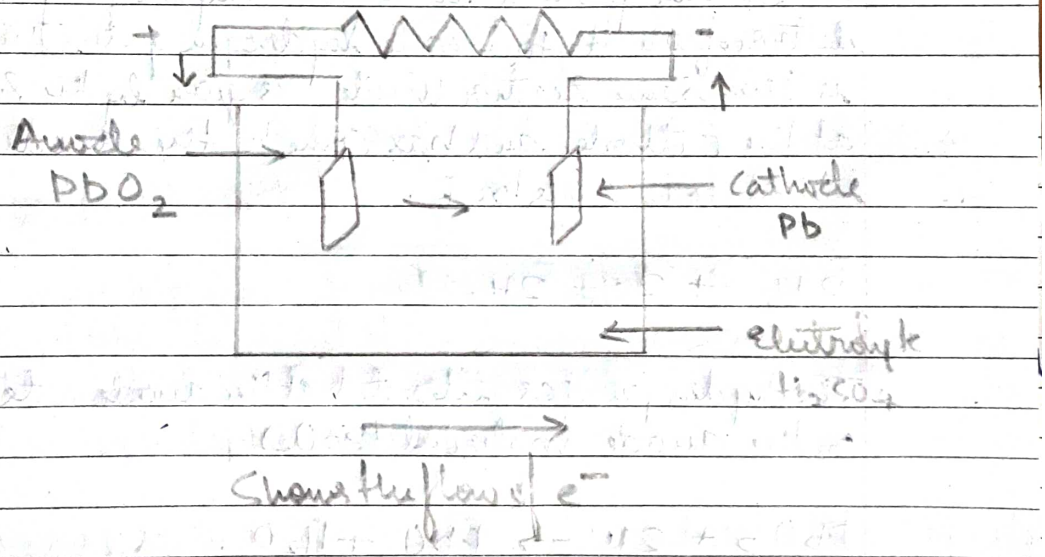
Page No.
Date

G.H Raisoni College of Engineering & Management
Wagholi Pune.

CAE - II SUMMER 2021

Department	F.Y B.Tech
Term/Section	Term II / Date of examination 22/07/21
Subject Name/Code	Environmental Chemistry (UBSL 102)
Roll No.	170 / Name: Swayam Pramod Terode
Registration Number	2020AIFT11010 47

(CO3 a.) Discharging of Lead Acid Battery



When the Sulphuric acid is dissolved, its molecules are ~~dissolved~~, it dissociated into hydrogen ions ($2H^+$) and sulfate ions (SO_4^{--}) while moves freely in the electrolyte.

When the load resistance is connected to terminals of the battery; the sulfate ions (SO_4^{--}) travel towards the cathode and hydrogen ions ($2H^+$) travel towards the anode.

Page No.
Date

The chemical reactions at the cathode are as follow:

At Cathode

$SO_4^- - 2e = SO_4$ (radical).

$Pb + SO_4 \longrightarrow PbSO_4$.

At Anode

Each hydrogen ion (H^+) on reaching the anode, takes an electron from it to become hydrogen gas. This electron from it to become hydrogen gas. This electron is the same reaction which is given by the sulfate ion at the cathode and has come to the anode via external load resistor R.

$2H^+ + 2e = 2H$.

The hydrogen gas liberated at the anode acts chemically on the anode material (PbO_2).

$PbO_2 + 2H \longrightarrow PbO + H_2O$.

This PbO_2 is reduced to PbO which reacts with H_2SO_4 and forms $PbSO_4$.

Page No.
Date

Thus during Discharge.

1. Both plates are transformed into lead Sulfate ($PbSO_4$)
2. Sulphuric acid is consumed and water is formed which reduces the Specific gravity of electrolyte from 1.29 to 1.18.
3. The terminal voltage of each battery cell falls to 1.8V.
4. Chemical energy is converted into electrical energy which is delivered to load.

Charging of Lead Acid Battery

The lead-acid battery can be recharged when it is fully discharged.

For recharging, positive terminal of DC source is connected to positive terminal of the battery (anode) and negative terminal of DC source is connected to the negative terminal (cathode) of the battery.

During recharging, hydrogen ions ($2H^+$) travel towards the cathode and sulfate ions (SO_4^{--}) travel towards the anode. The chemical reactions are as under:

At Anode:

$SO_4^{--} - 2e \longrightarrow SO_4$ (radical)

$SO_4 + H_2O \longrightarrow H_2SO_4 + O$.

The oxygen (in atomic stage) reacts chemically with anode material ($PbSO_4$):

$$PbSO_4 + O + H_2O \longrightarrow PbO_2 + H_2SO_4$$

At Cathode

$$2H^+ + 2e \longrightarrow 2H$$
$$PbSO_4 + 2H \longrightarrow Pb + H_2SO_4$$

Thus during charging

The anode is transformed into lead peroxide (PbO_2) and cathode into the spongy lead (Pb).

Electrical energy is converted into chemical energy which is stored in the cell.

Net charging Reaction

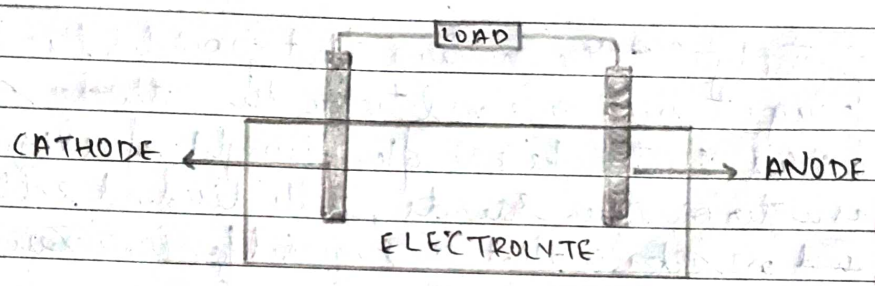
$$2PbSO_4 + 2H_2O \longrightarrow Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)}$$

Net discharging Reaction:

$$Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)} \rightarrow 2PbSO_{4(aq)} \longrightarrow$$
$$2PbSO_{4(s)} + 2H_2O_{(l)}.$$

CO3 c.) Batteries have 3 essential components.

1.) Anode
2.) Cathode
3.) Electrolyte



Anode material should exhibit the following properties:

1.) Efficient reducing agent
2.) High Coulombic output
3.) Good Conductivity.
4.) Stable
5.) Ease of fabrication
6.) Low Cost.
7.) Metals such as Zinc and Lithium are often used as anode materials.

Function: The Anode is negative or reducing electrode that releases electrons to the external circuit and oxidizes during and electrochemical reaction.

Page No.
Date

2.) Cathode is the positive or oxidizing electrode that acquires electrons from the external circuit and is reduced during the electrochemical reaction.

Properties:- Efficient oxidizing agent, Stable when in contact with electrolyte.

3.) Electrolyte: Is the medium that provides the ion transport mechanism between the cathode and anode of a cell. Electrolytes are often thought of as liquids, such as water or other solvents, with dissolved salts, acids and or alkalis that are required for ionic conduction.

Function: Strong Ionic Conductivity
No electric conductivity
Non-reactivity with electrode material

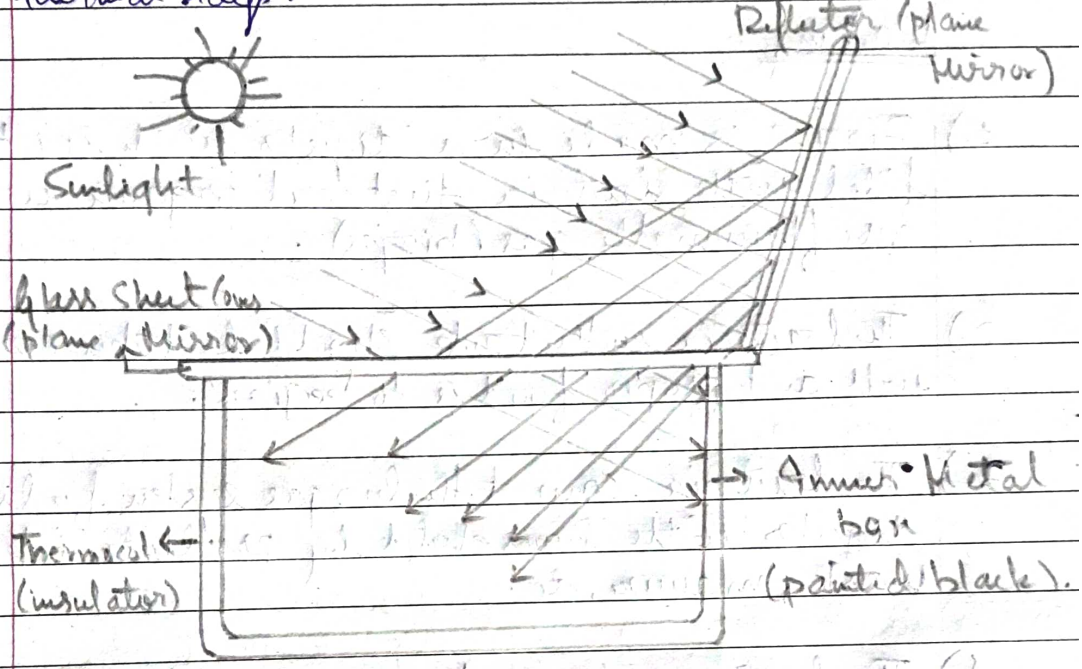
CO4 a) Working of Solar Cooker:

Concentrating Sunlight: A mirror surface with high specular reflectivity is used to concentrate and channelize light from the sun into a small cooking space. The sunlight can be concentrated by several orders of magnitude, producing magnitude high enough to melt salt and metal. For household Solar cooking applications such high temp are not required. Solar cookers available in the market are designed to achieve temp of 65°C to 400°C.

Page: 6 | Sign:

Page No.
Date

Trapping Heat Energy: The occurrence of convection is reduced by isolating the air inside the cooker from the air outside. The glazing traps the incoming sunlight but is opaque to escaping infrared thermal rays.



Advantages:

Solar Cookers use no fuel. This saves costs as well as the environment by not contributing to pollution.

Reduces carbon footprint by cooking with carbon dioxide - based fuels.

Page No: 7 | Sign: 22/07/24

CO4 b.) Biogas is a mixture of gases produced by the breakdown of organic matter in the absence of oxygen. It mainly consists of carbon dioxide and methane.

Working:

1.) Biogas is made in a digester which is a tank filled with bacteria that eat organic waste and give flammable gas (biogas).

2.) The bacteria in the tank should be taken care of well and proper food is to be given.

3.) The bacteria convert the biogas system fuels the digester with household by products like kitchen waste, manure, etc.

4.) The bacteria convert organic matter into methane gas through anaerobic respiration.

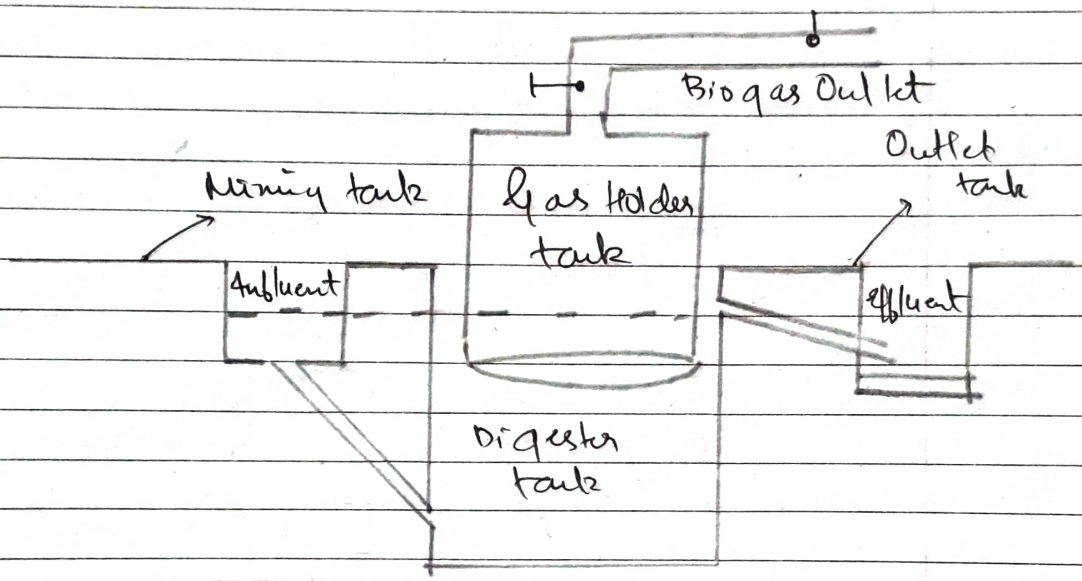
5.) The methane gas produced can be used for cooking lighting etc.

6.) The main part consist of

Mixing tank, Inlet chamber, Digester, Outlet chamber, Overflow tank.

Page No.: 6 | Sign:

Page No.
Date



Page No. : 1 | Sign: 22/07/21