PRAADIS EDUCATION

CHEMISTRY XI

REDOX REACTIONS

OBJECTIVE QUESTIONS

Classical Idea of Redox Reactions-Oxidation and Reduction Reactions

1. In the reaction of formation of magnesium oxide magnesium undergoes _____
a) reduction
b) oxidation
c) hydrogenation
d) decomposition

Answer: b
Explanation: Oxidation is a process that involves the addition of oxygen to an element or compound or the removal of hydrogen from a compound, an example is of this is the formation of magnesium oxide from magnesium.

2. A zinc ion is formed due to oxidation.
a) true
b) false

Answer: a
Explanation: Oxidation is the loss of electrons by an atom, ion or molecule. it is also known as de^{-}electronation. $Zn \rightarrow Zn^{2+} + 2e^{-}$, the loss of electrons from zinc i.e. formation of zinc is an example of oxidation.

3. Removal of oxygen from a compound is an example of _____
a) oxidation
b) reduction

c) oxygenation
d) dehydrogenation

Answer: b
Explanation: Reduction is a chemical process, which involves the addition of hydrogen or an element or compound for the removal of oxygen from a compound. An example of reduction is a chemical reaction;
$H_2 + F_2 \rightarrow 2HF$.

4. Reduction involves in _____ oxidation number.
a) decrease
b) increase
c) independence
d) remain constant

Answer: a
Explanation: The oxidation number is recharged in which an atom appears to have when all the atoms are removed from it as ions. It may have +ve or -ve sign. Reduction results in a decrease in the oxidation number.

5. Formation of copper from copper iron is an example of a reduction.
a) true
b) false

Answer: a
Explanation: Reduction is the gain of electrons by an atom, ion or molecule this process is known as electronation. Prayer for the formation of copper from copper iron as an example of reduction reaction because the copper gains two electrons in this case.

6. Oxidation is the same as _____
a) addition of hydrogen
b) removal of oxygen
c) addition of oxygen

d) removal of Nitrogen

Answer: c
Explanation: Oxidation is the same as the addition of oxygen or removal of hydrogen where reduction is the addition of hydrogen or removal of oxygen. Oxidation is caused by an oxidising agent and reduction is caused by a reducing agent.

7. Formation of zinc sulphide is an example of _____
a) reduction
b) oxidation
c) removal of oxygen
d) addition of hydrogen

Answer: b
Explanation: Addition of electronegative element or removal of any other electropositive element is also considered as a process that involves oxidation. Here, sulphur is an electronegative element. So the formation of zinc sulphide is an Oxidation reaction.

8. $SnCl_2 + 2FeCl_2 \rightarrow SnCl_4 + 2FeCl_2$ is an example of _____ reaction.
a) only oxidation
b) only reduction
c) redox
d) neither oxidation nor reduction

Answer: c
Explanation: Chemical reactions which involves both oxygen as well as reduction process simultaneously are known as redox reactions. The above given reaction involves both oxidation and reduction reactions, so it is a Redox reaction.

9. $SnCl_2 + 2FeCl_2 \rightarrow SnCl_4 + 2FeCl_2$. Which of the following element undergoes oxidation in the reaction given?
a) iron

b) tin
c) chlorine
d) ferrous

Answer: b
Explanation: Tin changes is oxidation state from + 2 to + 4. Increase in oxidation number indicates Oxidation reaction. Oxidation is the loss of electrons by an atom, ion or molecule, it is also known as the de^- electronation.

10. Which of the following do you think is a correct statement?
a) oxidation is caused by a reducing agent
b) the oxidation reaction is a Redox reaction
c) addition of electropositive element is a type of oxidation
d) reduction is the addition of hydrogen

Answer: d
Explanation: Oxidation is caused by an oxidizing agent, both oxidation and reduction reaction is combined together to form a Redox reaction and the addition of electropositive element is a type of reduction so the correct statement is that reduction as the addition of hydrogen.

Redox Reactions in Terms of Electron Transfer Reactions

1. What is the oxidation half reaction of $Cu^{+2} + Zn \rightarrow Cu + Zn^{+2}$?
a) $Zn \rightarrow Zn^{+2}$
b) $Cu^{+2} \rightarrow Cu$
c) $Cu^{+2} \rightarrow Zn^{+2}$
d) $Zn \rightarrow Cu$

Answer: a
Explanation: Oxidation is the loss of electrons by an atom, ion or molecule. It is also known as de-electronation. Here in the above given chemical reaction $Cu^{+2} + Zn \rightarrow Cu + Zn^{+2}$, the oxidation half-reaction is $Zn \rightarrow Zn^{+2}$.

2. When a zinc rod is kept in a copper nitrate solution what happens?
a) zinc is deposited on copper
b) copper is deposited on zinc
c) zinc is deposited in the beaker
d) copper is deposited in the beaker

Answer: b
Explanation: When zinc is placed in copper nitrate solution the intensity of the blue colour is produced and copper iron is deposited on zinc. This is a Redox reaction between zinc and an aqueous solution of copper nitrate occurring in a beaker.

3. In this reaction $Cu^{+2} + Zn \rightarrow Cu + Zn^{+2}$, what is an oxidising agent?
a) copper
b) zinc
c) hydrogen
d) oxygen

Answer: a
Explanation: Oxidant or oxidizing agent is a chemical substance which can accept one or more electrons and causes oxidation of some other species. Here to accept electrons from zinc, so copper is an oxidizing agent.

4. Loss of electrons is _____
a) oxidising agent
b) oxidation
c) reducing agent
d) reduction

Answer: b
Explanation: Oxidizing agent is the acceptor of electrons and the reducing agent is a donor of the electrons, where oxidation is termed by loss of electrons by any species and reduction is gain of electrons by any species.

5. Intensity of blue colour increases gradually when _____

a) copper rod is dipped in silver nitrate solution
b) silver rod is dipped in copper nitrate solution
c) zinc rod is dipped in silver solution
d) copper rod is dipped in zinc rod solution

Answer: a
Explanation: When a copper rod is dipped in silver nitrate solution, a redox reaction occurs between Copper and an aqueous solution of silver nitrate. So the intensity of blue colour increases gradually as silver deposits on the rod.

6. Which of the following is true as per metal activity series?
a) Zn<Ag<Cu
b) Zn<Cu<Ag
c) Zn>Ag>Cu
d) Zn>Cu>Ag

Answer: d
Explanation: Metal activity series or electrochemical series is a series in the decreasing order of metals which are active during a chemical reaction comparatively with each other. Here, Zinc's activity is greater than Copper's activity and Copper's activity is greater than that of silver.

7. What is a reducing agent of the reaction $Cu^{+2} + Zn \rightarrow Cu + Zn^{+2}$?
a) copper
b) zinc
c) hydrogen
d) oxygen

Answer: b
Explanation: Reductant or reducing agent is a chemical substance which can give one or more electrons and causes reduction of some other species in a chemical reaction. Therefore, zinc is a reducing agent in this reaction.

8. The oxidation number of oxidant increases in a Redox reaction.
a) true
b) false

Answer: b
Explanation: Oxidising agent is also known as an oxidant, the oxidation number of an oxidant decreases in a Redox reaction whereas the oxidation number of reductant increases in a reaction. Reducing agent is known as a reductant.

9. Which of the following is not an oxidising agent?
a) magnesium oxide
b) carbon dioxide
c) ozone
d) sodium hydride

Answer: d
Explanation: Molecules of most electronegative elements, compounds having an element in the highest oxidation state and oxides of metals and nonmetals are examples of oxidising agents. But sodium hydride is a metallic hydride, so it is not an oxidizing agent.

10. Hydrogen peroxide is a _____
a) oxidising agent
b) reducing agent
c) both reducing and oxidizing agent
d) neither reducing nor an oxidizing agent

Answer: c
Explanation: Hydrogen peroxide, which is chemically written as H_2O_2, is a strong oxidizer as well a reducer. As it contains two hydrogens and to oxygens, it easily looses hydrogen or oxygen i.e. oxidizes and reduces respectively.

Oxidation Number

1. Can 1/2 be an oxidation number?
a) yes
b) no
c) may be
d) cannot say

Answer: a
Explanation: The oxidation number is defined as the change in which appears to have when all other atoms are removed from it as ions it can be a whole number or a fractional or 0. So 1/2 can be an oxidation number.

2. The oxidation number of oxygen in Ozone is 1, -1 and 0.
a) true
b) false

Answer: a
Explanation: An element may have different values of oxidation number depending upon the nature of the compound in which it is present. Ozone molecule has three oxygens and the oxidation numbers of them are 1, – 1 and 0.

3. Helium element has an Oxidation state of _____
a) 2
b) 0
c) 1
d) -1

4. In NaH, the oxidation state of hydrogen is _____
a) 2
b) 1
c) -1
d) 0

Answer: c
Explanation: In all compounds except ionic metal hydride the oxidation number of hydrogen is +1. But in metal hydrides like sodium hydride, magnesium hydride, calcium hydride, etc, the oxidation number of hydrogen as -1.

5. What is the oxidation state of Cr in CrO_5?
a) 3
b) 4
c) 5
d) 6

Answer: d
Explanation: The oxidation states of oxygens in CrO_5 are -1, -1, -1, -1 and -2. The oxidation state of Cr is given by x. Therefore $x + 4(-1) + (-2)(1) = 0$. $X = 6$. The oxidation state of chromium in chromium peroxide is 6.

6. What is the oxidation state of C in C_3O_2?
a) 0
b) 2
c) -2
d) 0, 2, 2

Answer: d
Explanation: The structure of C_3O_2 is given as O=C=C=C=O. Where the oxidation number of carbon beside oxygen is +2 due to oxygen's -2 oxidation state. And the middle carbon's oxidation is 0, due to +2 charge on it's both sides.

7. What is the oxidation state of N in NH_4NO_3 (in order)?
a) -3, 5
b) 5, -3
c) 5
d) -3

Answer: a
Explanation: Dividing into two parts oxidation number of N in NH_4^+ is x; x + 4*1 = +1; x = -3, oxidation number of N in NO_3^- is y; y + 3*-2 = -1; y = 5. The oxidation States of Nitrogen in this compound are -3 and 5 respectively.

8. What is the average oxidation state of S in $Na_2S_6O_6$?
a) 5
b) 0
c) 5/2
d) 2

Answer: c
Explanation: the average Oxidation state of elements in a compound is the average of the different oxidation States. The average oxidation state of S in $Na_2S_6O_6$ is x. 2(1) + 4x + 6(-2) = 0; x = 5/2. The average Oxidation state of sulfur here is 5/2.

9. What is the stock notation of cuprous oxide?
a) copper oxide
b) copper (I) oxide
c) copper 1 oxide
d) copper 2 oxide

Answer: b
Explanation: The elements exhibiting different Oxidation States i.e. are denoted by Roman numeral such as I, II, III, IV etc, within parenthesis after the symbol or name of the element this is known as stock notation.

10. What is the stock notation of mercuric chloride?
a) Mercury
b) Mercuric chloride
c) Chloride
d) Mercury (II) chloride

Answer: d
Explanation: The system that exhibits variable oxidation States in specified Roman numerals within parentheses after the symbol is the name of the element is known as stock notation. Mercury (II) chloride is in stock notation.

Redox Reactions and Electrode Processes

1. $S + O_2 \rightarrow SO_2$ is an example of _____
a) combination
b) decomposition
c) disproportionation
d) double decomposition

Answer: a
Explanation: The chemical combination reaction results in the formation of a new compound from two elements substances. The above formation of Sulphur dioxide from Sulphur and oxygen is a type of combination reaction.

2. $2H_2O \rightarrow 2H_2 + O_2$ is an example of _____
a) combination
b) decomposition
c) disproportionation
d) double decomposition

Answer: b
Explanation: The reverse reaction of a combination reaction as a decomposition reaction. In a decomposition reaction, the breakdown of a compound happens into two or more components, here water is broken down into hydrogen and oxygen, so it is a decomposition reaction.

3. The exchange of salt between zinc and copper is an example of _____

a) combination
b) decomposition
c) disproportionation
d) displacement

Answer: d
Explanation: An ion in a compound is replaced by an ion of other element is a sort of displacement reaction. Here the ions are salts, the exchange of salts between zinc and copper is an example of a displacement reaction.

4. Breakdown of hydrogen peroxide into water and oxygen is an example of _____
a) combination
b) decomposition
c) disproportionation
d) double decomposition

Answer: c
Explanation: Disproportionation reactions are a special type of redox reactions. In this type of redox reactions, a single compound undergoes oxidation and reduction at the same time. The breakdown of hydrogen peroxide into water and hydrogen, the same thing happens.

5. Displacement reaction is of two types.
a) true
b) false

Answer: a
Explanation: Yes, the above statement is true, because, in displacement reactions, there are two types. One is the metal displacement and the other is nonmetal displacement, both of them are redox reactions.

6. $X + YZ \rightarrow XZ + Z$ is a form of _____
a) combination reaction
b) displacement reaction

c) disproportionate reaction
d) decomposition reaction

Answer: b
Explanation: In a displacement reaction, a metal or a non-metal, in a compound can be displaced by another metal in the uncombined state. So the above reaction $X + YZ \rightarrow XZ + Z$, is a displacement reaction.

7. Can ClO_4^- exhibit disproportionation reaction?
a) may be
b) yes
c) no
d) cannot say

Answer: c
Explanation: The above ion cannot its show disproportionation reaction because the chlorine in ClO_4^- is present in its maximum Oxidation state, that is +7. Disproportionation reaction occurs only when it is present in its intermediate Oxidation State.

8. $2F_2 + 2OH^- \rightarrow 2F^- + OF_2 + H_2O$ is a type of _____
a) combination reaction
b) displacement reaction
c) disproportionate reaction
d) decomposition reaction

Answer: c
Explanation: Disproportion reaction occurs when an element in a compound after reactions splits into two different oxidation States i.e. it is reduced and oxidized. In the above reaction. Florine is reduced as well as oxidized, so it is a disproportionate reaction.

9. $2NaH \rightarrow 2Na + H_2$ is an example of a combination reaction.
a) True
b) False

Answer: b
Explanation: The above statement is considered to be false because it is a decomposition reaction as sodium hydride is broken down into Sodium and hydrogen. A combination of reaction results in the formation of a new compound instead of breaking down.

10. Which of the following reaction is a combination reaction?
a) $X + YZ \rightarrow XZ + Z$
b) $2F_2 + 2OH^- \rightarrow 2F^- + OF_2 + H_2O$
c) $2NaH \rightarrow 2Na + H_2$
d) $S + O_2 \rightarrow SO_2$

Answer: d
Explanation: Only the reaction; $S + O_2 \rightarrow SO_2$ is a chemical combination reaction, whereas $X + YZ \rightarrow XZ + Z$ and $2F_2 + 2OH^- \rightarrow 2F^- + OF_2 + H_2O$ are disproportionation reactions and $2NaH \rightarrow 2Na + H_2$ is a chemical decomposition reaction.