Environmental Science

Que 1 Discuss briefly the consequences of Bhopal gas tragedy.

Ans On December 3, 1984, disaster struck Bhopal, the capital city of Madhya Pradesh.

It was an industrial disaster. It took place at the Union Carbide Subsidiary involved in the manufacture of carbamate type of pesticide. Due to the alleged functional failure, 42 tones of toxic methyl isocyanate (MIC) gas escaped from the underground storage tanks, exposing more than 5,00,000 people. About 2500 deaths & severe disibilities to survivers.

It is the world's worst industrial disaster.

Que 2- Differentiate b/w renewable and non-renewable source of energy.

Ans

Renewable	Non-renewable
• These are the natural resources that do not depleted even after their continuous consumption.	• These are the natural resources that get depleted with continuous consumption.
Examples are sunlight, wind, water, etc.	Examples are Mineral ores, fossil fuels such as coal & petroleum.

• These resources are easily available on the surface of the earth & can be replenished naturally in the course of time	These resources are in a limited amount on the surface of earth & can't be replenished as it takes millions of years to develop.
• They are sustainable and environmentally friendly.	• They causes pollution & also releases carbon di - oxide.

Q-3 What is solar energy? Enmuerate the application of solar energy in modern days.

Ans Solar energy is any type of energy generated by the sun. ~~It is a renewable source of energy~~. It is the most abundant energy resource on Earth. Solar energy uses the sun's light & heat to generate renewable or 'green' power.

1) Solar water heater & solar cooker are the modern technologies worked with solar energy.
2. Solar pump runs by the electricity produced by solar cells.
3. Solar cells are widely used in calculators, electronic watches, street lightening etc.

4. Solar energy is used to power home using solar panels.

5. Solar energy is used as solar heater.

Q 4 What is geothermal energy? Discuss its merits & demerits.

Ans The energy generated from the hot rocks present inside the earth is called geothermal energy. It is a renewable energy source. This energy is used directly for heat & their steam can be used to generate electricity.

Merits	Demerits
⇒ It is environment friendly type of energy.	⇒ It is location-specific.
⇒ It is renewable source of energy.	⇒ Can cause earthquakes in extreme cases.
⇒ No waste of generation of by-products.	⇒ Land requirement is large.
⇒ Maintainence cost of this energy is very less.	⇒ Expansion of Gases present inside the Earth into the atmosphere.
	⇒ Total generation potential is too small.

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Qus-5:- How will you get energy from biological degradable materials?

Ans Anaerobic digestion:- It is the microbial decomposition of organic waste in the absence of oxygen, producing biogas & fertilizer. Biogas is converted to heat & electricity.

Fermentation:- It refers to the conversion of organic waste to acid or alcohol in the absence of oxygen. This process is used to make bioethanol (clean fuel for transportation).

Qus6 Hydrogen can be considered as a future energy fuel. Explain?

Ans Hydrogen is the simplest element known to man. Hydrogen is abundant in chemical compounds such as water & the organic compounds of biomass. Hydrogen burns in air produces water & large amount of energy. Due to its high calorific value, hydrogen can be serve as an excellent fuel. Production of hydrogen is possible by thermal dissociation, photolysis or electrolysis of water.

Merits of Hydrogen as an energy source

→ It is pollution free, the combustion of hydrogen generation only steam and liquid waters, hence it is completely safe from environmental point of view.

⇒ As it is carbon free, there is no production of greenhouse gases.

Demerits of hydrogen:-

⇒ Hydrogen is difficult to handle, store & transport.

⇒ It is highly inflammable & explosive in nature.

⇒ Currently more expensive than other energy sources.

Ques 7:- What is nuclear energy? Discuss its potential & utilization in India.

Ans Nuclear energy is the sustainable source of energy. It is the energy released from the nucleus of an atom. Nuclear energy comes from splitting atoms in a reactor to heat water into steam, run turbine & generate electricity.

It is generated by two types of reactions:-

Nuclear fission → It is the subdivision of a heavy atomic nucleus, such as that of uranium or plutonium, into two nuclei with equivalent size & magnitude, with great detachment of energy.

$$^{235}_{92}U + {}_0n^1 \longrightarrow {}^{133}_{51}Sb + {}^{99}_{41}Nb + 2.5\ {}_0n^1 + 20\text{mev}$$

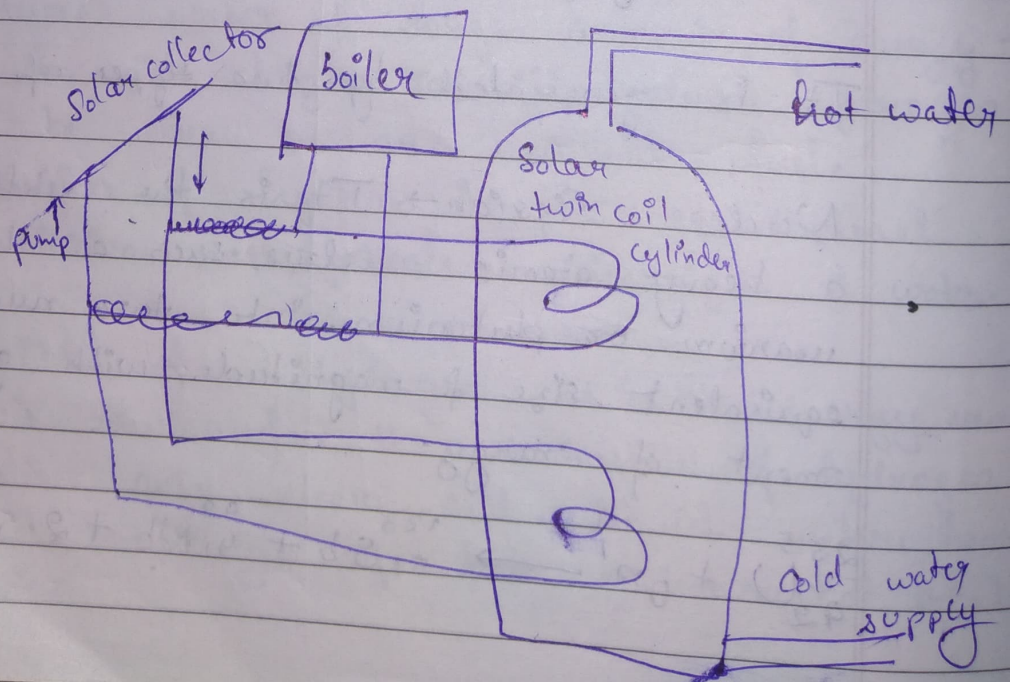
Nuclear fusion:- It is a reaction in which two or more atomic nuclei are combined to form one or more different atomic nuclei & subatomic particles.

$$_1H^2 + _1H^2 \longrightarrow {}_3He^2 + on^1 + 3.3\,mev$$

Ques:- Explain the use of solar energy for the purpose of:

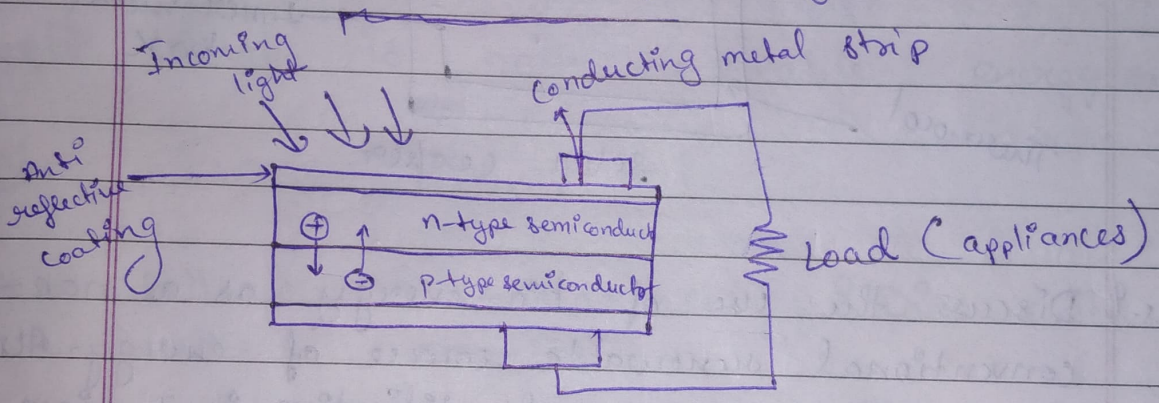
(a) Solar water heating
(b) Solar cells
(c) Solar cooker.

Ans (a)

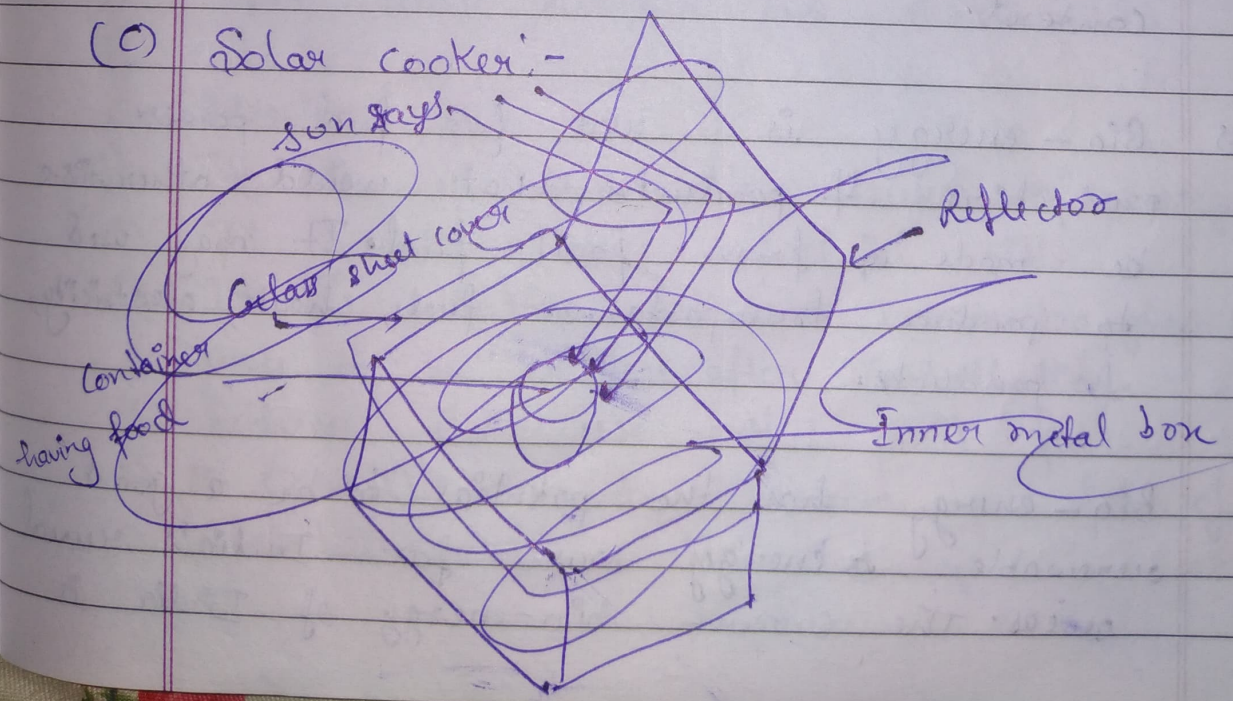


The Sun's rays fall on the collector panel. A black absorbing surface absorb the heat & transfer it to the water stored by means of a circulating pump.

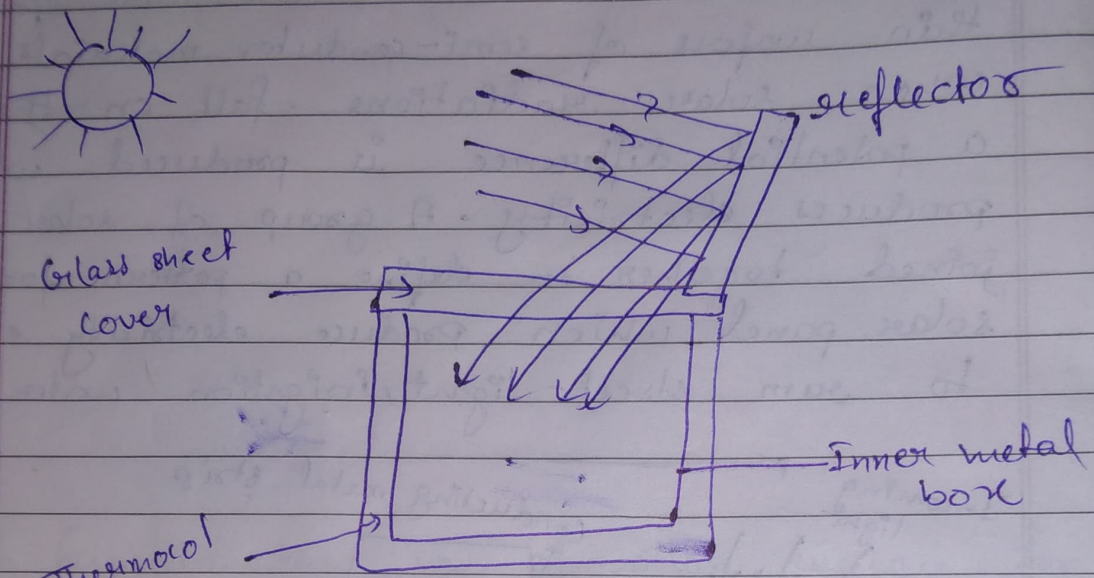
2. Solar cells:- Solar cells are made of thin wafers of semi-conductor materials. When solar radiations fall on them, a potential difference is produced which produces electricity. A group of solar cells joined together to define a pattern form a solar panel which produce electricity enough to run street-light, irrigation water pumps etc.



(c) Solar cooker:-



Solar cooker make use of solar heat by reflecting the solar radiations using a mirror directly on to glass sheet which covers the black insulated box within which the ~~food~~ raw food is kept.



solar cooker.

Ques-9 Discuss the use of bio-energy as a non-conventional renewable source of energy. Also discuss its scope and utilization in Indian context.

Ans Bio-energy is used for fuel, power production & products that would otherwise be made ~~up~~ from fossil fuel. It may used to produce transportation fuels, heat, electricity, & products.

Bio-energy has the potential to be a good renewable energy source for India's rural areas. The current bio-energy of India is

expected to be over 500 million metric tonnes per year. The power generated by bio-energy in India is ~~esteemed~~ estimated to be over 1800 MW. It now for 10-14% of the energy consumed in out country.

Que 10:- ~~Discuss the use of bio-energy as a non-conventional renewable source of energy.~~

Que 6:- Discuss 'hydrogen as an alternative future source of energy?

Ans Same As Answer - 6

Que 11:- What is non-renewable energy source?

Ans From Answer - 1.

Que 12:- What is solar energy? Discuss its merits & demerits.

Ans 1st Part same as Ans - 3.

Merits :-

1) It is a renewable source of energy.
2) It reduces the electric bill.
3) It is pollution-free and no green house gases to be emitted after installation.
4) Reduces the use of fossil fuel.
5) It doesnot require a lot of maintainenance.

Demerits:-

1) It become useless during night
2) Disposal of old solar panel can be harmful to the environment.
3) Manufacturing of solar panel can harm the environment.
4) It requires sunny weather to work best.
5) Installation & storage of solar energy is expensive.
6) It requires lot of space to produce more energy.

Qus 13 What is renewable resources?

Ans Same as answer - 1.

Qus 14:- What is biomass energy?

Ans Biomass is a renewable source of energy. It is defined as "the waste material of living beings and the dead parts of living being i.e plants, trees, animals". It includes cattle dung, wood, sewage, agricultural waste etc. Biomass fuel is burned to release energy.

It is of three types:-

1. Solid biomass fuel:- It includes wood, charcoal, animal dung & peat.
2. Liquid biomass fuel:- Biomass can be converted to liquid fuels.

Gas biomass fuel:- By using anaerobic microbial decomposition, biomass can be converted to biogas.

Qus-15 Explain the significance of biomass energy.

Ans It is a clean, renewable energy source that could dramatically improve our environment, economy, & energy security. Biomass energy generates far less air emissions than fossil fuels, reduces the amount of waste sent to landfills, & decreases our dependence on fossil fuel. Biomass technology is much cheaper. Manufacturers & producers are able to generate higher profits from a lower output.

Qus 16):- What are the alternative energy resources? Discuss any two of them. Differentiate b/w renewable and non-renewable natural resources.

Ans Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy Geothermal energy, biomass energy, Biogas, biofuel, hydrogen fuel, coal, petroleum, LPG, CNG, Natural gas, nuclear energy etc.

For part 2 → Solar, biomass - already discussed

For part 3 → same as answer 1

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Ans 17: What is Tidal Energy? Discuss its merit & demerit.

Ans Ocean tides produced by gravitational forces of sun & moon contain enormous amounts of energy. The 'high tide' & 'low tide' refer to the rise & fall of water in oceans.
A difference of several meters is required between the height of high and low tide to spin the turbines. The tidal energy can be harnessed by constructing a tidal barrage. During high tide, the sea water flows into the reservoir of the barrage & turns the turbine, it rotates the generator & produce electricity. During low tide, when the sea-level is low, the sea water stored in the barrage reservoir flows out into the sea & again turns the turbine.

Advantages:-
1) It is inexhaustible source of energy.
2) A highly predictable source of energy.
3) It is environmental friendly.
4) No fuel is needed.
5) Once a power plant built, the energy is almost free.

Disadvantages:-
1) The cost of building tidal power plants is significiently high.
2) Tidal energy is only available in a small number of regions.

3) It affects the habitat of the seabirds & the fish.
4) There is only about 10 hours per day when power can be generated by sea.
5) The cost of building tidal power plants is currently pretty expensive.

Que-18:- What is Hydroelectric Energy? Discuss its merit & limitation.

Ans Hydroelectric energy :- The water flowing in river is collected by making big dams on the water bodies. The water is allowed to fall from a height. The blades of the turbine move with the fast moving water which in turn rotates the generator & produces electricity. The electric energy is called hydroelectric energy.

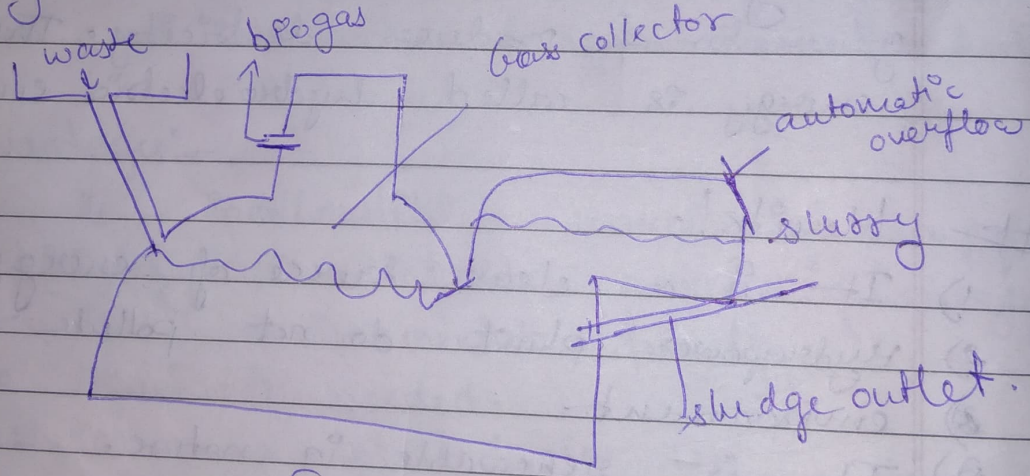
Merits:-
1) It is a clean source of energy.
2) Hydropower plant do not pollute the
3) environment.
4) It is renewable in nature.

Demerits:-
1) It ~~cause~~ installation of powerplant causes heavy deforestation.
2) Increase the incidence of water related diseases
3) Loss of wildlife due to deforestation.

Ques 19:- What is biogas? Discuss the fixed dome type biogas plant with its merits & demerits.

Ans Biogas is a mixture of gases having methane as a main component. When organic matter undergoes anaerobic decomposition methane, ammonia, hydrogen & carbon dioxide are released. This mixture of gases is called biogas.

Fixed dome plant comprises of a closed, dome-shaped digester with an immovable, rigid gas-holder & a displacement pit, also named 'compensation tank'. The gas is stored in the upper part of the digester. Was gas production commences, the slurry is displaced into the compensating tank.



Fixed dome plant.

Merits :-

1) Low initial costs and long useful life-span;
~~no moving or rusting~~
2. The underground construction saves space & protects the digester from temperature changes.

Disadvantages:-

1) Problem with gas-tightness of the brickwork, can cause heavy ~~cl~~ a small crack in the upper brickwork can cause heavy losses of biogas.
2) The gas pressure fluctuates substantially depending on the volume of the stored gas.
3) A specific environmental disadvantage is methane emission from the expansion chamber.

Ques-20) What is wind Energy? Discuss its merits & limitations.

Ans The high speed winds have a lot of energy in them as kinetic energy due to their motion. The wind energy is harnessed by making use of windmills.

Merits:-

1) It does not cause any pollution.
2) It is sustainable & renewable source of energy.
3) Economical & less place consuming Energy.
4) It has low maintainance cost.
5) It is a kind of clean fuel.

Demerits:-

1) The wind doesn't always blow, so we don't get the electricity 24/7.
2) It causes noise pollution

3) They pose a threat to wildlife like birds & bats
4) The installation of the wind turbine is expensive.
5) It can only be installed at the location where high speed wind blows.

Ques 2): what is the difference b/w Cell and battery.

Ans A cell is a single unit of device that converts chemical energy into electrical energy

Battery is a collection of cells that converts chemical energy into electrical energy.

A battery generally contains electrical energy which is already supplied from a factory or can be charged easily via an outlet. On the other hand, a cell contains chemical energy source like diesel, propane or natural gas. It converts these sources to electrical energy to generate power.

	Cell	Battery
1)	A cell is known to be a single unit device that tends to convert the chemical energy into electric energy.	A battry generally consists of a group of different cells.
2)	Depending on what	A battery can either

	types of electrolytes are used, a cell can be either of reserve, wet or dry kinds.	be a primary or secondary battery which means that it is either rechargeable or non-rechargeable
3)	A cell can only supply power for a shorter period.	A battry can supply power for much longer durations.
4)	A cell is generally used for lighter tasks. ~~& to do x.~~	4) A generally is used generally for heavy duty tasks.
5)	Cells are cheaper in ~~gene~~ general.	Batteries are comparatively costlier.

Ques-22:- Differentiate b/w primary battry & secondary battery.

Ans

	Primary Battery	Secondary Battery
1.	Primary batteries are not reversible i.e once they get discharge, they cannot be charged again.	1. Secondary batteries are reversible and can be easily charged by electrical supply.
2.	Irreversible reactions occur on it.	2) Reversible reactions occur on it.
3.	Primary batteries can be used once.	3. Secondary batteries can be used more than one time.

4. Their internal resistance is very high.	4. They possess very low internal resistance.
5. They cannot be used as storage devices.	5. They may be used as energy storage devices.
6. Mostly used for intermediate work with low current rates.	6. Can be used for condition rating with heavy load currents.
7. Ex:- Primary battery Daniel cell, Dry cell.	7. Ex:- lead-acid cells, Ni-Cd cells etc.

Ques-23)- Define the term battery. Classify battery based on their applications.

Ans Battery is the collection of one or more cells whose chemical reactions create electrons in a circuit.

Based on applications batteries are classified as→

1. Household batteries→ These are the type of batteries which are more likely to be known to the common man. They used in household work.

2. Industrial battries:- These batteries are required to serve heavy-duty requirements, like railroad, backup power etc.

3. Vehicle battries:- These are more user-friendly & less complicated version of industrial battries. They are specifically designed to power cars, motorcycles, boats & other vehicles.

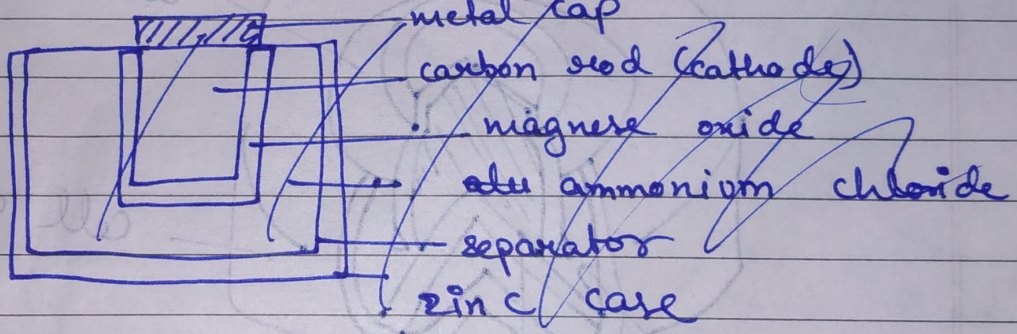
Ques-24:- What is primary battery? Discuss the construction of Leclanche cell with its cell reactions & diagram?

Ans Primary batteries are used once and discarded as the electrode metals are irreversibly changed during discharge.

Ex:- Alkaline battery used for flash.

Construction of Leclanche cell:-

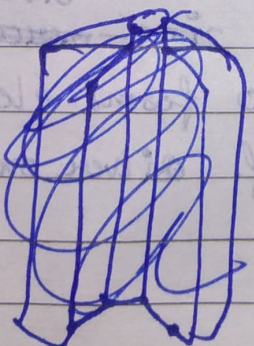
It consists of a zinc anode & carbon cathode. It uses ammonium chloride as electrolyte in the form of paste.

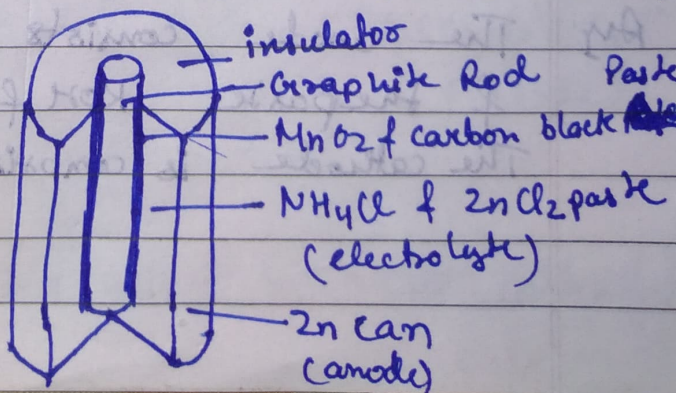


It consists of a zinc anode which is draped as a container. The cathode is comprised of a graphite rod surrounded by MnO_2. To reduce leakage the cell is enclosed in polypropylene cylinder.

$$Zn(s) \longrightarrow Zn^{2+} + 2e^- \quad \text{(At anode)}$$

$$2MnO_2 + 2NH_4^+ + 2e^- \rightarrow Mn_2O_3 + 2NH_3 + H_2O \quad \text{(cathode)}$$





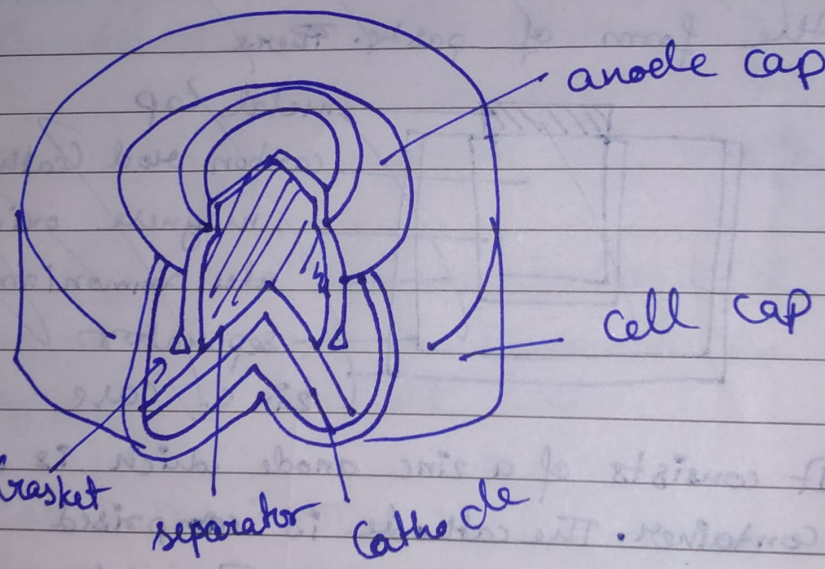
Ans Discuss the construction of mercury button cell with its cell reactions & diagram.

Ans The anode consists of zinc-mercury amalgam & cathode is comprised of a paste of HgO & carbon. A paste KOH & ZnO forms electrolyte.

The cell reaction is:

$$Zn + 2OH^- \rightarrow ZnO(s) + H_2O + 2e^- \quad \text{(Anode)}$$
$$HgO + H_2O + 2e^- \rightarrow Hg(l) + 2OH^- \quad \text{(Cathode)}$$

$$Zn + HgO \rightarrow ZnO + Hg$$



Qus-26)- Discuss the construction of silver button cell with its cell reactions & diagrams.

Ans The anode consists of zinc-~~mercury~~ silver amalgam & the paste KOH & ZnO forms electrolyte. The cathode is comprises of silver oxide (Ag_2O).

$Zn(s) + 2OH^-(aq.) \rightarrow ZnO(s) + H_2O(l) + 2e^-$

$Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq.)$

Diagram same as mercury button cell

Qus-27 What is secondary cell? Discuss the construction of lead storage cell with its cell reactions & diagram.

Ans A secondary cell is one in which electrodes & the electrolyte are altered by the chemical action that take place when cell delivers the current. Such Battries can be recharged & the cycle can be repeated number of times.

Lead storage cell construction:-

The cell consists of a lead grid filled with a spongy lead as anode & lead grid packed with lead oxide as cathode. A sol^n of H_2SO_4 is used as an electrolyte.

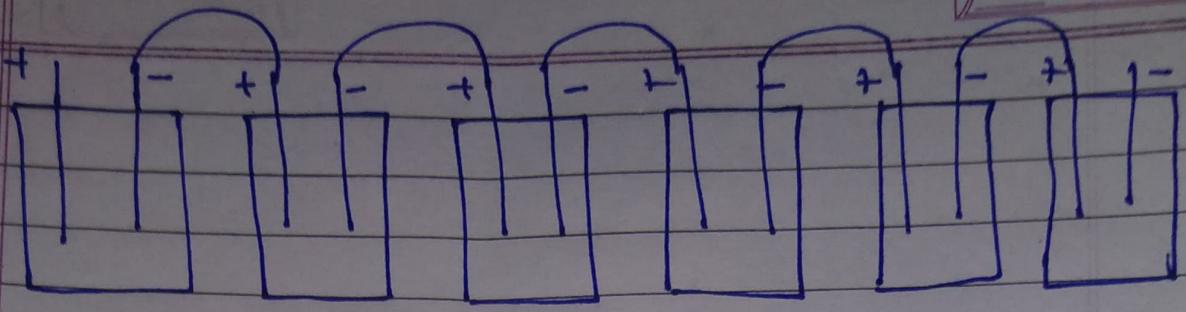
A battry consists of 6 such cells connected in series, each cell having an emf of about 2V, giving 12V.

Reactions:- $Pb(s) + SO_4^{2-}(aq) \longrightarrow PbSO_4(s) + 2e^-$ (Anode)

$PbO_2(s) + 4H^+(aq) + SO_4^{2-}(aq) + 2e^-$

$\downarrow$

$PbSO_4(s) + 2H_2O(l)$ (cathode)



Ques 28:- Explain Lead storage cell with suitable diagram. Write down the reactions involved during discharging & charging.

Ans Same as ques 27 (part 2).

Reactions:-

Discharging Reactions -

$Pb(s) + SO_4^{2-}(aq) \longrightarrow PbSO_4(s) + 2e^-$ (Anode)

$PbO_2 + 4H^+(aq) + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + H_2O$ (Cathode)

Charging Reactions -

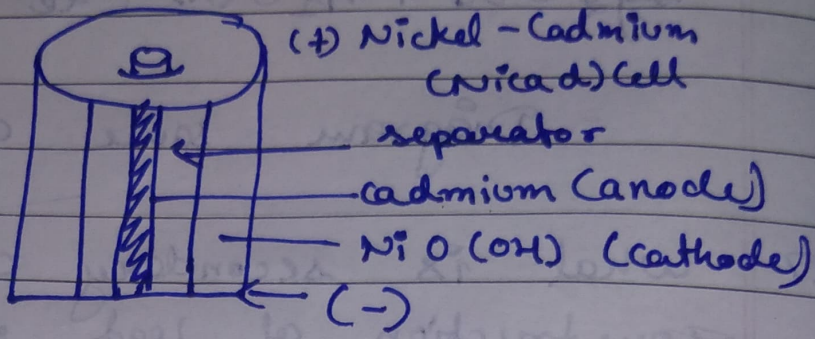
$PbSO_4(s) + 2e^- \longrightarrow Pb(s) + SO_4^{2-}(aq)$ (Cath.)

$PbSO_4(s) + 2H_2O(l) \longrightarrow PbO_2(s) + H^+ + SO_4^{2-} + 2e^-$ (An.)

$2PbSO_4 + 2H_2O \longrightarrow Pb(s) + PbO_2(s) + 4H^+ + SO_4^{2-}$

Ques 29:- Discuss the construction of nickel cadmium cell with its cell reactions & diagram.

Ans Nickel - cadmium cell consists of cadmium anode & a paste comprises the cathode.



Reactions:-

$Cd(s) + 2OH^- \longrightarrow Cd(OH)_2 + 2e^-$ (Anode)

$2NiO(OH)(s) + 2H_2O(l) + 2e^- \rightarrow 2Ni(OH)_2 + OH^-$ (Cathode)