Unit - 1 : Introduction & Solar Cells

* Conventional Energy Sources (Non Renewable Energy Sources) →

These are the sources of energy which are exhaustible i.e; can not be replaced if once they are used.

Examples - Coal, Natural Gas, Petroleum Products

Advantages - Efficiency & production expanses are low.

Disadvantages - Non renewable energy sources are not environmentally friendly & it can deplete soon.

* Non - Conventional Energy Sources (Renewable Energy Sources) →

These are the sources of energy which are inexhaustible i.e; can be used to produce energy again & again.

Example - Sun, Water, Animal dung, Agro - waste.

Advantages - Non Conventional energy sources are environmentally friendly & in exhaustible.

Disadvantages - High Cost, Pollution, Low Efficiency level, Harmful For wildlife.

Fossil Fuel as a Conventional Energy Source -

* Coal Energy →

1. Coal is conventional energy source.
2. It is formed due to degradation of trees & plants burried under layers of slit.
3. It is composed of mainly carbon & hydrocarbons.
4. Coal is found in U.P., M.P., Bihar etc.

Uses Of Coal -

1. Coal is used to generate electricity, power plants use coal for heating water to generate steam, which runs turbines to generate electricity.
2. Various industries are used to heat obtained from coal in making plastic, cable, fibre etc.
3. Coal is heated in furnace to make coke, which is used to melt iron for making steel.

* Environmental Problems -

1. Due to combustion of coal, Carbon dioxide (CO_2) is produced which is responsible for causing global warming.
2. Coal is also produced Sulphurdioxide which is cause of Acid Rain.

* **Natural Gas** →

1. Nature Gas formed by decomposition of dead animals & plants burried under the earth.

2. It is mainly composed of methane (CH_4) with small amount of propane & ethane.

3. Natural Gas is the cleanest fossil fuel.

Uses of Natural Gas –

1. It is used in thermal power plants for generating electricity.

2. It is used as a domestic & industrial fuel.

Advantages –

1. Natural Gas has a high calorific value & it burns without any smoke.

2. It can be easily transported through pipelines.

Various Sources Of Non Conventional Energy -

⊛ Solar Energy →

1. It is clean, cheap & abundantly avaiable renewable energy.

2. Most important of non conventional sources of energy because it is non-polluting & therefore helps in decreasing the green house effect.

3. Solar Energy can be used as :

(i) By direct conversion to a fuel by photosynthesis.

(ii) By direct conversion to electricity by photovoltaic.

4. The sun releases the enormous amount of energy due to continous fusion reaction taking place inside the sun.

5. The sun send out the energy in form of radiations at the rate of 3.7×10^{20} MW.

6. However, Energy intercepted by earth is about 1.85×10^{11} MW.

7. This Energy is available is several times more than all the energy produced & consumed in the world.

* Merits -

1. Reduced Electric Bill
2. Cheaper power source
3. Environmentally Friendly
4. Energy Independance

* Demerits -

1. Solar equipments fails to work in nights, raindays or cloudy days.
2. High initial cost
3. Small amount of pollution during manufacture, transport & installation.

Biomass →

1. Green plants trap solar energy through the process of photosynthesis & convert it into organic matter. This organic matter is called biomass.
2. Wood, Charcoal, agricultural waste produces the bio-energy after burning & cow dung, garbage are decomposed to obtain the energy.

3. Dried animal dung or cattle dung are used directly as fuels in rural area but it produces smoke & has low efficiency of burning.

* Merits - 1. Reliable
2. Abundant
3. Carbon - Neutral
4. Waste Reduction

* Demerits - 1. Requires space
2. Green House Gas Emission
3. Environmental Impact
4. Inefficient

Hydro Energy →

1. It is renewable energy source, which is used to generate electricity.
2. Hydropower is obtained from water flow or falling water from a height.
3. Water stored behind Dam & at a height has a lot of potential energy which is converted into

mechnical & electrical energy.

4. The water is released gradually & is allowed to fall under gravitational force & drive which rotate Hydraulic turbines.

5. The generators attached with turbine produce Electricity.

* Advantage - Hydropower does not pollute the water or air during operations & no waste product are formed.

* Limitations - The generation of electricity by hydroelectric power plants result in pollution & ecological disturbance like flooding situation & adverse effects on flora & fauna.

⊛ Geothermal Energy →

1. The energy harnessed from the hot rocks present inside the earth is called Geothermal Energy.

2. There is an increase in temparature of earth with increasing depth below the surface.

3. The fission of radioactive material naturally occuring in rocks increases the temparature of earth as we move down from the earth's surface.

4. Hot molten rocks called 'magma' are present in the core of earth. This causes sometimes volcanic action.

5. This hot steam is used to operate turbines to generate Electricity.

* Merits -

1. Cheap & Clean source energy

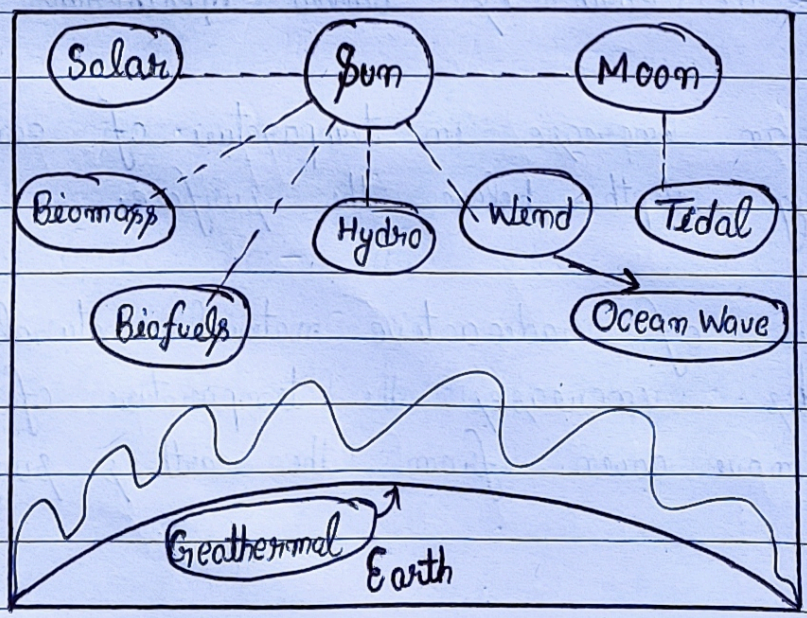
2. Geothermal plants require little land area.

* Limitations -

1. Air pollution results in case of release of gases like H_2S, NH_3 present in steam waste.

2. Noise pollution results from drilling operations.

Diagram of Renewable Sources of Energy →



Hydrogen Energy →

1. Non Conventional Energy Resources

2. It has tremendous potential because it can be produced from water which is available in abundance in nature.

3. In sun's core, hydrogen atoms combine to form Helium atom which is called Fusion Reaction.

4. It gives the radiant energy which sustains the life on earth.

5. Hydrogen can be seprated from water by means of electrical energy.

6. It can also be obtained from fossil fuels.

* Advantages - 1. Non - Toxic
2. Non - Polluting
3. More Efficient
4. It has very high energy content

* Disadvantages - 1. Highly Flammable
2. More Expensive
3. Not safest source of energy
4. Storage complications

Wind Energy →

1. Wind is used to produce Electricity by converting the Kinetic Energy of air in motion into Electricity.

2. In modern wind turbines, wind rotates the rotor blades, which convert Kinetic Energy into Rotational Energy.

3. This rotational energy is transferred by a shaft which to the generator, thereby producing Electrical Energy.

* 3 main parts of wind turbine in motion →

1. The Rotor - Composed of 3 blades & bushing that joins them together. Its function is to capture the force of the wind & convert it into Mechanical Rotational Energy.

2. Multiplier - Connected to the Engine by means of a shaft. It's function is to increase the rotational speed from 30 rpm to 1500 rpm.

3. The Generator - This element is responsible for converting the mechanical energy of rotation into electrical energy.

Advantages - 1. Free Fuel

2. One of cleanest Forms of energy

3. Advances in Technology

4. Reduces dependence of Fossil Fuels

Disadvantages - 1. Dangerous to some wildlife

2. Noisy

3. Expensive Unfront Cost

4. Unreliable

Mechanism of Photoconduction in PV Cell →

p-n junction

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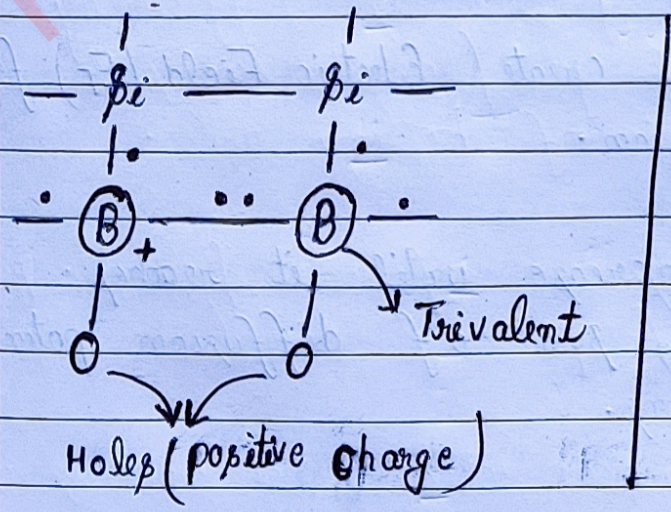
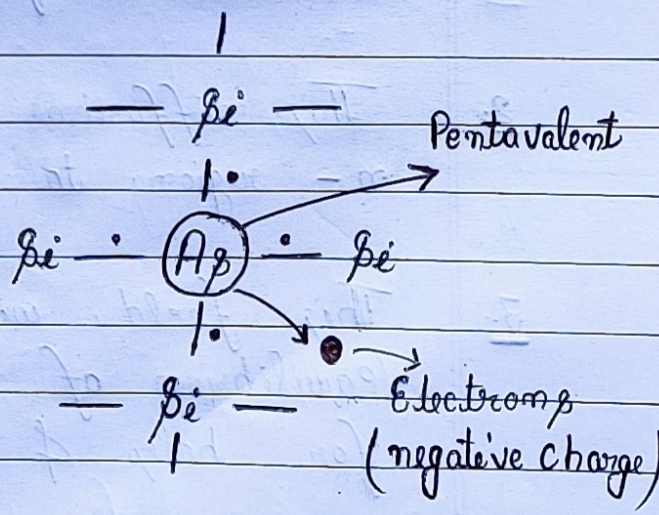
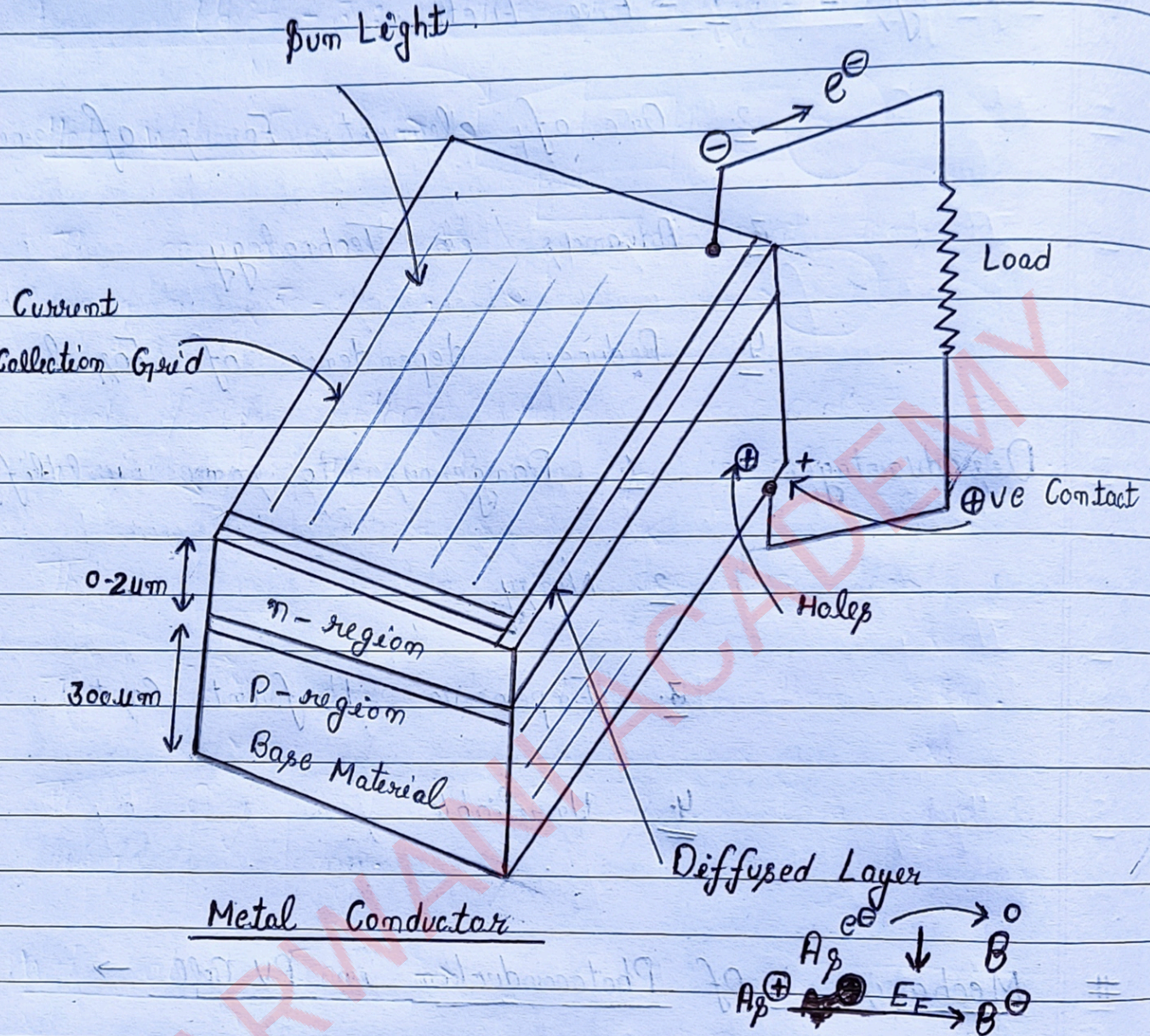
p-type semiconductor

n-type semiconductor







1. In p-n junction, after the photons (sun light particles) are absorbed, the free $e^{\ominus}$ of n-side will tend to flow to the p-side & the holes of the p-side will tend to flow to n-side.

2. This diffusion will create Electric Field (E_F) from n-region to p-region.

3. This field will increase until it reaches equilibrium of Ve, sum of diffusion potential for holes & electrons.

4. If electrical contacts are made with two semiconductor materials & the contacts are connected through external electrical conductor, the free electrons will flow from n-type material through conductor to p-type material.

Thank You For Supporting Me

5. The flow of $e^{\ominus}$ through external conductor constitutes an electric current which will continue as long as more free $e^{\ominus}$ & holes are being formed by solar radiation.

6. This is the basis of photovoltaic conversion, that is, conversion of solar energy to electrical energy.

7. Combination of n & p-type semiconductors thus constitutes a PV Cell Or Solar Cell.

8. All such cell generates DC which can be convert AC if desired.

* Hand Written Notes By Aditya Kesharwani