

CHP 3 – CHEMICAL REACTIONS AND EQUATIONS

Q1]

- a. To prevent rusting, a layer of zinc metal is applied on iron sheets.
- b. The conversion of ferrous sulphate to ferric sulphate is oxidation reaction.
- c. When electric current is passed through acidulated water decomposition of water takes place.
- d. Addition of an aqueous solution of ZnSO_4 to an aqueous solution of BaCl_2 is an example of double displacement reaction.

Q2]Ans a)

The reaction which involves simultaneous oxidation and reduction is called an oxidation-reduction or redox reaction.

In a redox reaction, one reactant gets oxidised while the other gets reduced during a reaction.

Redox reaction = Reduction + Oxidation

In redox reaction, the reductant is oxidized by the oxidant and the oxidant is reduced by the reductant.

Example: $\text{CuO}_{(s)} + \text{H}_{2(g)} \rightarrow \text{Cu}_{(s)} + \text{H}_2\text{O}$

In this reaction, oxygen is removed from copper oxide therefore it is a reduction of CuO, while hydrogen accepts oxygen to form water that means oxidation of hydrogen takes place. Thus oxidation and reduction reactions occur simultaneously.

b.

At room temperature, the decomposition of hydrogen peroxide into water and oxygen takes place slowly. However, the same reaction occurs at a faster rate on adding manganese dioxide (MnO_2), powder in it.

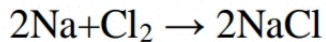
c.

Reactant: The substance which take part in a chemical reaction are called reactants.

Product: the substance which forms as a result of chemical reaction is called products.

The new substance produced as a result of chemical reaction is called products.

For example: When two sodium atoms react with two chlorine atoms(reactants), they give a completely new compound (product) i.e. sodium chloride (two atoms).



d.

There are main three types of chemical reactions with reference to oxygen and hydrogen:

1. Combination Reaction

When two atoms react to form a compound, it is known as combination reaction.

For example: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

2. Decomposition Reaction

When a compound breaks into simple molecular substances from which it is made up of, it is known as decomposition reaction.

For example: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$

3. Oxidation and reduction reaction:

Oxidation:

- (i) The addition of oxygen to a substance is called oxidation.
- (ii) The removal of hydrogen to a substance is called oxidation.

Reduction:

- (i) The addition of hydrogen to a substance is called reduction.
- (ii) The removal of oxygen to a substance is called reduction.

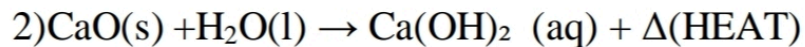
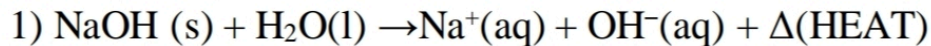
For example : $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$

In the above reaction, copper oxide is changing to Cu. That is, oxygen is being removed from copper oxide. So, copper oxide is being reduced to copper.

In the above reaction, H_2 is changing into H_2O . That is , oxygen is being added to hydrogen. So, hydrogen is being oxidised to water.

e.

Chemical equations involved:



Similarities:

- 1) Both of the equations are exothermic. It means a lot of heat is evolved during the reaction.
- 2) Both reaction form strong basic solution.

Differences :

- 1) Sodium Hydroxide is strong base dissociates to form Na^+ and OH^- ion. While Calcium oxide added water to form Calcium Hydroxide which further dissociates.
 - 2) NaOH is a monoacidic base. and CaO is a Di-Acidic base.
 - 3) NaOH , CaO should be added to water gradually with constant stirring. CaO on reacting with water produces basic solution called as Calcium hydroxide which is used for white washing and this reaction is more dangerous as compare to NaOH .
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Q3]

a.Endothermic reaction:

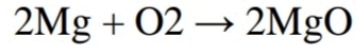
Endothermic reactions are chemical reactions in which the reactants absorb heat energy from the surroundings to form products. These reactions lower the temperature of their surrounding area, thereby creating a cooling effect. Physical processes can be endothermic as well – Ice cubes absorb heat energy from their surroundings and melt to form liquid water (no chemical bonds are broken or formed). For example



b. Combination reaction:

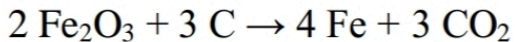
Those reactions in which two or more substances combine to form single substance is called combination reaction

For example: Magnesium and oxygen combine, when heated, to form magnesium oxide.

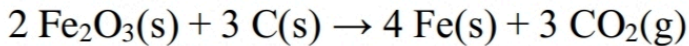


c. **Balanced equation:**

A balanced equation is an equation for a chemical reaction in which the number of atoms for each element in the reaction and the total charge are the same for both the reactants and the products. In other words, the mass and the charge are balanced on both sides of the reaction. The balanced equation is:



Both the left and right sides of the equation have 4 Fe, 6 O, and 3 C atoms. When you balance equations, it's a good idea to check your work by multiplying the subscript of each atom by the coefficient. When no subscript is cited, consider it to be 1. It's also good practice to cite the state of matter of each reactant. This is listed in parentheses immediately following the compound. For example, the earlier reaction could be written as:



where s indicates a solid and g is a gas state of matter.

d. Displacement reaction:

Displacement reaction is a chemical reaction in which a more reactive element displaces a less reactive element from its compound. Both metals and non-metals take part in displacement reactions.

Chemical reactivity of metals is linked with their relative positions in the activity series.

A metal placed higher in the activity series can displace the metal that occupies a lower position from the aqueous solution of its salt. For example



Q4] Give scientific reasons.

a. Limestone is made up of calcium carbonate. When calcium carbonate is heated Carbon dioxide is evolved. Lime water is made up of Calcium hydroxide.

When carbon dioxide is passed through lime water, the Carbon dioxide reacts with calcium hydroxide to form Calcium carbonate which is a white precipitate, then lime water turns milky as there is formation of calcium carbonate.



b. It takes time for pieces of Shahabad tile to disappear in HCl , but its powder disappears rapidly because in pieces of the tile, the surface atoms can only react with HCl but in powdered form all the atoms can react with HCl . This makes the difference in their reactivity. Powders are simpler substances of the pieces and they take lesser time for the reaction as compare to whole piece of tile, which is a compound.

for example: powdered salt react and water will dissolve, but salt rocks and water will not dissolve.

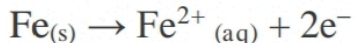
c. While preparing dilute sulphuric acid from concentrated sulphuric acid in the laboratory, the concentrated sulphuric acid is added slowly to water with constant stirring because sulphuric acid (H_2SO_4) reacts very vigorously with water, it is a highly exothermic reaction. If you add water to concentrated sulphuric acid, it can boil and bump out due to which you may get a nasty acid burn. Water is a good absorber of heat, so we add acid to the water, slowly and with constant stirring.

d. It is recommended to use air tight container for storing oil for long time in order to avoid the problem of rancidity. Rancidity is the condition produced by aerial oxidation of fats and oils marked by unpleasant smell and taste.

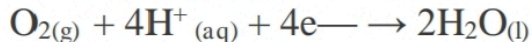
Q5]

The rusting of iron is an oxidation process. The rust on iron does not form by a simple reaction between oxygen and iron surface. The rust is formed by an electrochemical reaction. Fe oxidises to $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ on one part of iron surface while oxygen gets reduced to H_2O on another part or surface, Different regions on the surface of iron become anode and cathode.

(1) Fe is oxidised to Fe^{2+} in the anode region.



(2) O_2 is reduced to form water in the cathode region.



When Fe^{2+} ions migrate from the anode region they react with water and further get oxidised to form Fe^{3+} ions.

A reddish coloured hydrated oxide is formed from Fe^{3+} ions. It is called rust. It collects on the surface.



Because of various components in the atmosphere, oxidation of metals takes place, consequently resulting in their damage. This is called 'corrosion'. Iron rusts and a reddish coloured layer is formed on it. This is corrosion of iron.

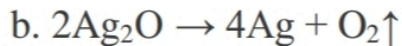
Q6] Identify from the following reactions the reactants that undergo oxidation and reduction.



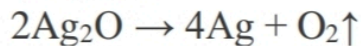
Answer:



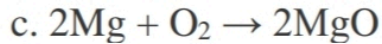
In this reaction, Iron (Fe) undergoes oxidation and sulphur. (S) undergoes reduction.



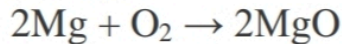
Answer:



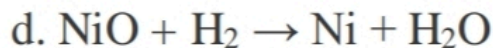
In this reaction, reduction of Ag_2O takes place.



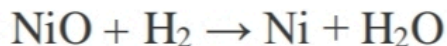
Answer:



In this reaction, oxidation of Mg takes place.

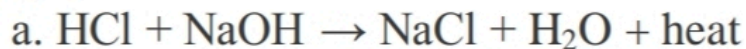


Answer:



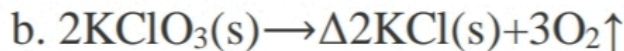
In this reaction, reduction of NiO takes place and oxidation of H₂ takes place.

Q8]



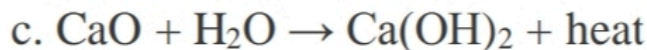
Answer:

Exothermic reaction.



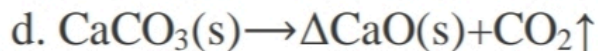
Answer:

Exothermic reaction.



Answer:

Exothermic reaction.



Answer:

Exothermic reaction.

Q9] Answer :-

Reactants	Products	Type of chemical reaction
$\text{BaCl}_{2(\text{aq})} + \text{ZnSO}_{4(\text{aq})}$	$\text{BaSO}_4\downarrow + \text{ZnCl}_{2(\text{aq})}$	Double displacement
$2 \text{AgCl}_{(\text{s})}$	$2\text{Ag}_{(\text{s})} + \text{Cl}_{2(\text{g})}$	Decomposition
$\text{CuSO}_{4(\text{aq})} + \text{Fe}_{(\text{s})}$	$\text{FeSO}_{4(\text{aq})} + \text{Cu}_{(\text{s})}$	Displacement
$\text{H}_2\text{O}_{(\text{l})} + \text{CO}_{2(\text{g})}$	$\text{H}_2\text{CO}_{3(\text{aq})}$	Combination