



# **SNS COLLEGE OF TECHNOLOGY**

Vazhiampalayam, Coimbatore-35

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## **DEPARTMENT OF CHEMISTRY**

**COURSE NAME : 19CHB101- CHEMISTRY FOR ENGINEERS**

**I YEAR / II SEMESTER**

**UNIT : 1. MODERN BATTERIES**

**TOPIC : 3. Lead Acid batteries**



## SECONDARY BATTERY

In these cells, the electrode reaction can be reversed by passing an external electrical energy. Hence, they can be recharged by passing electric current through them and can be used again and again. They are also called as storage cells or accumulators.

**Examples:** Lead acid storage cell, Nickel – Cadmium cell, etc.



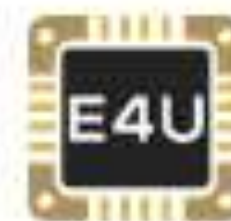
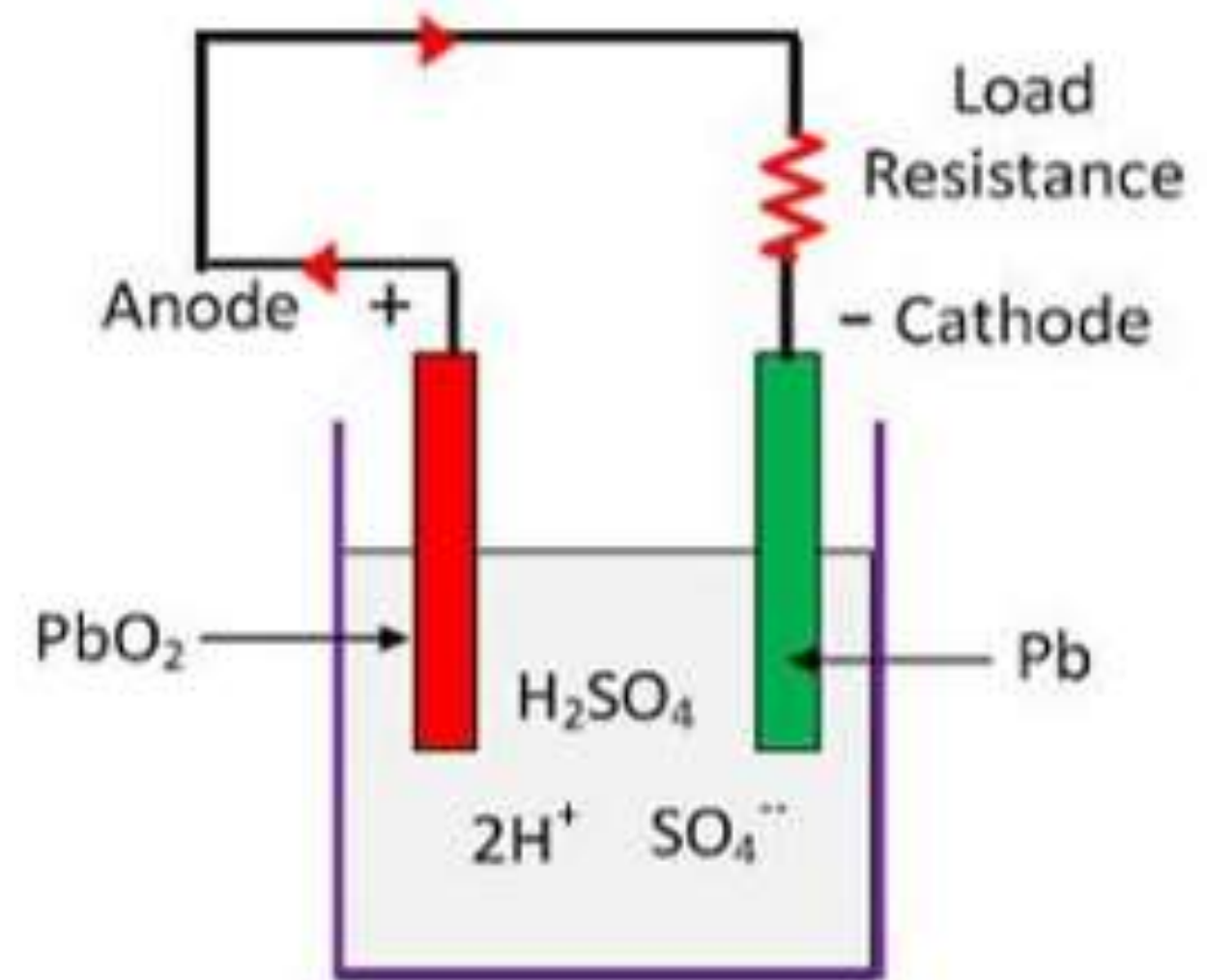
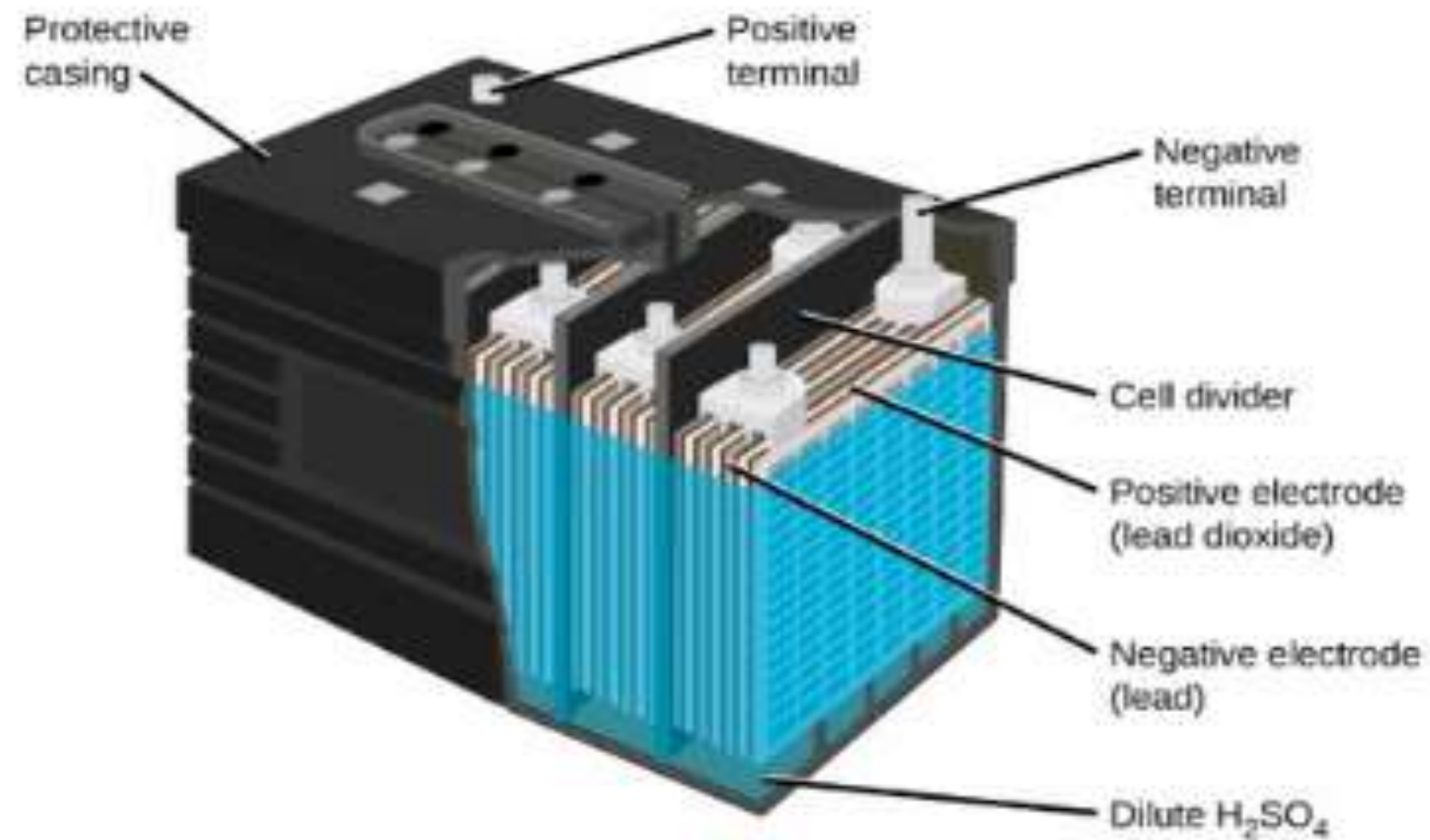
# LEAD ACID BATTERY

- **Lead acid battery (or) Lead storage cell (or) Lead accumulator (or) Acid storage cell**

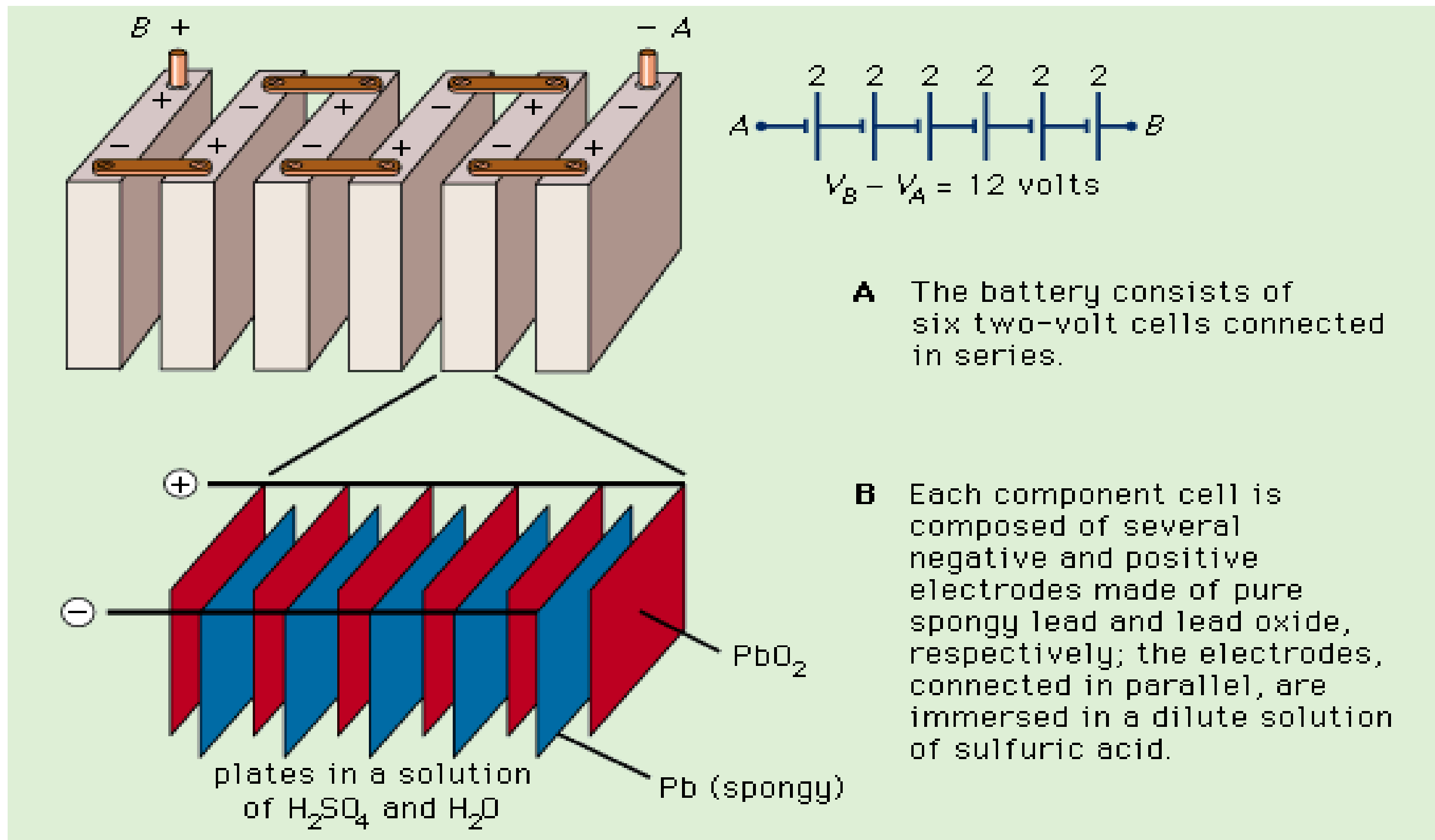
Lead acid battery can be operated both as a voltaic and electrolytic cell. When it acts as a voltaic cell, it supplies electrical energy and run down. When it is recharged, it acts as an electrolytic cell. Thus, it is rechargeable.



# How does a Lead Acid Battery Work?

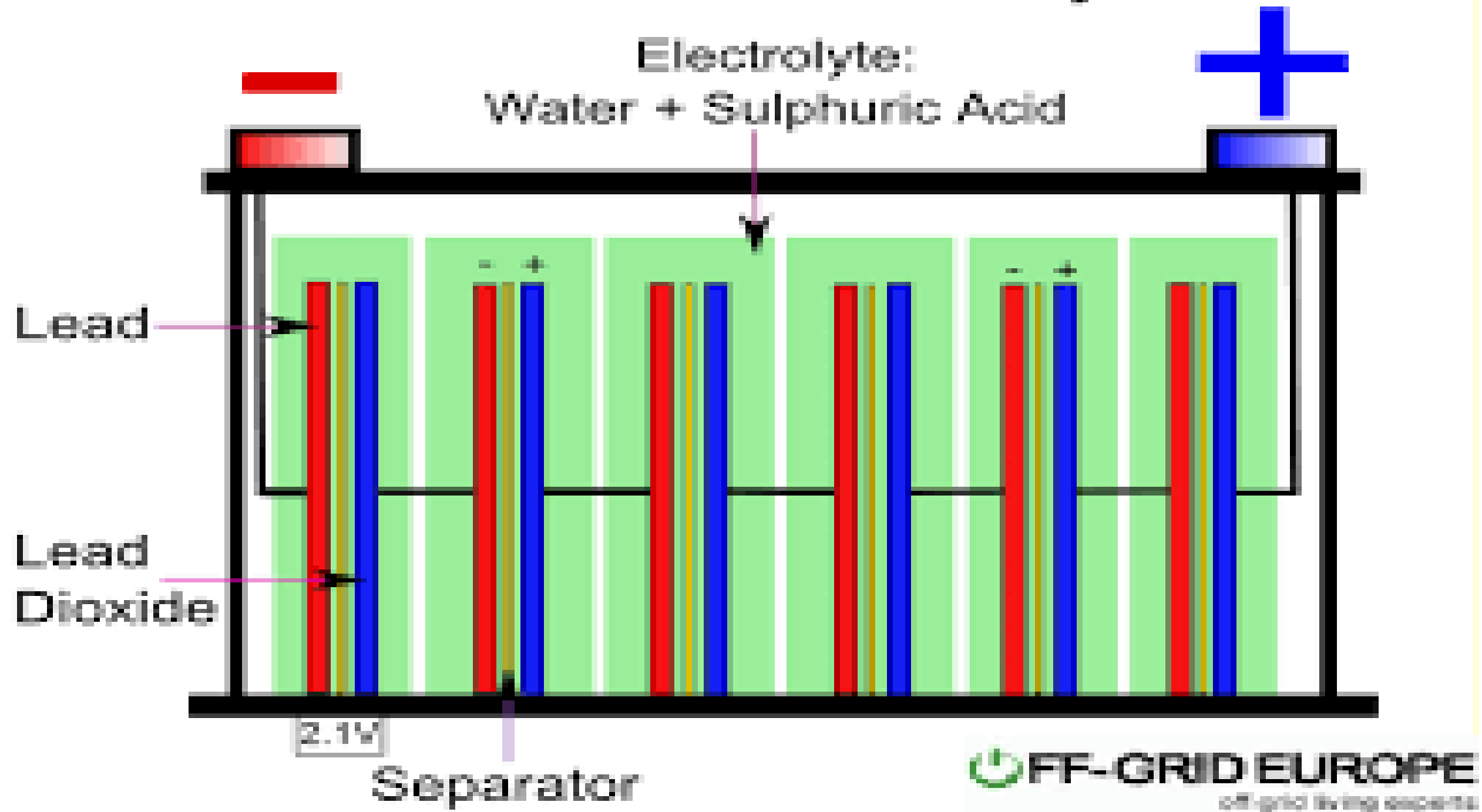


**Electrical 4 U**





# 12V Lead-Acid Battery





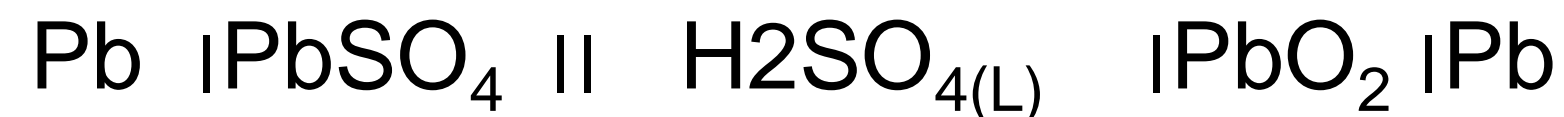


## Construction

A lead storage battery consists of 3 to 6 voltaic cells connected in series. In each cell, lead acts as anode and lead dioxide ( $\text{PbO}_2$ ) acts as cathode .

Various plates are separated from the adjacent one by insulator like rubber.

Anodes and cathodes are immersed in 20 to 21 % dil.  $\text{H}_2\text{SO}_4$  having a density of 1.3 gm/ml. The cell representation is given below.





## Working (Discharging)

When the storage cell is supplying electricity, lead is oxidized to  $\text{Pb}^{2+}$  ions and  $\text{PbSO}_4$  is formed at anode. At cathode,  $\text{PbO}_2$  gains the liberated electrons and gets reduced to  $\text{Pb}^{2+}$  and  $\text{PbSO}_4$  is formed.

**At anode:**







**At cathode:**



**Overall cell reaction during (discharging) use (1) + (2)**



At the time of discharging process,  $\text{PbSO}_4$  is deposited at both the electrodes and  $\text{H}_2\text{SO}_4$  is consumed. As a result, the concentration of  $\text{H}_2\text{SO}_4$  decreases gradually.



## Recharging

The cell is recharged when the density of H<sub>2</sub>SO<sub>4</sub> becomes below 1.2 gm/ml. It can be done by applying an external electricity across the electrodes. The following reaction will take place during recharging process :



## Overall Reaction



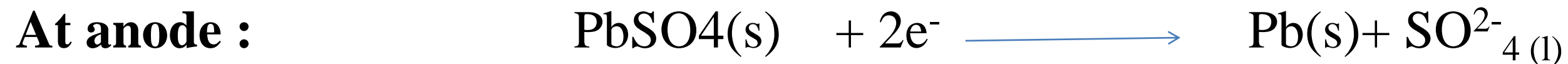
## Net Reaction :





## Recharging

The cell is recharged when the density of H<sub>2</sub>SO<sub>4</sub> becomes below 1.2 gm/ml. It can be done by applying an external electricity across the electrodes. The following reaction will take place during recharging process :



## Overall Reaction



## Net Reaction :





Hence, the recharging involves exactly the reverse process of the normal cell reaction.

**Note:**

Decrease in density Decrease in density of dil.  $H_2SO_4$  can be measured with the help of hydrometer.

**Uses**

It is used in automobiles such as cars, buses, etc.

It is also used in gas engine ignition, telephone exchanger, hospitals, power stations, etc.



## **Advantages of lead acid battery**

It can be constructed easily.

It produces high voltage.

It acts as effectively even at low temperature.

Self-discharge is very low when compared to all other batteries.

## **Disadvantages**

Recycling of this battery causes environmental pollution.

Mechanical strain and normal pumping reduces battery capacity.



# SUMMARY





# REFERENCES



1. O.G. Palanna, “Engineering Chemistry ”Tata McGraw-Hill Pub. Co. Ltd, New Delhi.2017.
2. Wiley, “Engineering Chemistry”, John Wiley & Sons. InC, USA.
3. P.C.Jain & Monicka Jain, “Engineering Chemistry” , Dhanapat Rai Publising Company Pvt. Ltd. 2017.

**THANK YOU**