CHEMISTRY STUDY MATERIALS FOR CLASS 10
(NCERT Based notes of Chapter -01)

GANESH KUMAR DATE:- 17/04/2021

CHEMICAL REACTIONS AND EQUATIONS

CORROSION

Corrosion is defined as the slow and steady destruction of a metal by the environment. It results in the deterioration of the metal to form metal compounds by means of chemical reactions with the environment.

Corrosion is a simple electro chemical reaction. When the surface of iron is in contact with moisture and other gases in the atmosphere an electrochemical reaction occurs. In this, impure iron surface acts as the cathode and pure iron acts as anode. H_2CO_3 formed from moisture and CO_2 from air acts as electrolyte.

The electrochemical reactions are as follows:

$$Fe \rightarrow Fe^{2+} + 2e^-$$

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

The Fe^{2+} ions are oxidised to Fe^{3+} ions.

The Fe^{3+} ions combine with OH^- ions to form $Fe(OH)_3$.

This becomes rust ($Fe_2O_3.xH_2O$) which is hydrated ferric oxide.

METHODS OF PREVENTING CORROSION

Corrosion of metals is prevented by not allowing them to come in contact with moisture,CO2 and O2.This is achieved by the following methods:

- **By coating with paints:** Paint coated metal surfaces keep out air and moisture.
- **By coating with oil and grease:** Application of oil and grease on the surface of iron tools prevents them from moisture and air.
- **By alloying with other metals:** Alloyed metal is more resistant to corrosion.
- **Example:** stainless steel.

- **By the process of galvanization:** This is a process of coating zinc on iron sheets by using electric current. In this zinc forms a protective layer of zinc carbonate on the surface of iron. This prevents corrosion.
- **Electroplating:** It is a method of coating one metal with another by passing electric current. Example: silver plating, nickel plating. This method not only lends protection but also enhances the metallic appearance.
- **Sacrificial protection:** Magnesium is more reactive than iron. When it is coated on the articles made of steel it sacrifices itself to protect the steel.

RANCIDITY

When fats and oils are oxidised, they become rancid and their smell and taste change. Rancidity is the chemical decomposition of fats, oils and other lipids.

There are three basic types of rancidity.

- ❖ Hydrolytic rancidity occurs when water splits fatty acid chains away from the glycerol backbone in glycerides.
- ❖ Oxidative rancidity occurs when the double bonds of an unsaturated fatty acid react chemically with oxygen.
- ❖ Microbial rancidity refers to a process in which microorganisms such as bacteria use their enzymes, including lipases, to break down chemical structures in the fat.

In each case, these chemical reactions result in undesirable odors and flavors. it is a condition produced by aerial oxidation of unsaturated fat present in foods and other products, marked by unpleasant odour or flavour. When a fatty substance is exposed to air, its unsaturated components are converted into hydroperoxides, which break down into volatile aldehydes, esters, alcohols, ketones, and hydrocarbons, some of which have disagreeable odours.

Butter becomes rancid by the foregoing process and by hydrolysis, which liberates volatile and malodorous acids, particularly butyric acid. Saturated fats such as beef tallow are resistant to oxidation and seldom become rancid at ordinary temperatures.

Usually substances which prevent oxidation (antioxidants) are added to foods containing fats and oil. Keeping food in air tight containers helps to slow down oxidation.

Rancidity can be avoided by:

1. Storing food in air tight containers
2. Storing food in refrigerators
3. Adding antioxidants
4. Storing food in an environment of nitrogen

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Question 1: Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

Answer : When an iron nail is placed in a copper sulphate solution, iron displaces copper from copper sulphate solution forming iron sulphate, which is green in colour.

$$\underset{\text{Iron}}{Fe_{(s)}} + \underset{\substack{\text{Copper sulphate}\\(\text{Blue colour})}}{CuSO_{4(aq)}} \longrightarrow \underset{\substack{\text{Iron sulphate}\\(\text{Green colour})}}{FeSO_{4(aq)}} + \underset{\text{Copper}}{Cu_{(s)}}$$

Therefore, the blue colour of copper sulphate solution fades and green colour appears.

Question 2: Give an example of a double displacement reaction other than the one given in Activity 1.10.

Answer : Sodium carbonate reacts with calcium chloride to form calcium carbonate and sodium chloride.

$$\underset{\substack{\text{Sodium}\\\text{carbonate}}}{Na_2CO_{3(aq)}} + \underset{\substack{\text{Calcium}\\\text{chloride}}}{CaCl_{2(aq)}} \longrightarrow \underset{\substack{\text{Calcium}\\\text{carbonate}}}{CaCO_{3(s)}} + \underset{\substack{\text{Sodium}\\\text{chloride}}}{2NaCl_{(aq)}}$$

In this reaction, sodium carbonate and calcium chloride exchange ions to form two new compounds. Hence, it is a double displacement reaction.

Question 3: Identify the substances that are oxidised and the substances that are reduced in the following reactions.

$$4Na_{(s)} + O_{2(g)} \longrightarrow 2Na_2O_{(s)}$$

$$CuO_{(s)} + H_{2(g)} \longrightarrow Cu_{(s)} + H_2O_{(l)}$$

Answer : (i) Sodium (Na) is oxidised as it gains oxygen and oxygen gets reduced.

(ii) Copper oxide (CuO) is reduced to copper (Cu) while hydrogen (H_2) gets oxidised to water (H_2O).

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