Engineering chemistry

(2021)

1. (i) During a chemical reaction, atomic numbe
   (a) changes
   (b) remains same
   (c) changes and then is restored
   (d) changes alternately

Ans.(b)

(ii) The electronic configuration of an atom havi atomic number 20 is
   (a) 2, 8, 8, 2
   (b) 2, 8, 10
   (c) 2, 6, 8, 4
   (d) 2, 4, 8, 6

Ans.(a)

(iii) Which of the following does not conduct electri ity?
   (a) Fused NaCl
   (b) Solid NaCl
   (c) Brine solution
   (c) Copper

Ans.(b)

(iv) The principal ore of Iron is
   (a) Haematite
   (b) Iron pyrites
   (c) Copper pyrites
   (d) Spathic iron

Ans.(a)

(v) The main constituent of duralumin is
   (a) Magnesium
   (b) Copper
   (c) Manganese
   (d) Aluminium

Ans.(d)

(vi) Which of the following is thermosetting plastic
   (a) PVC
   (b) Polystyrene
   (c) Bakelite
   (d) Teflon

Ans.(c)

(vii) The presence of CFCs in the atmosphere is respo sible for the
   (a) formation of ozone
   (b) production of healthy plants
   (c) depletion of ozone layer
   (d) None of these

Ans.(c)

(viii) The major air pollutant is
   (a) CO
   (b) Oxides of Nitrogen
   (c) Soot
   (d) Oxides of Sulphur

Ans.(a)

Q2. (a) What do you mean by Hunds rule and Aufb principle? Explain with example.

Ans.Refers to Chapter 1

Q2.(b) What is plastic? Differentiate between therm plastic and thermosetting plastic.

Ans.Refers to Chapter 6

Q3. (a) ... theory of ionisation? Write its postulates.

Ans. Refers to Chapter 5

Q3.(b) Explain Faradays first and second law.

Ans. Refers to Chapter 5

Q4.(a) Explain different processes involved in the extraction of metal from ore.

Ans. Out of Syllabus

Q4.(b) What is alloy? What are the purposes of making alloy?

Ans. Out of Syllabus

Q5.(a) What do you mean by pollution and pollutant? Explain ozone depletion with cause and control methods.

Ans. **Pollution and Pollutant:** Refers to Chapter 7

Ozone depletion : Ozone is produced in the upper layer of the atmosphere, about 20 km above the earth's surface, from oxygen gas by the absorption of ultraviolet light.

$$3O_2 \xrightleftharpoons[\text{light}]{\text{u.v.}} 2O_3$$

Thus, air in the upper layer is very rich in ozone. Ozone an allotrope of oxygen is an important chemical species present in the stratosphere and its concentration at an altitude of about 30 km is nearly 10 ppm. Ozone is quite destructive to fabrics, rubber goods, crops etc., but it checks the entry of u.v. radiations from sunlight. This upper layer of the atmosphere enveloped by ozone is commonly known as "ozone layer or protective layer" or "ozone umbrella". Thus, it acts as a protective shield for life on earth. It strongly absorbs u.v. radiations from the sun in the region 220 to 330 nm and thereby protects the life on earth from severe radiation damage.

If ozone layer in the atmosphere is depleted then the harmful u.v. radiations from the sun would reach the earth's surface and would damage the plants, causes diseases like skin cancer in animals and human and ultimately causes the gradual destruction of life on the earth.

Ozone is formed in the stratosphere by photochemical reactions

$$O_2 + h\nu \rightarrow O + O$$

$$O + O_2 + M \text{ (third body, such as } N_2 \text{ or } O_2) \rightarrow O_3 + M$$

The third body absorbs the excess energy liberated by the above reactions and ozone molecules are thus stabilised. Formation of ozone in atmosphere is a continuous process.

Causes of Ozone Depletion : The following are the causes of ozone depletion :

(i) The chlorine which is released in the atmosphere due to volcanic activity and due to the reaction with nitric oxide, atomic oxygen, reactive hydroxyl radical causes the ozone destruction.

$$O_3 + N \rightarrow NO_2 + O_2$$

$$O_3 + O \rightarrow O_2 + O_2$$

$$O_3 + HO \rightarrow HO_2 + HOO$$

$$HOO^- + O \rightarrow HO^- + O_2$$

NO is present in the atmosphere due to photochemical and chemical reactions, supersonic jets, nuclear explosions, etc. Chlorine comes from CIFCs, (chloro-fluoro-carbons) and volcanoes, and OH comes from biomass burning and from natural water systems.

(ii) Chloro-fluoro-carbons (CIFCs) are used in refrigerators, air-conditioners, propellants in aerosol sprays and in plastic foams like 'thermocole' causes destruction of ozone in the stratosphere. CIFC molecules escape into the atmosphere and decompose to give chlorine in ozone layer. Each chlorine atom so liberated attacks many of the ozone molecules. i.e., one atom of chlorine can react with 10^5 molecules of ozone converting into oxygen.

$$Cl + O_3 \rightarrow ClO + O_2$$

$$ClO + O \rightarrow Cl + O_2$$

The chlorine atom regenerates and forms a chain process which conserves Cl atoms.

All developed countries produce CIFCs in large quantity and ozone layer is getting thinner and thinner day by day. All these CIFCs must be replaced by suitable materials, otherwise the depletion of ozone layer will go on increasing and will be dangerous to living beings due to damaging effects of increased u.v. radiations.

Effects of Ozone Depletion :

Thinner and weaker ozone layer will allow more and more u.v. radiation to enter causing skin cancer, swelling of skin, sunburns, burning sensation, skin aging, leukemia, breast cancer, cataracts of eyes, haemorrhage, lung cancer, dizziness, premature aging, DNA breakage.

Q5.(b) Explain B.O.D. and C.O.D. with their significance.

Ans. **Biochemical Oxygen Demand (BOD):** Biochemical Oxygen Demand is a measure of the amount of oxygen that would be needed by the microoraganisms to cause biodegradation of the pollutants. Ultimately, the pollution load a transformed into simple, non-hazardous com-

oxygen is consumed in this process. In order to elucidate biochemical oxygen demand, the water sample is first saturated with oxygen. It is then incubated as a constant temperature, usually 20°C, for five days. This allows time for microoraganisms to act on pollutants. The remaining amount of dissolved oxygen is determined and biochemical oxygen demand is obtained by subtraction.

$$BOD = \left|\begin{matrix}\text{Saturation value of dissolved} \\ \text{oxygen per liter at } 20^\circ C\end{matrix}\right| - \left|\begin{matrix}\text{Amount of dissolved oxygen} \\ \text{per liter at } 20^\circ C \text{ after 5 days}\end{matrix}\right|$$

Biochemical oxygen demand indicates the extent of pollution load. If the pollution load is large, then greater amount of dissolved oxygen will be consumed and according to the above equation, BOD will be high. Conversely, a law value of BOD indicates relatively unpolluted water. For drinking water, the biochemical oxygen demand should be in the 0.75 - 1.50 ppm range.

Biochemical oxygen demand does not measure the contamination caused by any specific chemical. It is a measure of the contamination by the totality of those compounds which can be oxidised in the presence of oxygen and microorganisms. A large number of organic compounds, for example, detergents are, however, resistant to microbial oxidation. Some, like cellulose, do not get completely oxidised within the 5 days period required for elucidation of BOD. It is also possible that the water sample may contain some toxic chemicals, like pesticides, which may poison the water-purifying microorganisms. Moreover, the 5 days period for BOD assessment is quite long.

Chemical Oxygen Demand (COD): COD may be defined as the amount of (dissolved) oxygen required to oxidize and stabilize (organic and inorganic content of) the sample solution. It is used to measure the content of oxidizable organic as well as inorganic matter of the given sample of waters. The oxygen equivalent is measured by using a strong chemical oxidizing agent in a acidic medium. Potassium dichromate has been found to be excellent for this purpose. The COD test is used with advantage to measure the oxidizable matter in industrial and municipal wastes containing compounds that are toxic to biological life (which is not possible with BOD test). The COD of a waste is higher than the BOD because more compounds are chemically oxidized in a short interval of time. It had the advantage of getting completed in 3 hours compared to 5 days of the BOD test. It is possible to correlate BOD and COD. BOD_5/COD ratio is called Biodegradability Index and varies from 0.4 to 0.8 for domestic wastewaters.

If BOD/COD is > 0.6 then the waste is fairly biodegradable and can be effectively treated biologically.

is required to treat it biologically.

If BOD/COD is < 0.3 then it cannot be treated biologically.

Q6.(a) What is valency? Explain types of velency with example.

Ans. Refers to Chapter 1

Q6.(b) Write the differences between Natural rubber and Synthetic rubber. Why vulcanisation of natural rubber is required?

Ans. Refers to Chapter 6

Q7. Write short notes on any two :

(i) Greenhouse effect

(ii) E-waste

(iii) Thermal insulating material

(iv) Electrorefining of metals

Ans.(i) Greenhouse effect: Refers to Chapter 7

Ans.(ii) E-waste: Refers to Chapter 7

Ans.(iii) Thermal insulating material: Refers to Chapter 6

Ans.(iv) Electrorefining of metals: Out of Syllabus