6. Chemical Reaction and Catalyst

Exercise Questions

1. Question

Conversion of $FeCI_3$ into $FeCI_2$ is called as?

A. Oxidation

B. Reduction

C. Decomposition

D. Addition

Answer

Because Fe is changing its oxidation state of +3 in $FeCl_3$ to + 2 in $FeCl_2$.Hence, it is a reduction reaction

2. Question

A single substance is splitted into simple molecule, then reaction will be :

A. dissociation

B. displacement

C. oxidation

D. addition

Answer

The reaction in which a single substance is splitted into simple molecules is called dissociation reaction.

3. Question

Electron releasing substance are called :

A. Oxidising agent

B. Reduction

C. Reducing agent

D. None of these

Answer

Electron releasing substances are known as reducing agents because these elecrons which are released later on reduces other species.

4. Question

Reactions which flow in both the direction are :

A. Oxidation

B. Reduction

C. Irreversible

D. Reversible

Answer

Reversible reactions are those which occur in both forward and backward direction.

5. Question

Substances which increases rate of reaction :

A. Catalysts

B. Oxidising agents

C. Reducing agent

D. None of these

Answer

Substances which increases the rate of a reaction are called catalysts. These substances effects the rate of a reaction and itself remains unaffected at the end.

6. Question

Enzymes are :

A. Negative catalysts

B. Positive catalysts

C. Auto-catalysts

D. Bio-catalysts

Answer

Enzymes are the biological catalysts present in the human body.

7. Question

$2Mg + O_2 \rightarrow 2MgO$

In this reaction magnesium is being :

A. Oxidized

B. Reduced

C. Decomposed

D. Displaced

Answer

As in the above reaction magnesium is gaining oxygen. Hence, it is oxidized.

8. Question

For reversible reaction which sign is used :

A. $\rightarrow$

B. $\uparrow$

C. $\downarrow$

D. $\leftrightharpoons$

Answer

As reversible reactions are those which occur in both forward and backward direction. Hence, for reversible reaction $\leftrightharpoons$ sign is used.

9. Question

The reaction which is catalysed by the product formed, is known as :

A. rBio-chemical

B. Reversible

C. Auto-catalytic

D. Irreversible

Answer

In autocatalytic reactions the product formed catalyses the reaction.

10. Question

In exothermic reaction energy (i.e., heat) is :

A. Released

B. Absorbed

C. Dissipated

D. None of these

Answer

Exothermic reactions proceed with the evolution of heat energy.

11. Question

What do you mean by chemical change?

Answer

The changes in which the chemical composition and the chemical properties of the substance changes are known as chemical change.

12. Question

Name the catalyst which converts vegetable ghee.

Answer

Finely divided powdery form of Raney Ni is the catalyst which converts vegetable ghee.

Vegetable oil + $H_2 \xrightarrow{Ni}$ Vegetable ghee

13. Question

What are the types of catalysis? Write names.

Answer

The types of catalysis are: -

i. Based on their physical state:

a. Heterogeneous catalyst

b. Homogeneous catalyst

ii. Based on their action:

a. Positive catalyst

b. Negative catalyst

c. Auto-catalyst

d. Bio-catalyst

14. Question

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

This reaction is an example of which type?

Answer

This is a replacement reaction as in this reaction the more reactive element Zinc is replacing the less reactive element Copper from its salt or compound.

15. Question

Give an example of a redox reaction.

Answer

The reactions in which both oxidation and reduction takes place simultaneously are known as redox reactions.

An example of a redox reaction is:-

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

In the above reaction ferric oxide (Fe_2O_3) is reduced into iron (Fe) by losing the oxygen atoms attached to it and carbon monoxide (CO) is oxidized into carbon dioxide (CO_2) by gaining the oxygen atoms.

16. Question

What is reversible reaction?

Answer

Reaction which occurs in both the directions i.e the products are formed from the reactants and the reactants are being formed from the product at the same time are known as reversible reactions. In these reactions, the concentration of the reactants never becomes zero.

Example: Formation of ammonia is a reversible change as shown:

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

17. Question

What is meant by the catalytic promoter and catalytic poison?

Answer

Catalytic promoter – Those substances which are added with catalysts in a chemical reaction to increase the efficiency or activity of the catalyst is known as the catalytic promoter.Example:

$N_2 + 3H_2 \xrightarrow{Fe/Mo} 2NH_3$In Haber's process for the synthesis of ammonia, traces of molybdenum increases the activity of finely divided iron which acts as a catalyst hence, acts like a catalytic promoter.Catalytic poison - Those

substances which are added with catalysts in a chemical reaction to decrease the efficiency or activity of the catalyst are known as a catalytic poison.

Example:

$$N_2 + 3H_2 \xrightarrow{Fe/CO} 2NH_3$$

In the above reaction of synthesis of ammonia carbon monoxide decreases the efficiency of the iron catalyst and hence, acts like a catalytic poison.

18. Question

The reaction between an acid and a base is know as?

Answer

The reaction between a strong acid and a strong base which forms salt and water is known as a neutralization reaction.

A typical neutralization looks like:

HX	+	**BOH**	→	**BX**	+	**H_2O**
Acid		Base		Salt		Water

Example is given below:

HCl	+	**NaOH**	→	**NaCl**	+	**H_2O**
Acid		Base		Salt		Water

HBr	+	**KOH**	→	**KBr**	+	**H_2O**
Acid		Base		Salt		Water

19. Question

How many type of reaction are based on speed?

Answer

There are two types of reaction based on speed: -

i. Fast reactions

ii. Slow reactionsExample:Rusting is a slow reaction

Burning and explosions are very fast reactions

20. Question

Give an example of the thermal decomposition reaction.

Answer

An example of a thermal decomposition reaction is the decomposition of calcium carbonate to produce calcium oxide and carbon dioxide on heating at 473K.This could be seen in the following reaction:-

$CaCO_3 \rightarrow CaO + CO_2$

21. Question

What is the function of a catalyst in a chemical reaction?

Answer

Catalysts are the substances which changes the rate of the chemical reaction but itself remains unchanged after the completion of the reaction.

Example: NO acts as a catalyst in the conversion of sulphur dioxide to sulphur trioxide as shown:

$2SO_2 + O_2 \xrightarrow{NO} 2SO_3$

22. Question

What is the basic principle of balancing a chemical reaction?

Answer

The basic principle of balancing a chemical reaction is that on both the sides of the arrow there must be equal number of atoms of each type according to the basic rule of chemical combination i.e mass conservation law. While balancing the empirical formula of the compound must not be changed.

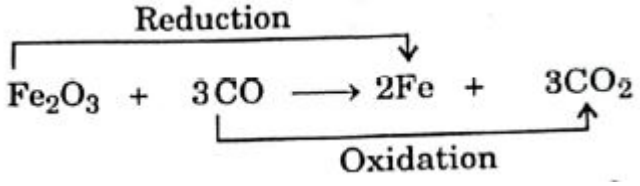
23. Question

What are redox reactions?

Answer

The reactions in which both oxidation and reduction takes place simultaneously are known as redox reactions.

Example: Reaction of ferric oxide with carbon monoxide to form iron and carbon dioxide as shown below:-



In the above reaction ferric oxide (Fe_2O_3) is reduced into iron (Fe) by losing the oxygen atoms attached to it and carbon monoxide (CO) is oxidized into carbon dioxide (CO_2) by gaining the oxygen atoms.

24. Question

Combustion of coal is a which type of reaction?

Answer

Combustion of coal is an addition reaction. It is represented by the following equation:-

$C(s) + O_2(g) \rightarrow CO_2(g)$

Here oxygen is added to carbon (of hydrocarbon) to produce carbon dioxide gas in the product.

25. Question

What is the pH of solution obtained by reacting a strong acid with a strong base?

Answer

The pH of the solution obtained by reacting a strong acid with a strong base is 7 and the resulting mixture would be neutral in nature.

26. Question

Write difference between physical and chemical changes.

Answer

Physical change	Chemical change
Only physical properties of the substance changes.	The new substance formed after the reaction is completely different in chemical properties and chemical composition than the initial reactants.
Substances returns back to its original state if the cause of the change is removed.	This change is generally not reversed in the backward direction.
These are temporary changes.	These are permanent changes.
No new substances are formed.	New substances are formed with new properties.
Chemical identity of the substance is conserved.	Chemical identity of the substance changes.

27. Question

Write addition and dissociation reaction with one example of each.

Answer

Addition reaction – Reactions in which two or more substances or reactants combine to form a new single product are termed as addition reaction.

Example- $C(s) + O_2(g) \rightarrow CO_2(g)$

Dissociation reaction – Reactions in which a single reactant decomposes to form two or more product are termed as dissociation reaction.

Example - $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

28. Question

$AgNO_3 + KCI \rightarrow AgCI + KNO_3$

The above reaction is of which type? Write its name and explain.

Answer

The above reaction is a double displacement reaction.

Double displacement reaction – The reactions in which a mutual exchange of ions takes place between two reactants are termed as double displacement reaction.

Here potassium is displaced by silver from its salt to form silver chloride and the displaced potassium then reacts with nitrate ion to form potassium nitrate. Hence, it is a double displacement reaction.

29. Question

Explain Oxidation-reduction reaction based on the exchange of electrons.

Answer

Oxidation reaction – On the basis of the exchange theory of electrons an oxidation reaction could be termed as that in which an atom, element, molecule or an ion loses an electron.

Example – $Na \rightarrow Na^+ + e^-$

Reduction reaction – On the basis of the exchange theory of electrons a reduction reaction could be termed as that in which an atom, element, molecule or an ion gains an electron.

Example – $Cl + e^- \rightarrow Cl^-$

30. Question

What are the type of catalysts? Write.

Answer

The type of catalysts are as follows –

iii. Based on their physical state:

a. Heterogeneous catalyst :

When in a reaction the catalysts, reactants, and products are in different physical states then the catalyst is known as heterogeneous catalyst.

Example-

Vegetable oil (l) + H_2 (g) $\xrightarrow{Ni(s)}$ Vegetable ghee (l)

b. Homogeneous catalyst:

When in a reaction the catalysts, reactants and products are in the same phase then the catalyst is known as homogeneous catalyst.

Example:-

$2SO_2$ (g) + O_2 (g) $\xrightarrow{NO(g)}$ $2SO_3$ (g)

iv. Based on their action:

a. Positive catalyst:

The catalysts which increases the rate of a reaction are termed as positive catalyst.

Example:

$2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

b. Negative catalyst:

The catalysts which decreases the rate of a reaction are termed as negative catalyst.

Example:

$2H_2O_2 \xrightarrow{Glycerol} 2H_2O + O_2$

c. Auto-catalyst;

When the product formed in a reaction itself behaves as a catalyst, then it is known as auto-catalyst.

Example:

$CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_50H$

d. Bio-catalyst:

The catalyst which increases the rate of the biochemical reactions occurring in a living organism are termed as bio-catalyst. These are also known as enzymes.

Example:

Maltose $\xrightarrow{Maltase}$ Glucose

31. Question

What are the types of dissociation reaction? Explain.

Answer

The types of dissociation reaction are:-

i. Electrolysis:

In this method electrical energy is used to decompose the reactant into products. To bring about the decomposition electrical energy or electric current is passed through the fused salt of the substance.

Example – Electrolysis of water gives hydrogen and oxygen as shown –

$$2H_2O \xrightarrow{\text{Electric current}} 2H_2 + O_2$$

ii. Thermal decomposition:

In this method heat energy is used to decompose the reactant into products.

Example – Decomposition of calcium carbonate as shown to give calcium oxide and oxygen s is a thermal decomposition reaction –

$$CaCO_3 \xrightarrow{\text{on heating}} CaO + O_2$$

iii. Photolysis:

In this method energy from the sun is used to decompose the reactant into products.

Example – Decomposition of hydrogen bromide as shown –

$$2HBr \rightarrow H_2 + Br_2$$

32. Question

Why some amount of ethyl alcohol is added in chloroform to store it?

Answer

Chloroform directly reacts with oxygen from the air and gets oxidized to form a very poisonous gas known as phosgene. Hence, in order to decrease the rate of this reaction some amount of ethyl alcohol is added in chloroform to store it so that the rate of creation of phosgene is reduced and it is safe for use.

33. Question

The solution obtained by weak acid and strong base in basic in nature. Why?

Answer

In the reaction between a strong base and a weak acid, the acid does not get completely ionized and some amount of acid is present in unionized form. So, when we take equal moles of a weak acid and strong base and mix them together them also some OH^- remains excess in the solution and the solution becomes basic in nature.

34. Question

Are following reaction problem? Clear answer with reason.

(i) $Cu + ZnSO_4 \rightarrow CuSO_4 + Zn$

(ii) $Fe + CuSO_4 \rightarrow FeSO_4 \rightarrow FeSO_4 + Cu$

Answer

(i) $Cu + ZnSO_4 \rightarrow CuSO_4 + Zn$

The above replacement reaction is not possible because Copper is less reactive then Zinc. Hence, it would not able to replace Zinc from its compound ($ZnSO_4$).

(ii) $Fe + CuSO_4 \rightarrow FeSO_4 \rightarrow FeSO_4 + Cu$

The above replacement reaction is possible because Copper is less reactive then Iron. Hence, Iron would easily replace copper from its compound ($CuSO_4$) to form ferrous sulphate($FeSO_4$).

35. Question

Identify oxidation-reduction in the following reaction:

(i) $C + O_2 \rightarrow CO_2$

(ii) $Mg + CI_2 \rightarrow MgCI_2$

(iii) $ZnO + C \rightarrow Zn + CO$

(iv) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Answer

(i) $C + O_2 \rightarrow CO_2$

The above reaction is an oxidation reaction in which the carbon atom is gaining the oxygen and is oxidized.

(ii) $Mg + CI_2 \rightarrow MgCI_2$

The above reaction is an oxidation reaction because here a more electronegative atom which is chlorine is being added to magnesium.

(iii) $ZnO + C \rightarrow Zn + CO$

The above reaction is a redox reaction in which zinc is getting reduced as it is losing oxygen atoms and carbon is getting oxidized as it is gaining the oxygen atoms.

(iv) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

The above reaction is a redox reaction in which ferric oxide (Fe_2O_3) is reduced into iron (Fe) and carbon monoxide (CO) is oxidized into carbon dioxide (CO_2) by gaining the oxygen atoms.

36. Question

What are the various types of chemical reaction? Explain.

Answer

The various types of chemical reactions are:

i. Addition reactions:

The reaction in which two or more reactants combine to form a single product are known as addition reaction. In this new type of bonds are formed between the reactants.

Ex- $C(s) + O_2(g) \rightarrow CO_2(g)$

ii. Replacement reactions:

In these reactions a more reactive element replaces a less reactive element from its compound.

Ex- $Fe + CuSO_4 \rightarrow FeSO_4 \rightarrow FeSO_4 + Cu$

Double displacement reaction:

This is a subcategory of replacement reactions in which mutual exchange of ions occurs between two reactants.

Ex – $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$

iii. Dissociation reactions:

These are the reactions in which a single reactant decompose to form two or more products. There are various types of dissociation reaction as follows: -

The types of dissociation reaction are :-

a) Electrolysis:

In this method electrical energy is used to decompose the reactant into products. Electric energy is passes through the fused salt of the substance.

Example – Electrolysis of water gives hydrogen and oxygen as shown –

$2H_2O \xrightarrow{\text{Electric current}} 2H_2 + O_2$

b) Thermal decomposition:

In this method heat energy is used to decompose the reactant into products.

Example – Decomposition of calcium carbonate as shown to give calcium oxide and oxygen–

$CaCO_3 \xrightarrow{\text{on heating}} CaO + O_2$

c) Photolysis:

In this method energy from the sun is used to decompose the reactant into products.

Example – Decomposition of hydrogen bromide s shown –

$2HBr \rightarrow H_2 + Br_2$

iv. Reversible reactions:

The reactions those which occur in both forward and backward direction are known as reversible reactions.

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

v. Irreversible reactions:

Those reactions which flow in only one direction and products are formed from the reactants are known as irreversible reactions.

Ex- $C + O_2 \rightarrow CO_2$

37. Question

What is meant by oxidation reduction? Explain with examples.

Answer

Oxidation:

The reactions in which oxygen or a more electronegative elements are added to any substance.

Or

The reactions in which oxygen or a more electronegative elements are added to any substance.

Or

Process in which a chemical species losses electrons.

Reduction:

The reactions in which oxygen or more electronegative elements are removed from any substance.

Or

The reactions in which hydrogen or a more electropositive elements are added to any substance.

Or

Process in which a chemical species gains electrons.

The reactions in which both oxidation and reduction takes place simultaneously are known as oxidation reduction reactions.

Ex- $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

In the above reaction ferric oxide (Fe_2O_3) is reduced into iron (Fe) by losing the oxygen atoms attached to it and carbon monoxide (CO) is oxidized into carbon dioxide (CO_2) by gaining the oxygen atoms. Hence, it is an oxidation reduction reaction.

38. Question

What do you know about properties of catalyst and its types?

Answer

Properties of catalyst:

i. Catalysts only change the rate of a chemical reaction but itself remain unchanged in composition and amount.

ii. Catalysts are sufficient in small amounts only.

iii. For a specific reaction there is a specific catalyst and a single catalyst cannot catalyse all the reaction.

iv. Catalysts does not initiate a chemical reaction but only increases the rate of the reaction,

v. In reversible reactions catalysts equally increases the rate of forward and backward reaction.

vi. Catalysts are more efficient and effective at a particular temperature. By changing the temperature we can control their activity.

The types of catalysts are as follows –

i. Based on their physical state:

a. Heterogeneous catalyst :

When in a reaction the catalysts, reactants and products are in different physical states then the catalyst is known as heterogeneous catalyst.

Example-

Vegetable oil (l) + H_2 (g) $\xrightarrow{Ni(s)}$ Vegetable ghee (l)

b. Homogeneous catalyst:

When in a reaction the catalysts, reactants and products are in the same phase then the catalyst is known as homogeneous catalyst.

Example:-

$2SO_2$ (g)+ O_2(g) $\xrightarrow{NO(g)}$ $2SO_3$(g)

ii. Based on their action:

a. Positive catalyst:

The catalysts which increases the rate of a reaction are termed as positive catalyst.

Example:

$2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

b. Negative catalyst:

The catalysts which decreases the rate of a reaction are termed as a negative catalyst.

Example:

$2H_2O_2 \xrightarrow{Glycerol} 2H_2O + O_2$

c. Auto-catalyst;

When the product formed in a reaction itself behaves as a catalyst, then it is known as auto-catalyst.

Example:

$CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_50H$

d. Bio-catalyst:

The catalyst which increases the rate of the biochemical reactions occurring in a living organism is termed as bio-catalyst. These are also known as enzymes.

Example:

Maltose $\xrightarrow{\text{Maltase}}$ Glucose

39. Question

Write steps in writing a chemical equation and its specifications.

Answer

Steps of writing a chemical equation are: -

i. At first, reactants are written followed by a single arrow and then products are written.

ii. If reactants or products are more than one in number then they are separated by a + sign.

iii. The Mass conservation law is followed while writing a chemical reaction. According to which in both the sides of the arrow there must be an equal number of atoms of each type.

iv. Mass of reactants and mass of products must be equal.

v. While balancing a chemical equation first of all atoms other than oxygen and hydrogen are balanced.

vi. After balancing the chemical; equation the physical state of each substance is represented by writing - s, l, g in brackets after each substance indicating solid, liquid and gaseous state respectively.

vii. Substances in solution are represented by writing aq in the bracket after each substance.

viii. Reaction conditions for a reaction to occur like temperature, pressure, catalyst etc. are written above the arrow.

ix. In case of an exothermic and endothermic reaction, amount of energy is written with (+) and (-) sign respectively along with products in R.H.S of the equation.

x. Delta (Δ) symbol is sometimes used to represent chemical changes in a reaction.

40 A. Question

Differentiate between the following :

Reversible-irreversible reactions

Answer

Reversible reaction	Irreversible reaction
The reactions those which occur in both forward and backward direction are known as reversible reactions.	Those reactions which flow in only one direction and products are formed from the reactants are known as irreversible reactions
These reactions occur in both the directions simultaneously.	These are unidirectional.
These reactions never go to completion all the time some reactant and product are present in the reaction mixture.	Here the reactant concentration decreases slowly as the reaction proceeds and the product concentration begins to increase.
When represented by chemical equation then a reversible symbol (⇌) is used to depict the direction of the reaction.	When represented by chemical equation then a single-headed arrow (→) is used to depict the direction of the reaction.

40 B. Question

Differentiate between the following :

Catalytic promoter-catalytic poison

Answer

Catalytic promoter	Catalytic poison
Those substances which are added with catalysts in a chemical reaction to increase the efficiency or activity of the catalyst are known as the catalytic promoter.	Those substances which are added with catalysts in a chemical reaction to decrease the efficiency or activity of the catalyst are known as a catalytic poison.

40 C. Question

Differentiate between the following :

Homogeneous- heterogeneous catalysis

Answer

Homogeneous catalysis	Heterogeneous catalysis
When in a reaction the catalysts, reactants, and products are in the same phase then the catalyst is known as a homogeneous catalyst and the process is known as homogeneous catalysis.	When in a reaction the catalysts, reactants, and products are in different physical states then the catalyst is known as a heterogeneous catalyst and the process is known as heterogeneous catalysis.

40 D. Question

Differentiate between the following :

Oxidation- reduction

Answer

Oxidation	Reduction
The reactions in which oxygen or more electronegative elements are added to any substance.	The reactions in which oxygen or more electronegative elements are removed from any substance
The reactions in which oxygen or more electronegative elements are added to any substance.	The reactions in which hydrogen or a more electropositive elements are added to any substance.
Process in which a chemical species losses electrons.	Process in which a chemical species gains electrons.