Environmental chemistry.

Unit-I

Environmental chemistry

Unit-II

Air pollution

Unit-III

Water pollution

Unit-IV

Chemical toxycology

Unit-V

Ecosystem and Bio diversity.

25/6/25

Unit-1 Environmental chemistry

① Definition, concept of environmental chemistry scope and importance of environment of nowadays. – 5m

*② Sigments of environment - 10m

③ Effects of human activities on environment. – 5m

④ Natural resoreses

a) Renewable resoreses — Solar energy, biomass energy

b) non Renewable resoreses – Thermal power, atomic energy

⑤ Reactions of atmospheric oxygen.- 5m

*⑥ Hydrological cycle – 5m.

①A Environment

Environment is gotten from the french word. Environner it means surround.

Definition:- Environment has all the physical, chemical and biological parts surroundings of plants or animals along with their effects upon each other. Environment has both biotic (living) and abiotic (non-living)

Biotic parts

① Animals, plants, Microorganisms.

Abiotic parts

① Physical factors like, light, heat,

Tide, wind, Moisture, Solar, Energy, pH, soil, local inorganic natural materials.

Scope of environmental study

→ It tells about different natural resources available in a region.

→ It tells about ecological system and relationship among their parts.

→ It gives information on Biodiversity at local national and global level.

→ This study tells about the cause and results of natural and manmade calamities and actions to be taken to minimize effects.

→ This study tells about the problems of pollution and develop suitable eco-friendly solutions of different environmental problems.

→ It tells about the suitable use of natural resources with out spoiling the quality.

Importance:-

① Environmental studies have different branchs of like life science, social studies, Law

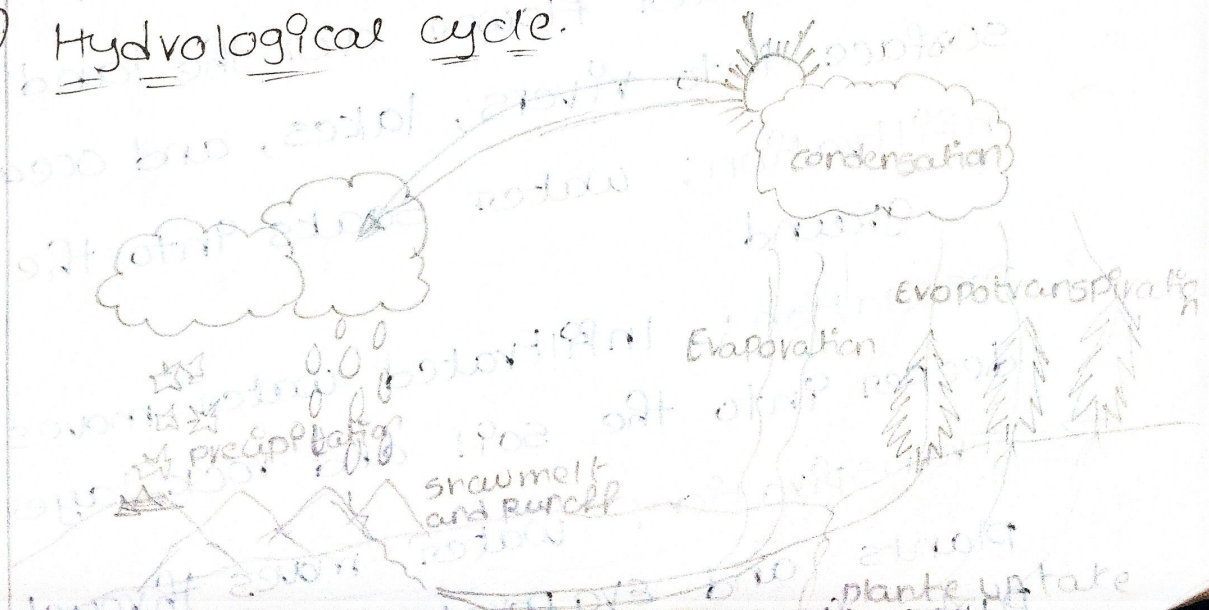
② The Environmental Problems will be solved by creating and spredding the knowding knowledge of environment among the people and introduced the children in the school level.

③ Enough quantity of chemical fellilizers and pesticides must be used in Agriculture to save the environment.

④ The land is polluted by througing away large quantity of solid waste from mines, urban areas.

⑤ The pollution released from many industries lead to global warming, acid rains, ozone depletion, sea level raise and the strong effects on different parts of environment.

② Hydvological cycle.



The hydrological cycle, also known as the water cycle, is the continuous movement of water on, above, and below the surface of the earth. This cycle is driven by solar energy and gravity, and it involves various processes like evaporation, condensation, precipitation, and runoff, which continuously distribute water across the planet.

Processes:

-> Evaporation: water turns into vapour and rises into the atmosphere.
-> Condensation: water vapour cools and changes back into liquid, forming clou
-> Precipitation: water falls back to ear in the form of rain, snow, sleet, or ha
-> Runoff: water flows over the land surface into rivers, lakes, and oceans
-> Infiltration: water soaks into the ground.
-> Percolation: Infiltrated water moves deeper into the soil and rock layers.
-> Transpiration: water moves through plants and evaporates from aerial parts like leaves.

The hydrological cycle is crucial for maintaining water balance on Earth, regulating climate, and supporting life. It Ensure the continuous availability of freshwater resources and influences weather patterns.

(2) Sigments of Environment-

The environment is everything that surrounds us.

→ The Air we breath, The water we drink The land we liveon, and the living beings we interact with. It is a complex and dianamic system made up various components. That are interrelated and interdepented. To understand environmental chemistryand the impact of human activities it is essiential to break down the environment into major sigmenents.

They are

(1) Atmosphere.
(2) Hydrosphere
(3) Litho sphere.
(4) Bio sphere.

① Atmosphere

distient.
Each sigment has destient characteristic and plays a vital role in maintaining the life on Earth.

① Atmosphere

The atmosphere is the invisible layer of gases That surrounds the Earth. It act has a protective blanket and crucial for life.

Composition of the Atmosphere

The atomosphere is made up of several gases.

(a) Nitrogen – 78% (N_2)
(b) Oxygen (O_2) – 21%.
(c) Argon (Ar) – 0.93%.
(d) Carbon dioxide (CO_2) – 0.03% to 0.04%.
(e) other gases such as, Methane (CHO), Water vapour, in trace amounts.

Structure of atmosphere

As is deveded into 5 Main layer based on temperature.

① Tropo sphere – 0–11 km.
② Strato sphere – 12–50 km (ozone layer

③ Meso sphere – 50 - 80 km
④ Thermo sphere – 80 – 700 km (ino sphere)
⑤ Exosphere – 700 – 1000 km

Importance of Atmosphere.

→ provide oxygen for respiration and CO_2 for photosynthesis.
→ Act as a shield against harmful UV radiation
→ Helps in wheater in regulation and support the water cycle.
→

Hydrosphere.

Its includes all water found on earth in liquid, solid and vapour form. It is essitial for all forms of life. 71% occupies on earth surface as oceans seas, rivers and lakhs / provied fresh water for drinking, irriga-tion, industries. Grand water water below the earth surface. stored water distribution. salt water (97.5%) / oceans. fresh water (2.5%) / found in glaciers (69%), grand water (30%) and surface water (1%)

Role and significance :-

→ Essitial for life process digetion, circulation, photosynthesis.

→ regulates earths temperature by absorbing and storing heat.

→ support aquatic eco-systems.

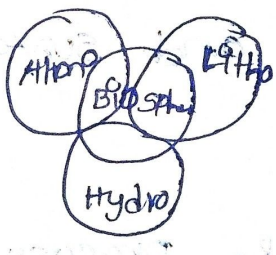
⇒

Lithosphere

The LS refers to the solid outer part of the earth it includes the crust and the upper part of the Mantel (Mantel); extending upto 100km deep. composed mainly of rocks, minerals, and soil. Major land forms, Mountains, plateus, continants, plains. Valcanos and earthquake occur due to techtonic activity in the Lithosphere. supplies natural resoreses. minirals, fosil fuells.

Biosphere :-

The BS is the part of the earth where life exists. it includes all living organisms and their interaction with the atmosphere, Hydrosphere, Lithosphere



composition of the Biosphere:-

1) Flora - plants, trees, fungi, algae
2) Fauna - Animals, birds, insects.
3) Micro organisms - bateria, virus, protozoa.
4) Humans - The most influencial species is due to technological development.

(6) Hydrological cycle

The hydrological or water cycle. It is The continuous moment of water on Earth. It involves.

Evaporation:- water forms oceans, reverse and lakes turns into vapour due to heat.

Transpiration:- plants release water vapour through their leaves.

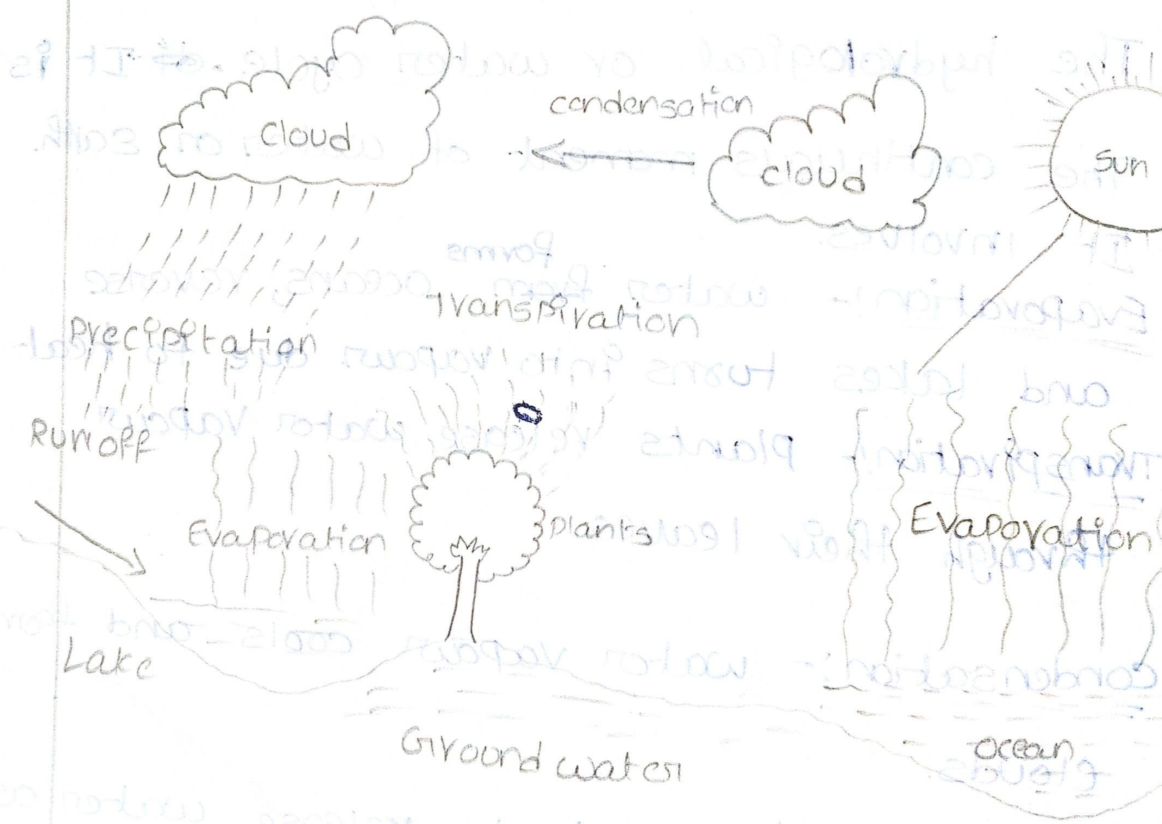
Condensation:- water vapour cools and forms clouds.

precepitation:- clouds release water as rain, snow or hail.

Run off:- water flows over land into revers and back to oceans.

Infiltration:- some water seeks into the ground and Repleations ground water.

This cycle Maintains the balance of water in nature. It supports life helps in climate regulation and influences weather Parameters. however, deforestation, urbanisation, and Pollution are disturbing the cycle. leading to water scarecity, fluids, droughts.



(3) Effects of Human activities on Environment.

Human activities have a significate impact on the environment. often causing harm. some major effect include

1) Air pollution:- Burning fossil fuels, for energy and transport. releases harmful gases like CO_2, SO_2, and ~~NOx~~ NOx. leading to snog, acid rains. and clamate change.

2) water pollution:- Industrial waste, seawage and chemicals contaminate. revers and oceans. effecting aquatic life and human health

3) de forestation:- cutting down forest for agriculture, and constructions, reduces biodiversity and increasing green house gases.

4) soil degradation:- over use of fertilizers and pesticides in farming. makes soil infertaile. and harms underground water.

5) plastic pollution:- non-biodigradable plastics choke marine life and pollute soil and water bodies.

climate change:- Excessive green house gases emissions trap heat in the atmosphere leading to raise in temperature. sea level raises and extreme wheather events.

To reduce the harmful effects sustainable practices, recycling, conservation, awareness, are necessary.

(5) Reactions of Atmospheric oxygen.

Oxygen plays a key role in many natural and chemical processes. In the atmosphere. important reactions include

① Combustion:

when fuels burn in the presence of oxygen they release the energy, CO_2 and water vapour.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + Q$$

Methane

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O + Q.$$

Butane

② oxidation:

oxygen react with metals and non-metals to form oxides.

Ex:- rusting of iron

$$4Fe + 3O_2 \xrightarrow{(O)} 2Fe_2O_3$$

(3) ozone formation:

In the stratosphere UV light breaks O_2 molecules into atoms which then form ozone (O_3). ozone protect Earth from ~~UV~~ harmful UV rays. UV rays.

$$O_2 + O \longrightarrow O_3$$

$$3O_2 \longrightarrow 2O_3$$

(4) photo oxidation:

~~Pl~~ pollutants like hydrocarbons react with oxygen in the presence of sun light to form <u>smog</u>

These reactions are reactions are essitial for life but also lead to pollution if un balanced.

Natural Resources:

RENEWABLE ENERGY:

Introduction:-

In the 1970s and early 1980, there was great national interest in energy policy and energy conservation. This was primarily due to the huge increase in the price of oil, caused by reductions in oil supplies as a result of the OPEC oil prohibition in 1973 and the Iranian hostage crisis in 1979. The higher price for oil spurred private and governmental development of renewable energy sources as, solar power, wind, geothermal, and biomass.

SOLAR ENERGY:-

Solar energy is produced in the core of the sun. In a process called nuclear fusion, the intense heat in the sun causes hydrogen atoms to break apart and fuse together to form helium atoms. Less than 1% of this energy reaches the earth yet it is enough to provide all of the earths energy reaches the earth's energy needs. The sun's energy travels at the speed of light, 186,000 miles per second, and reaches the earth in about eight minutes.

One primary use of solar energy is home heating. There are two basic kinds of

heating systems : active and passive.

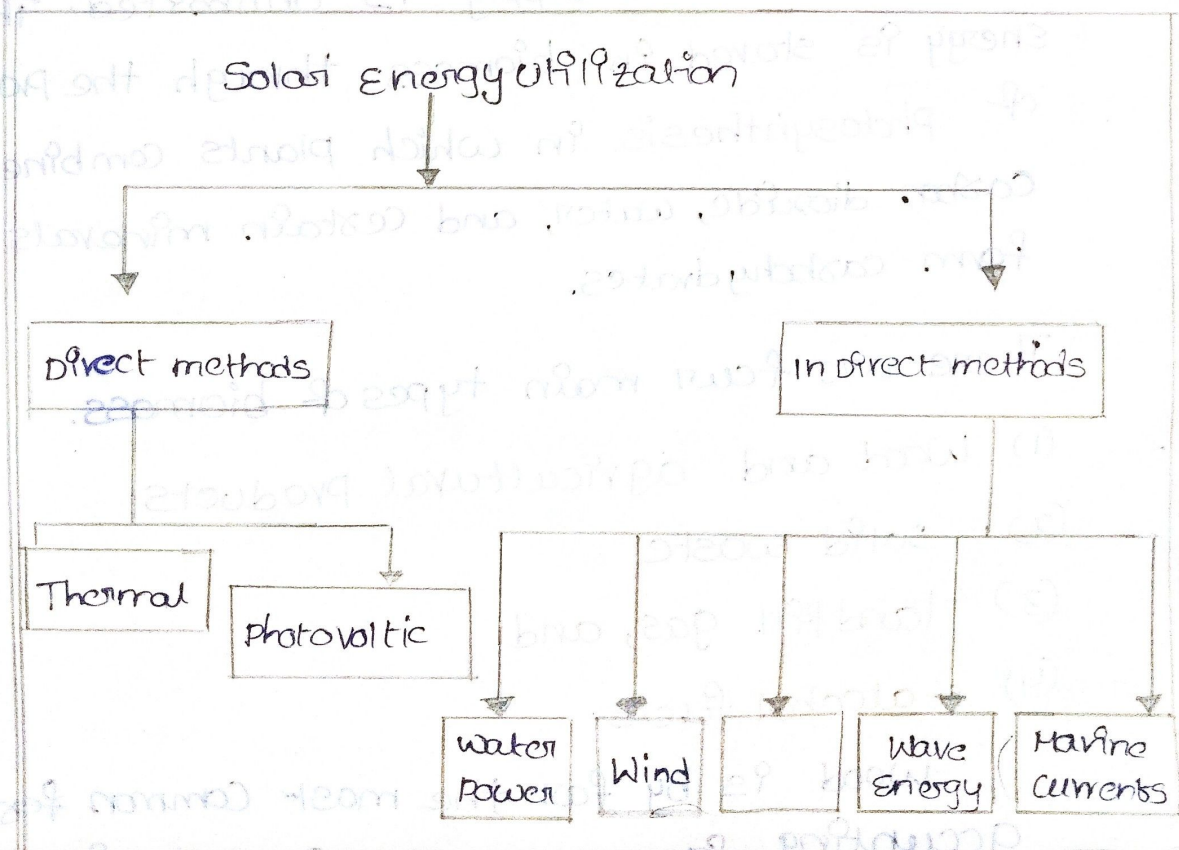
1. Active system:

In an active system, special equipment (such as solar collectors) is used to collect and distribute the solar energy.

2. Passive system:

In a passive system, the home is designed to let in large amount of sunlight. The heat proceduced from the light is trapped inside. A passive system does not rely on special mechanical equipment.

Another primary use of solar energy is producing electricity. The other primary way to produce electricity is using solar thermal systems.



Advantages of solar energy:

- Unlimited supply
- Causes no air or water pollution.

Disadvantages of solar Energy:

- May not be cost Effective
- Storage and backup are necessary
- Reliability depends on availability of sunlight

BIOMASS:

Biomass is any organic substance that can be used as an energy source. The common Examples are wood, crops, seaweed, and animal wastes. Biomass has been used for thousands of years and is the oldest known Energy source. It is a renewable energy source because its supply is unlimited. The energy is stored in biomass through the process of Photosynthesis, in which plants combine carbon dioxide, water, and certain minerals to form carbohydrates.

There are four main types of biomass.

(1) Wood and agricultural products
(2) solid waste
(3) land fill gas, and
(4) alcohol fuels.

Wood is by far the most common form, accounting for

biomass energy.

Advantages of Biomass:

- Abundant and "renewable"
- can be used to burn waste products.

Disadvantages of Biomass;

- Burning biomass can result in air pollution
- May not be cost effective.

NON-RENEWABLE RESOURCES:

THERMAL POWER:

Thermal power, also known as thermoelectric power, is a type of electricity generation that is based on the use of heat to produce steam, which in turn drives a turbine connected to a generator to produce electricity. There are several key components and processes involved in thermal power generators.

1. Heat sources: Thermal power plants require a source of heat to produce steam. This source of heat can vary, as mentioned earlier, and it may involve the burning of fossil fuels or the use of nuclear reactors to produce heat.
2. Boiler: The heat source is used to heat water in a boiler, creating high-pressure steam. The boiler is a crucial components efficiency is

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2. Boiler: The heat source is used to heat water in a boiler, creating high-pressure steam. The boiler is a crucial components in the process, and its efficiency is

is essential for the overall efficiency of the power plant.

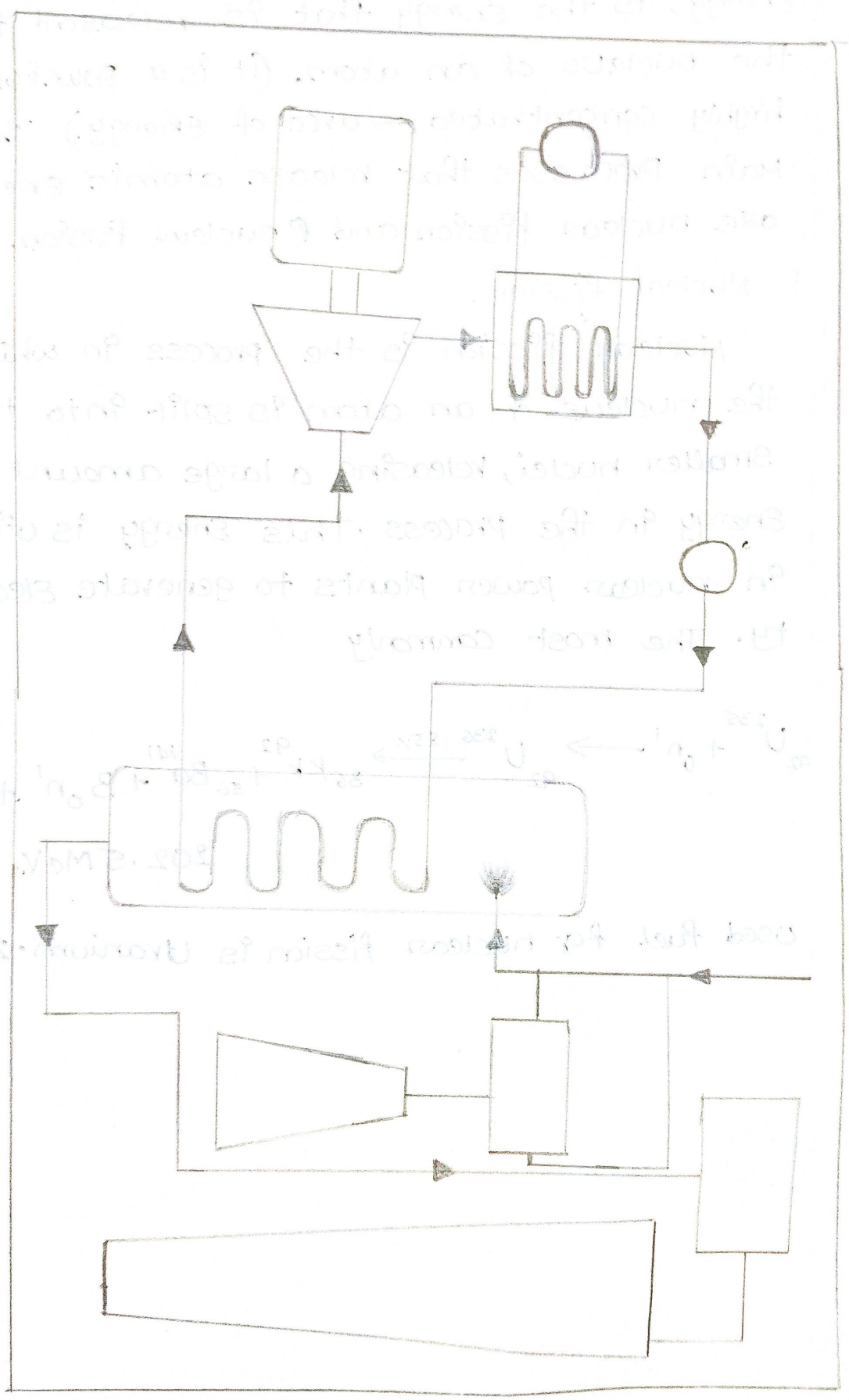
3. Steam Turbine: The high-pressure steam produced in the boiler is used to drive a steam turbine. As the steam passes through the turbine, it expands, causing the blades of the turbine to spin.

4. Generator: The spinning motion of the steam turbine is used to turn an electrical generator. This rotation of the generator's rotor within a magnetic field generates electricity.

5. Cooling System: After the steam has passed through the turbine, it needs to be condensed back into water. This is typically done using a cooling system, which can involve cooling towers, water bodies, or other methods.

6. Transmission and Distribution: The electricity generated at the power plant is then transmitted through high-voltage lines to substations and, from there, distributed to homes, businesses, and industries for use.

Thermal power plants are known for their reliability and ability to provide a consistent and stable power supply.



ATOMIC ENERGY:

Atomic energy, also known as nuclear energy, is the energy that is released from the nucleus of an atom. (It is a powerful and highly concentrated source of energy.) The two main processes that release atomic energy are nuclear fission and nuclear fusion.

1. Nuclear fission:

Nuclear fission is the process in which the nucleus of an atom is split into two smaller nuclei, releasing a large amount of energy in the process. This energy is utilized in nuclear power plants to generate electricity. The most commonly

$$_{92}U^{235} + {}_{0}n^{1} \longrightarrow {}_{92}U^{236} \xrightarrow{85\%} {}_{36}Kr^{92} + {}_{56}Ba^{141} + 3\,{}_{0}n^{1} + 202.5\ MeV.$$

used fuel for nuclear fission is Uranium-235.