R_f = k_f[NH_3]^2$$

The expression for equilibrium constant of reaction is

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

(vi) Define equilibrium constant.

Equilibrium Constant:-

Equilibrium constant is a ratio of the product of concentration of products raised to the power of coeffient

to the product of concentration of reactants raised to the power of coefficient as expressed in the balanced chemical equation.

$$K_c = \frac{\text{Product of concentration of products raised to the power of coefficients}}{\text{Product of concentration of reactants raised to the power of coefficients}}$$

(Vii) Derive equilibrium constant expression for ionization of hydrochloric acid?

Hydrochloric acid ionizes in aqueous solution as:

$$HCl \rightleftharpoons H^+ + Cl^-$$

$$K_c = \frac{[H^+][Cl^-]}{[HCl]}$$

(Viii) Define law of mass action.

Law of Mass Action :-

According to this law "the rate of which a substance reacts is directly proportional to its active mass and the rate of a reaction directly proportional to the product active masses of the reacting substances."

Question : 4

Write any five parts of the following.

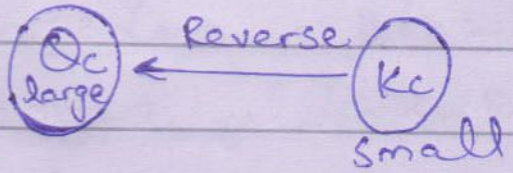
(i) Write two characteristics of dynamic equilibrium?

1- An equilibrium is achievable only in closed system.

2- An equilibrium state is attainable from either way i.e starting from reactant or from product.

(ii) If reaction quotient Q_c of a reaction is more than K_c. What will be the direction of the reacting?

If reaction quotient Q_c is large than equilibrium K_c the reaction will go from right to left



(iii) Write down the use of oxygen.

Oxygen is used to prepare

sulphur dioxide. Sulphur dioxide is used in preparation of sulphuric acid (H_2SO_4).

(iv) How the active mass is represented?

Active mass is considered molar concentration. It has a unit of mole dm^{-3} and expressed as square brackets [].

(v) Write down the component of atmosphere and its %age.

The two major components of atmosphere are nitrogen and oxygen gases. Both of these gases constitute 99% of the atmosphere.

(vi) Why is equilibrium state attainable from either why?

The concentration of specie at equilibrium stage attain the same values whether we start the reaction in the vessel in the forward direction or

backward direction.

(Vii) An industry was established based on reversible reaction. It failed to achieve products on commercial scale. Can you point basic reasons of its failure being a chemist?

There are following certain reasons of failure of reaction.

1. Reaction is reversible so, products recombine to form reactants and dynamic equilibrium is established.
2. Reaction condition like temperature, pressure and catalyst are not satisfied.

(Viii) If a reaction has large value of K_c, will it go to completion and why?

Those reactions that have large K_c, value proceed almost forward so, more of the products are required to attain equilibrium.

(PART - II)

Question : 5(a)

Describe a reversible reaction. With the help of an example and graph.

Definition:

"Reversible reactions are those in which products recombine to form reactants. They proceed in both ways i.e forward and reverse."

Explanation:

Reversible reaction occur in both direction i.e forward as well as backward. These reactions never go to completion. Reversible reaction is one which can be made to proceed in either direction depending the condition.

Representation:

They are represented by a double arrow $\rightleftharpoons$ between

the reactants and products.

Example:

Consider formation of hydrogen Iodide

$$H_2 + I_2 \rightleftharpoons 2HI$$

Forward Reaction:

Iodine I_2 is of purple colour. When hydrogen and Iodine vapours are heated in a closed flask as a result colourless Hydrogen Iodide is formed as.

$$H_2 + I_2 \xrightarrow{\Delta} 2HI$$

colourless purple colourless

This reaction is called forward reaction.

Reverse Reaction:

When hydrogen Iodide is heated in a closed flask, purple colour appears which is the indication of Iodine formation such as.

$$2HI \xrightarrow{\Delta} H_2 + I_2$$

colourless ↓ purple ↓

This reaction is reverse reaction. So, Hydrogen Iodide is a reactant and hydrogen and Iodine vapours are products.

Graphical Explanation:

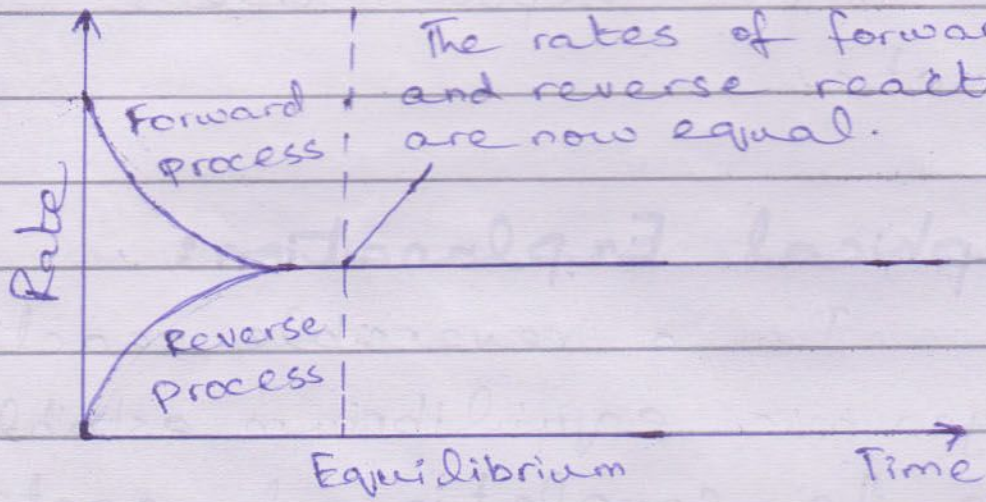
In a reversible reaction a dynamic equilibrium established before the completion of reaction.

Dynamic Equilibrium:

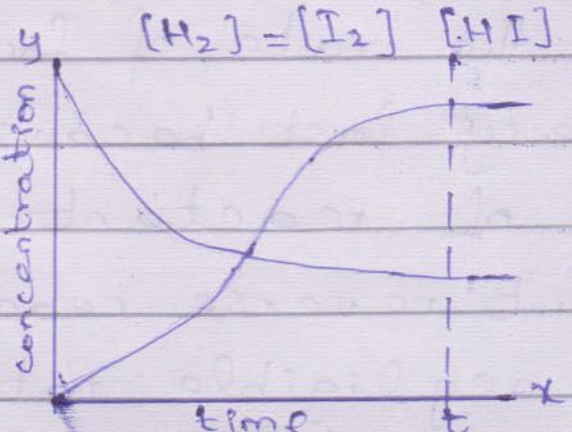
"Dynamic equilibrium state is one at which forward and reverse reaction proceed at equal rate but in opposite direction. So, that overall does not stop."

Initially the rate of forward reaction is very fast because concentration of reactants are maximum. But reverse reaction occur at a negligible rate.

As reaction proceed forward reaction shows down and reverse reaction speeds up. Eventually, both reactions attain the dynamic equilibrium. It is represented graphically as.



So, in case of Hydrogen Iodide formation. H_2 and I_2 is higher than that of HI. As reaction proceed the rate of H_2 and I_2 decreases and rate of HI is increased. Thus, an equilibrium set up and concentration of H_2, I_2 and HI becomes constants.



Question : 5(b)

Given:

equilibrium constant $= K_c = 0.13 \text{ mol}^{-1}\text{dm}^3$

Concentration of $PCl_3 = 10.0 \text{ mol dm}^{-3}$

concentration of $Cl_2 = 9.0 \text{ mol dm}^{-3}$

Concentration of $PCl_5 = ?$

Solution:

Equation

$$PCl_3 + Cl_2 \rightleftharpoons PCl_5$$

$$K_c = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

putting the values

$$0.13 \text{ mol}^{-1}\text{dm}^3 = \frac{[PCl_5]}{(10.0 \text{ mol dm}^{-3})(9.0 \text{ mol dm}^{-3})}$$

$$0.13 \text{ mol}^{-1}\text{dm}^3 = \frac{[PCl_5]}{90 (\text{mol dm}^{-3})^2}$$

$$0.13 \times 90 = [PCl_5]$$

$$\Rightarrow \boxed{[PCl_5] = 11.7 \text{ mol} \cdot \text{dm}^{-3}}$$

Ans

Question : 6(a)

Law of Mass Action :-

According to this law "the rate at which a substance reacts is directly proportional to its active mass and the rate of a reaction directly proportional to the product of the active masses of the reacting substances".

Derivation for Equilibrium Constant :-

Consider the following reversible reaction

$$A + B \underset{k_r}{\overset{k_f}{\rightleftharpoons}} C + D$$

Suppose [A], [B], [C] and [D] are molar concentration of A, B, C and D are respectively. So,

$$R_f \propto [A][B]$$

$$R_f = k_f [A][B] \quad \text{——— (1)}$$

Where R_f is rate of forward reaction while k_f is

a rate constant for forward reaction.

Similarly,

$$R_r \propto [C][D]$$

$$R_r = k_r[C][D] \quad \text{——— (2)}$$

Where R_r is rate of reverse reaction while k_r is the rate constant for a reverse reaction.

At equilibrium state

$$R_f = R_r \quad \text{——— (3)}$$

By putting the values of eq (1) and (2) in eq (3) we have

$$k_f[A][B] = k_r[C][D]$$

$$\frac{k_f}{k_r} = \frac{[C][D]}{[A][B]}$$

$$K_c = \frac{[C][D]}{[A][B]}$$

K_c is a equilibrium constant.

Question : 6(b)

Macroscopic Characteristics:-

Dynamic means reaction is still continuing.

A few characteristics are given below.

1- **Closed System :-**

Dynamic equilibrium is attainable only in close vessel because substances can neither leave nor enter in closed system.

2- **Concentration remain the same :-**

Amount of reactants and products do not change at equilibrium state.

3- **Physical properties will not change :-**

Physical properties like colour, density etc remain the same.

4- **Reaction does not stop :-**

Reaction will not cease in dynamic equilibrium. Forward and reverse reaction keep on taking place at the same rate but in opposite direction. It can be shown as.

Rates of forward reaction $\rightleftharpoons$ Rates of Inverse reaction

5- Equilibrium can be established from either side :-

An equilibrium state is attainable from either way i.e starting from reactants or from products.

6- Equilibrium can be established after stress :-

An equilibrium state can be disturbed and again achieved under certain conditions of concentration, pressure and temperature.

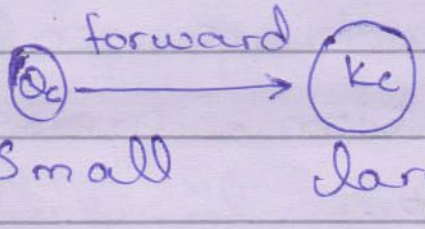
Question : 7(a)

Direction of Reaction :-

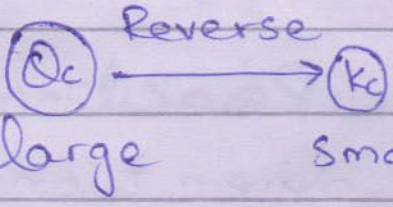
The direction of chemical reaction at a particular moment can be predicted by using reaction quotient which is $\frac{[\text{products}]}{[\text{Reactants}]}$

ratio. It is calculated at any moment before a reaction attain equilibrium. It is represented by Q_c. It predicts the direction of reaction by comparing the values of Q_c with K_c. Thus, we can make following generalization about the direction of reaction.

1- If $Q_c < K_c$ the reaction goes from left to right. So, reaction will proceed in the forward direction.



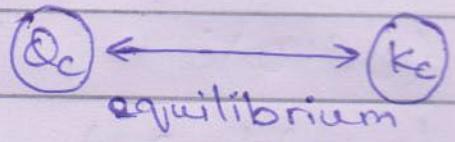
2- If $Q_c > K_c$ the reaction goes from right to left.



The reverse reaction will occur to attain the equilibrium.

3- If $Q_c = K_c$ then forward and reverse reaction take place at same rate. It implies

that the equilibrium has established.



Example:

Consider the formation of hydrogen Iodide at 700k.

$$H_2 + I_2 \rightleftharpoons 2HI$$

$K_c = 57.0$ at 700k

At any moment we withdraw the sample from reaction mixture and calculate the amounts of H_2, I_2 and HI. Suppose,

$[H_2]_t = 0.10 \text{ mol } dm^{-3}$

$[I_2]_t = 0.20 \text{ mol } dm^{-3}$

$[HI_2]_t = 0.40 \text{ mol } dm^{-3}$

Where 't' subscript represents the measurement of concentration at any time 't'. By putting the values of these concentration the equilibrium constant expression we get a value called the reaction quotient. Thus

$$Q_c = \frac{[HI]_t^2}{[H_2]_t[I_2]_t}$$

$$Q_c = \frac{(0.40)^2}{(0.10)(0.20)} = 8.0$$

So, the value of Q_c is less than K_c the reaction is not at equilibrium. It needs more amounts of products. Therefore, reaction will move in forward reaction.

Question : 7(b)

Data :

Amount of H_2 = $0.011\ mol.dm^{-3}$

Amount of I_2 = $0.011\ mol.dm^{-3}$

Equilibrium concentration of

$[HI]$ = $0.078\ mol.dm^{-3}$

Equilibrium constant value (K_c) = ?

Solution :

Equation

$$2HI \rightleftharpoons H_2 + I_2$$

$$K_2 = \frac{[H_2][I_2]}{[HI]^2} \quad \text{——— (1)}$$

By putting values, we get

$$K_c = \frac{(0.011\ mol.dm^{-3})(0.011 mol.dm^{-3})}{(0.078 mol.dm^{-3})^2}$$

$$K_c = \frac{(0.000121)}{(0.006084)}$$

$$\boxed{K_c = 0.019}$$

Ans.