Chapter 3 – Chemical reactions and Equations

Q.1) Choose the correct option from the bracket and explain the statement giving reason. (Oxidation, displacement, electrolysis, reduction, zinc, copper, double displacement, decomposition)

a. To prevent rusting, a layer of zinc metal is applied on iron sheets.

b. The conversion of ferrous sulphate to ferric sulphate **is** an oxidation reaction.

c. When electric current is passed through acidulated water of electrolysis of water takes place.

d. Addition of an aqueous solution of ZnSO4 to an aqueous solution of BaCl2 is an example of double displacement reaction.

Q.2) Write answers to the following.

a. What is the reaction called when oxidation and reduction take place simultaneously? Explain with one example.

Ans) 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.

Example: $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O$

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. How can the rate of the chemical reaction, namely, decomposition of hydrogen peroxide be increased? .

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. Explain the term reactant and product giving examples.

1. The substance which undergoes bond breaking while taking part in a chemical reaction is called reactant.
2. The substance formed as a result of a chemical reaction by formation of new bonds is called product.
3. Example: In a chemical reaction, the formation of carbon dioxide gas takes place by combustion of coal in air. In this reaction, coal (carbon) and oxygen (from air) are the reactants while carbon dioxide is the product.
   $C + O_2 \dashrightarrow CO_2 + Heat$

d. Explain the types of reaction with reference to oxygen and hydrogen. Illustratre with examples.

1. Oxidation reaction:

Examples:

(1) When carbon burns in air, it forms carbon dioxide. In this reaction carbon accepts oxygen, therefore, this is an oxidation reaction.

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

(2) When sodium reacts with ethyl alcohol, sodium ethoxide and hydrogen gas is formed. In this reaction, hydrogen is removed from ethyl alcohol, therefore this is an oxidation reaction.

$$\underset{\text{Ethyl alcohol}}{2C_2H_5OH_{(l)}} + \underset{\text{Sodium}}{2Na} \longrightarrow \underset{\text{Sodium ethoxide}}{2C_2H_5ONa} + \underset{\text{Hydrogen}}{H_2\uparrow}$$

(3) Acidified potassium dichromate ($K_2Cr_2O_7$ / H_2SO_4) oxidises ethly alcohol to acetic acid.

$$CH_3 - CH_2 - OH \xrightarrow[K_2Cr_2O_7/H_2SO_4]{2(O)} CH_3 - COOH + H_2O$$

2. Reduction reaction:

Examples:

(1) When hydrogen gas is passed over black copper oxide a reddish coloured layer of copper is formed.

In this reaction an oxygen atom removed from CuO to form copper, hence, this is reduction.

$$\underset{\text{Copper oxide}}{CuO_{(s)}} + H_{2(g)} \rightarrow \underset{\text{Copper}}{Cu_{(s)}} + H_2O_{(l)}$$

(2) when hydrogen gas is passed over red hot coke, methane is obtained.

Here, hydrogen is added to coke (carbon). Hence, this is reduction.

$$\underset{\text{Carbon}}{C_{(s)}} + \underset{\text{Hydrogen gas}}{2H_{2(g)}} \rightarrow \underset{\text{Methane}}{CH_{4(g)}}$$

e. Explain the similarity and difference in two events, namely adding NaOH to water and adding CaO to water.

Similarity : Both NaOH and CaO, when dissolved separately in water, solid NaOH dissolves releasing heat, resulting in rise in temperature. This reaction is exothermic reaction.

When solid CaO dissolves in water, $Ca(OH)_2$ is formed, large amount of heat is evolved. This reaction is also exothermic reaction.

Both reactions are combination reactions and single product is obtained.

$NaOH_{(s)} + H_2O \rightarrow NaOH_{(aq)} + Heat$

$CaO_{(s)} + H_2O \rightarrow Ca(OH)_{2(aq)} + Heat$

Difference:

1. Aqueous solution of NaOH is considered as a strong alkali.
2. Aqueous solution of $Ca(OH)_2$ is considered as a weak alkali.

Q.3) Explain the following terms with examples.

Done in the class

Q.4)Give scientific reasons.

a.When the gas formed on heating limstone is passed through freshly prepared lime water, the lime water turns milky.

A) when lime stone is heated, calcium oxide and carbon dioxide are formed. This carbon dioxide gas is passed through freshly prepared lime water, insoluble calcium carbonate and water are formed. In this reaction, lime water turns milky.

$$Ca(OH)_2 + CO_2 \rightarrow \underset{\text{Calcium carbonate}}{CaCO_3} + H_2O$$

b. It takes time for pieces of Shahabad tile to disappear in HCl, but its powder disappears rapidly.

A)The rate of a reaction depends upon the size of the particles of the reactants taking part in the reaction. The smaller the size of the reactants particles, the more is their total surface area and the faster is the rate of reaction.

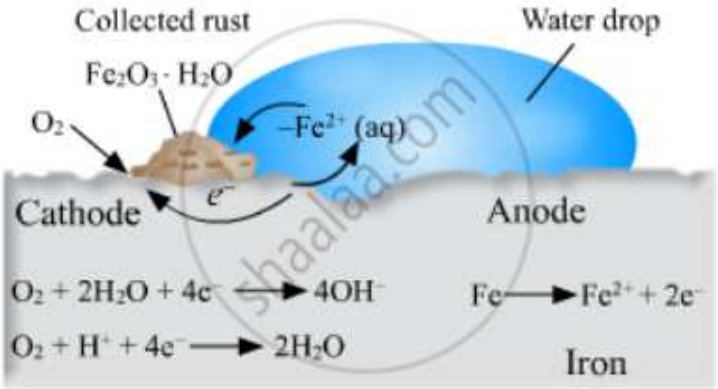
c.While preparing dilute sulphuric acid from concentrated sulphuric acid in the laboratory, the concentrated sulphuric acid is added slowly to water with constant stirring.

A) The preparation of dilute sulphuric acid falls in the category of extreme exothermic process. In the process of dilution or conc. sulphuric acid with water, very large amount of heat is liberated. As a result, water gets evaporated instantaneously, if it is poured in to conc. H_2SO_4 which may cause an accident.

d. It is reccommended to use air tight container for storing oil for long time.

A) 1) If edible oil is allowed to stand for a long time, it undergoes air oxidation, it becomes rancid and its smell and taste changes.
2)Rancidity in the rood stuff cooked in oil or ghee is prevented by using antioxidants. The process of oxidation reaction of food stuff can also be slowed down by storing it in air tight container.

Q.5) Observe the following picture a write down the chemical reaction with explanation.



ANSWER:

Ans

The rusting of iron is an oxidation process. The rust is formed by an electrochemical reaction. Fe oxidises to Fe_2O_3. H_2O on one part of iron surface while oxygen gets reduced to H_2O on another part or surface.

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

$2Fe^{3+}_{(aq)} + 4H_2O_{(l)} \rightarrow Fe_2O_3.H_2O_{(s)} + 6H^+_{(aq)}$...

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.

Q.6) Identify from the following reaction the reactants that undergo oxidation and reduction.

a. $Fe + S \rightarrow FeS$

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

b. $2Ag_2O \rightarrow 4Ag + O_2\uparrow$

In this reaction, reduction of Ag_2O takes place.

c. $2Mg + O_2 \rightarrow 2MgO$

In this reaction, oxidation of Mg takes place.

d. $NiO + H_2 \rightarrow Ni + H_2O$

$NiO + H_2 \rightarrow Ni + H_2O$

In this reaction, reduction of NiO takes place and oxidation of H_2 takes place.

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q.7) Done in class

Balance the following equation stepwise.

Q.8) Identify the endothermic and exothermic reaction.

Done in Class

Question 9: Done in class