

Short Answer Questions

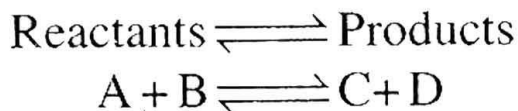
Q.1 Why at equilibrium state reaction does not stop?

Ans. At equilibrium state the reaction does not stop because the rate of forward reaction is exactly equal to the reverse reaction but in opposite direction.

Q.2 Why equilibrium state is attainable from either way?

Ans. Equilibrium state is attainable from either way because a reversible reaction proceeds in both way.

Equilibrium state is attained when a reaction moves forward as well as reaction moves backward.



Q.3 What are the characteristics of a reaction that establishes equilibrium state at once?

Ans. The reactions which attain the equilibrium are called reversible reactions.

(i) In these reactions dynamic state of equilibrium is established in which

$$\text{Rate of forward reaction} = \text{Rate of reverse reaction}$$

(ii) These reaction does not go to stop.

(iii) These can be proceed in both directions.

(iv) For these reactions value of K_c is neither too large nor too small.

Q.4 Which natural process is responsible for existence of life on earth?

Ans. We inhale oxygen and exhale carbon dioxide while plants consume carbon dioxide and release oxygen. This natural process is responsible for existence of life on earth.

Q.5 Differentiate between reactants and products.

Ans.

| Reactants | Products |
|---|--|
| In a chemical reaction the substances that combine are called reactants | In a chemical reaction, reactants combine to form new substances which are called products |

Q.6 Differentiate between irreversible reaction and reversible reaction.

Ans.

| Irreversible reaction | Reversible reaction |
|--|--|
| i. The reactions in which products do not recombine to form reactants | i. The reaction in which products react to produce reactants are called reversible reactions |
| ii. They are supposed to complete | ii. These reactions never go to completion |
| iii. These are represented by a single arrow (\rightarrow) between reactants and products | iii. They are represented by a double arrow (\rightleftharpoons) between reactants and products |

Q.7 What is static equilibrium state?

Ans. When reaction ceases to proceed. It is called static equilibrium.

Example:

A building remains standing rather than falling down because all the forces acting on it are balanced.

Q.8 What is dynamic equilibrium state?

Ans. When reaction does not stop only the rate of forward and reverse reaction become equal to each other but take place in opposite directions. This is called dynamic equilibrium state.

Q.9 What is equilibrium constant?

Ans. Equilibrium constant is a ratio of the product of concentration of products raised to the power of coefficient to the product of concentration of reactants raised to the power of coefficient as expressed in the balance chemical equation.

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

Q.10 Why the reaction mixture does not have 50% reactants and 50% products at equilibrium position?

Ans. At equilibrium state the conc. of reactants and products are constants so it is not necessary that the reactants and products are in 50% ratio.

Q.11 If a reaction has large value of K_c , will it go to completion and why?

Ans. The large value of K_c indicates that at equilibrium position the reaction mixture consists of almost all products and reactants are negligible the reaction has almost gone to completion.

Q.12 What do you mean by the extent of reaction?

Ans. Extent of reaction means the degree of completion of a chemical reaction. It also tells stability of reactants and products.

Q.13 Why the reversible reaction does not go to completion?

Ans. The reversible reaction does not go to completion because, it proceeds in both directions. After the equilibrium attained the product start to convert back into the reactants at this state the composition of reaction mixture remains constant.

Q.14 What are irreversible reactions? Give few characteristics of them?

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

- i. In the reversible reaction static equilibrium is attained or established.
- ii. These are represented by a single arrow (\rightarrow) between reactants and products.
- iii. Irreversible reactions go to completion and 100 % conversion of reactants to products take place.

Q.15 Define chemical equilibrium state.

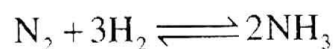
Ans. When the rate of the forward reaction takes place at the rate of reverse reaction, the composition of the reaction mixture remains constant, it is called a chemical equilibrium state.

Q.16 What is relationship between active mass and rate of reaction?

Ans. According to Guldberg and Waage's law the rate of reaction is directly proportional to the product of the active masses of the reacting substances.

Q.17 Derive equilibrium constant expression for the synthesis of ammonia from nitrogen and hydrogen.

Ans. For the reaction of nitrogen with hydrogen to form ammonia, the balanced chemical equation is



For the reaction

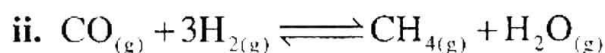
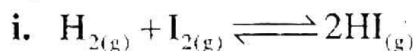
The rate of forward reaction $R_f = k_f [\text{N}_2] [\text{H}_2]^3$

The rate of reverse reaction $R_r = k_r [\text{NH}_3]^2$

The expression for the equilibrium constant for this reaction is:

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

Q.18 Write the equilibrium constant expression for the following reactions:



Ans. The equilibrium constant expression for these reactions

i. $K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$

ii. $K_c = \frac{[\text{CH}_4][\text{H}_2\text{O}]}{[\text{CO}][\text{H}_2]^3}$

Q.19 How direction of reaction can be predicted?

Ans. Direction of a reaction at a particular moment can be predicted by measuring reaction quotient Q_c . The reaction quotient Q_c is useful because it predicts the direction of the reaction by comparing the value of Q_c with K_c . If Q_c is less than K_c the reaction is forward.

Q.20 How can you know that a reaction has achieved an equilibrium state?

Ans. If $Q_c = K_c$, forward and reverse reactions takes place at equal rates i.e equilibrium has been established.

Q.21 If reaction quotient Q_c of a reaction is more than K_c . What will be the direction of the reaction?

Ans. If Q_c of a reaction is more than K_c the reaction goes from right to left, i.e. in reverse direction to attain equilibrium.



Q.22 What are the uses of atmospheric gases in the manufacture of chemicals?

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

These gases are being used to manufacture chemicals since the advent of 20th century.

Nitrogen is used to prepare ammonia, which is further used to manufacture nitrogenous fertilizers.

Oxygen is used to prepare sulphur dioxide which is further used to manufacture king of chemicals sulphuric acid.

Q.23 Define the law of Mass Action.

Ans. The rate at which a substance reacts is directly proportional to its active mass and the rate of a reaction is directly proportional to the product of the active masses of the reacting substances.

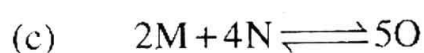
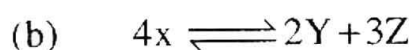
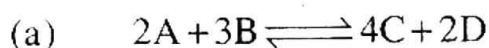
Q.24 How the active mass is represented?

Ans. An active mass is considered as the molar mass concentration in unit of mol dm^{-3} , expressed as square brackets []

Q.25 How dynamic equilibrium is established?

Ans. In a reversible reaction, dynamic equilibrium is established before the completion of reaction. At initial stage the rate of forward reaction is very fast and reverse reaction is taking place at a negligible rate. But gradually forward reaction slows down and reverse reaction speeds up. Eventually, both reactions attain the same rate and dynamic equilibrium state is established.

Q.27 Point out the coefficient of each in the following hypothetical reactions.



Ans. (a) Coefficients of this reactions are (a) 2, 3, 4, 2

(b) 4, 2, 3

(c) 2, 4, 5

Q.27 An industry was established based upon a reversible reaction. It failed to achieve products on commercial level. Can you point out the basic reasons of its failure being a chemist?

Ans. In a reversible reaction, the amounts of reactants and products remain same when the equilibrium state is achieved. If industry is based on reversible reaction, it cannot achieve desired commercial product and its required amount because expected yield is not achieved and industry fails.

Q.28 Write the importance of equilibrium constant.

Ans. (i) It is used to predict the direction of reaction.

- (ii) It is used to predict the extent of reaction, means how much reactants are converted into products.

Q.29 Which physical factor effects the value of K_c ?

Ans. Temperature highly effect the numeric value of K_c . Temperature change will effect both equilibrium position and equilibrium constant.

Q.30 Write the names of two chemicals in which nitrogen is used?

Ans. (i) Urea (ii) Nitric Acid

Q.31 What is the proportion of oxygen and nitrogen in our atmosphere?

Ans. In our atmosphere, the total proportion of O_2 and N_2 is 99%.

Nitrogen = 78% Oxygen = 21%

Multiple Choice Questions

1. The reaction in which the products do not recombine to form reactants are called;

- (a) Irreversible reactions
- (b) Reversible reactions
- (c) Decomposition (d) Addition

2. The reaction in which the products can recombine to form reactants are called;

- (a) Irreversible reactions
- (b) Reversible reactions
- (c) Decomposition (d) Addition

3. The colour of iodine is;

- (a) purple (b) Black
- (c) red (d) Pink

4. The colour of hydrogen iodide is;

- (a) colourless (b) black
- (c) red (d) pink

5. When the rate of the forward reaction takes place at the rate of reverse reaction the composition of the

reaction mixture remains constant it is called;

- (a) Chemical equilibrium
- (b) Dynamic equilibrium
- (c) Static equilibrium
- (d) all

6. When the reaction ceases to proceed, it is called;

- (a) Chemical equilibrium state
- (b) static equilibrium
- (c) Dynamic equilibrium
- (d) all

7. Guldberg and waage put forward law of mass action in;

- (a) 1860 (b) 1869
- (c) 1870 (d) 1879

8. The % age of nitrogen and oxygen in our atmosphere is;

- (a) 80 (b) 90
- (c) 95 (d) 99

9. Which gas is used to prepare ammonia?