

Internal Assessment Test – 3

Sub: Renewable Energy Resources				Code: 21EE652
Date: 30/07/2024	Duration: 90 min	Max Marks: 50	Sem: 6	Section: All Branches
Answer ANY FIVE full questions. Explain your notations explicitly and clearly. Sketch figures wherever necessary. Good luck!				
			Marks	OBE CO RBT
Q1.	Define biomass. Give a descriptive classification of biomass resources and mention the main advantages and disadvantages of biomass energy?		[10]	CO3 L2
Q2.	Compare fixed dome and float drum type bio digesters.		[10]	CO3 L2
Q3.	Classify wave energy devices. With neat sketches, explain the different types of wave energy devices used to harness wave energy.		[10]	CO4 L2
Q4.	With a neat diagram, explain the working of single and double basin tidal power plant.		[10]	CO4 L2
Q5.	Explain Carnot efficiency for an OTEC plant with the help of a thermodynamic cycle on a T-S plane.		[10]	CO3 L2
Q6.	With a neat diagram, explain the principle of ocean thermal energy conversion		[10]	CO4 L2

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HOD/EEE

***** All the Best *****

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Internals - 3

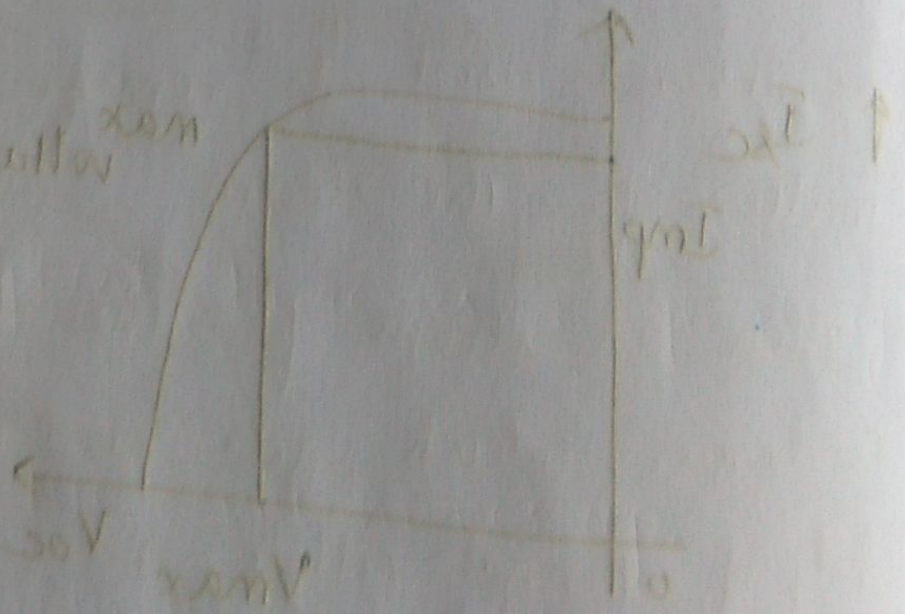
① Biomass:- biomass is an organic matter or any plant and dead animal residues which can be used to generate energy

* The dead things can be wood barks, organic waste, waste from the agriculture land and waste from the home, industries etc.

Classification of biomass:-

* Biomass is classified into

- * Wood biomass
- * Organic waste
- * agricultural waste
- * waste from the household
- * vegetable biomass.



→ wood biomass is the dead plants of tree, like bark, wood pieces and

- organic waste includes anything which is not harming or polluting the soil and environment.
- agricultural waste can be the remaining dead leaves, stalk, petals and other plants.
- waste from the household, excreta from the animals, dead skin all these comes under household waste
- vegetable biomass include biomass from dead or waste fruits, vegetables, spinach which contribute to the biomass.

• Advantages of biomass

- Reduces the emission of CO_2 and it is less harmful
- Emission of greenhouse gasses is not seen.
- It is a renewable energy resources.
- It does not pollute the environment.
- It is harmless.

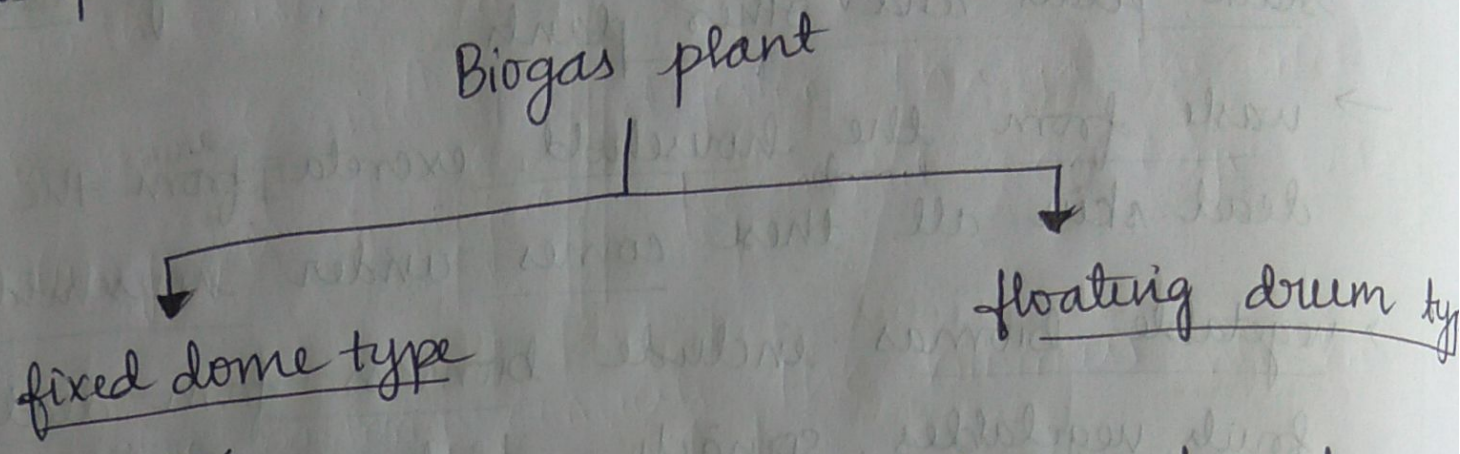
• Disadvantages of biomass:-

- Burning this biomass releases some amount of CO_2 to the atmosphere
- landfill - due to biomass storage we need a huge land
- It has less energy density due compared to fossil fuels

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② • Classification of biogas plants

* Biogas plants are classified into 2 types,



• FIXED DOME TYPE:

* In the fixed dome type there is dome shaped structure which is used to collect biogas.

* This type of biogas are made of concrete and cement

* Hence we absorb porosity and gas can escape.

* It is less efficient compared to floating drum type

Ex: chinese model

• FLOATING DRUM TYPE:

* In this type of biogas plant there is a floating cover kind of structure

* As biogas is accumulated the cover moves up.

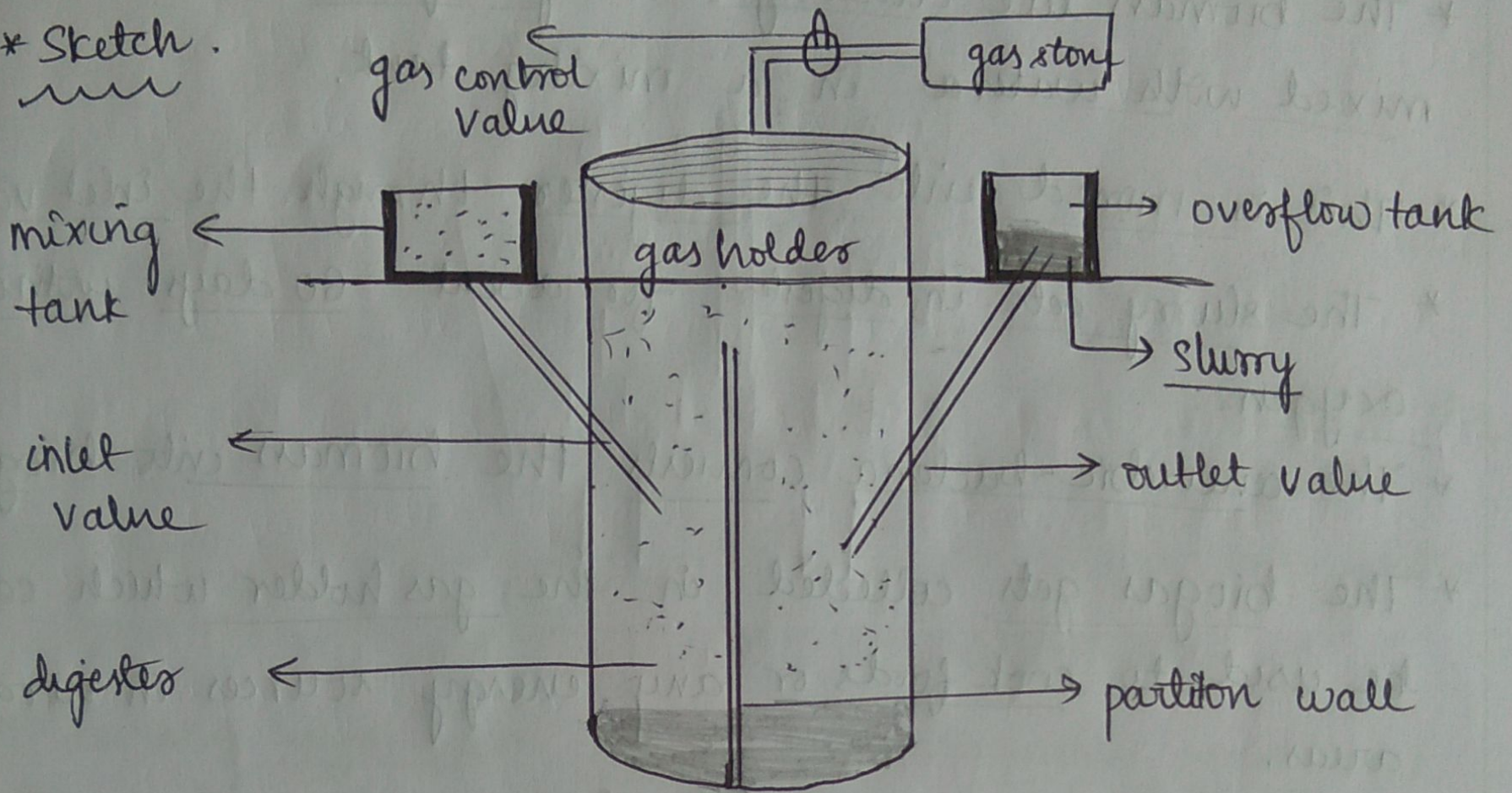
* It is made up of steel which is cylindrical in structure

* Maintenance cost is high due to movable parts

Ex: KVIC - Khadi village industries commission

• KVIC type biogas plant:-

* Sketch.



* Components:-

- 1) mixing tank
- 2) inlet value
- 3) outlet value
- 4) gas holder
- 5) digester.
- 6) Overflow tank

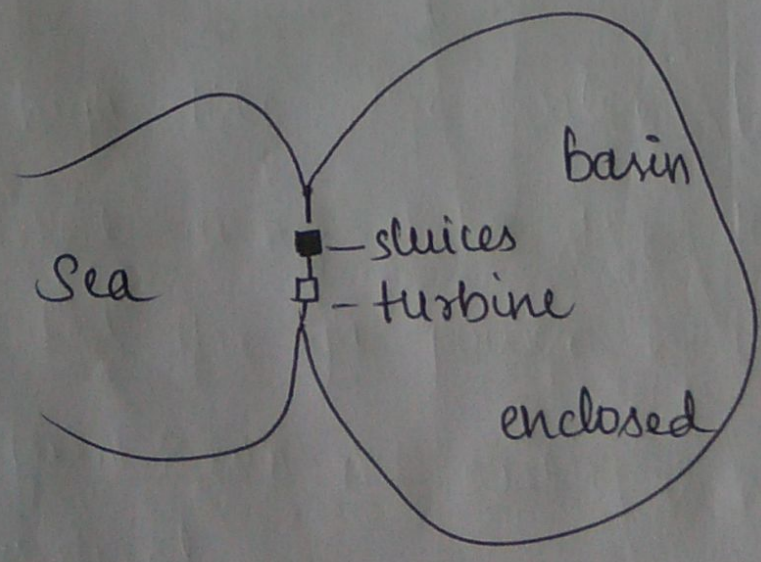
* Explanation:

- * The biomass like cowdung or any organic material is mixed with water in a mixing tank.
- * This is moved into the digester through the inlet valve.
- * The slurry gets in digester for about 60 days without oxygen.
- * The anaerobic bacteria converts the biomass into biogas.
- * The biogas gets collected in the gas holder which can be used to cook foods or any energy sources in rural areas.
- * Remaining slurry is moved into overflow tank which can be removed manually and used as manure to plant.

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(4) • Single basin tidal power plant:

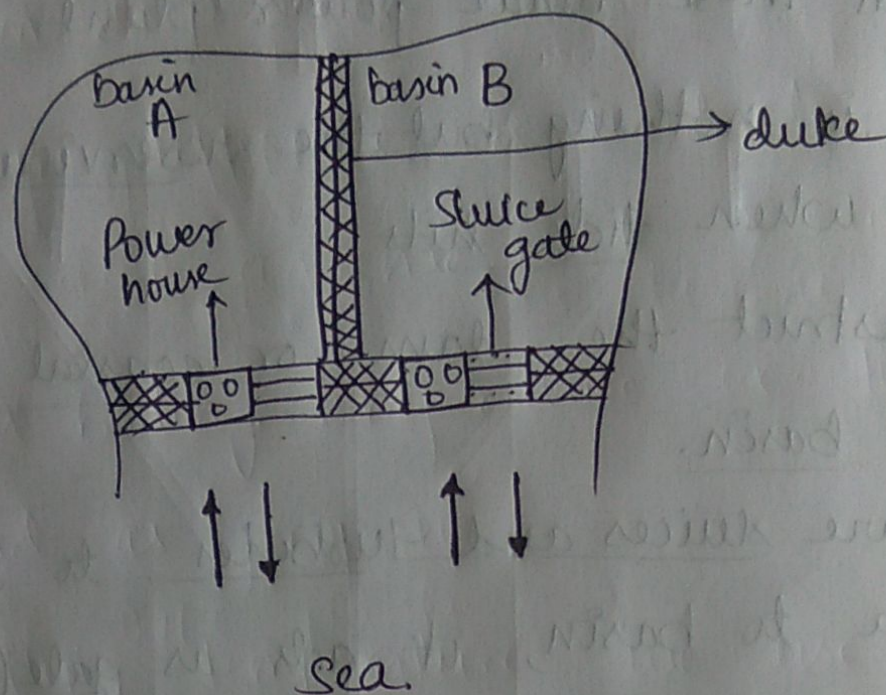
* Diagram:



* Explanation :-

- as the name itself suggest there is only one single basin in these tidal power plant.
- basin is nothing but the reservoir to collect the water when tide hits
- we construct the dam or coastal barrier across the sea and basin.
- There are sluices and turbines to move the water from sea to basin, it acts as gate (valve)
- during high tide sluices gates remains open and wave moves into basin from sea
- this rotates the turbine and generate the electricity through generator.
- during low tides sluices gates closes and water is stored in the reservoir
- when tides fall to still low then water is released back to the ocean through the turbines, this creates additional energy

• Double basin tidal power plant

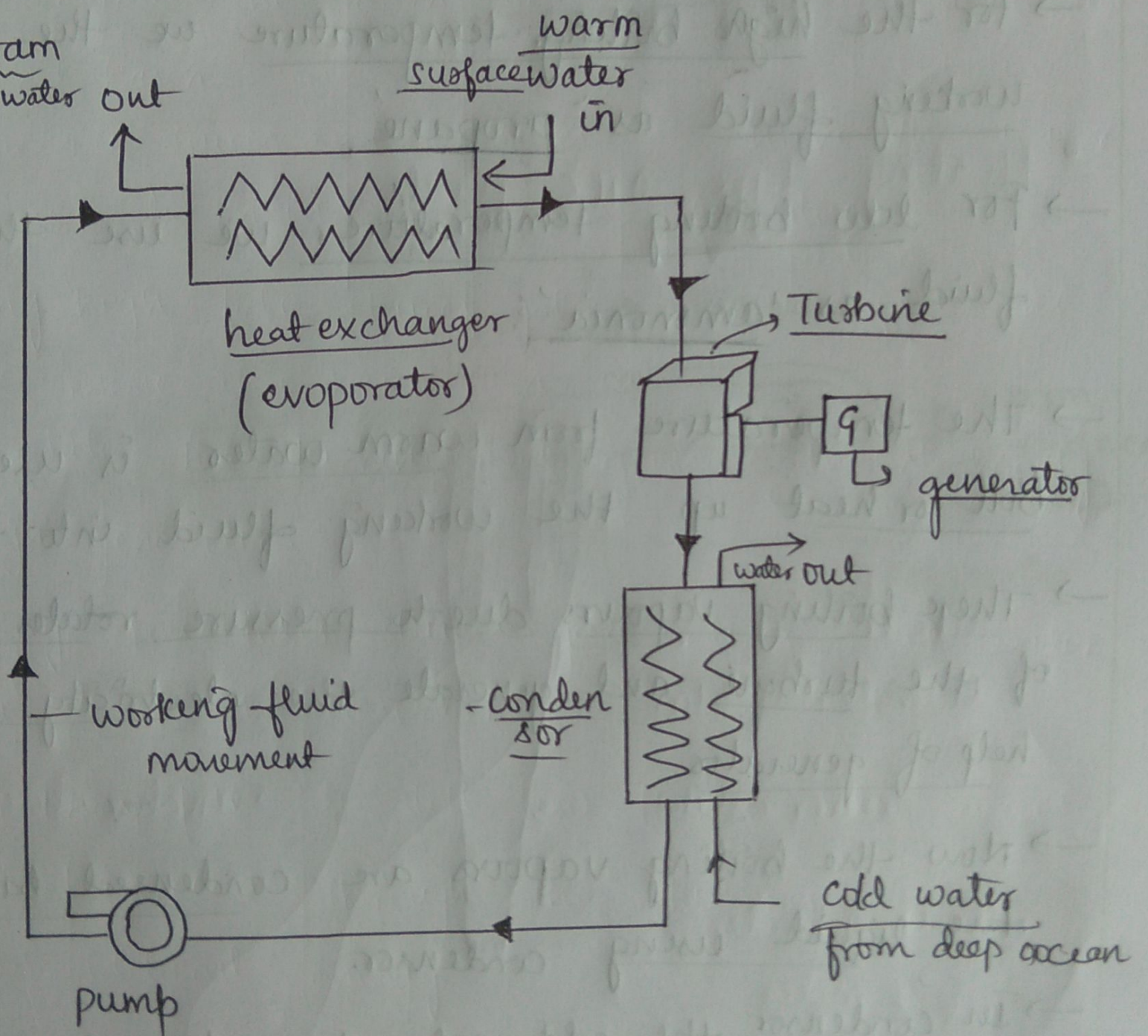


- in the double basin tidal power plant there are 2 basin basin A and basin B.
- Basin A is located near to the sea and it has sluices & turbines and power house.
- Basin B is further located from basin A which is used to collect the water from basin A.
- during high tide the water from sea moves to basin A and then rotates the turbine and electricity is generated through power house.
- Again from basin A, water is moved into basin B, and it is stored.
- during low tides the water from basin B is sent back.

back to sea through turbine valves which creates additional electricity.

⑥ Principle of ocean thermal energy conversion OTEC

• diagram



- principle: harnessing the ocean thermal energy is based on the thermal gradient between the cold water from deep ocean and warm surface water
- The temperature difference is used to heat the liquid fluid and condense back to liquid
- For the high boiling temperature we use the working fluid as 'propane'
- For low boiling temperature we use the working fluid as 'ammonia'
- The temperature from warm water is used to boil or heat up the working fluid into the vapours
- These boiling vapours due to pressure rotates the blades of the turbine and generate the electricity with the help of generator
- Now the boiling vapours are condensed back to the liquid using condenser.
- In condenser the cold water from the deep ocean is pumped back to cool the fluid.
- Hence the cycle continues.

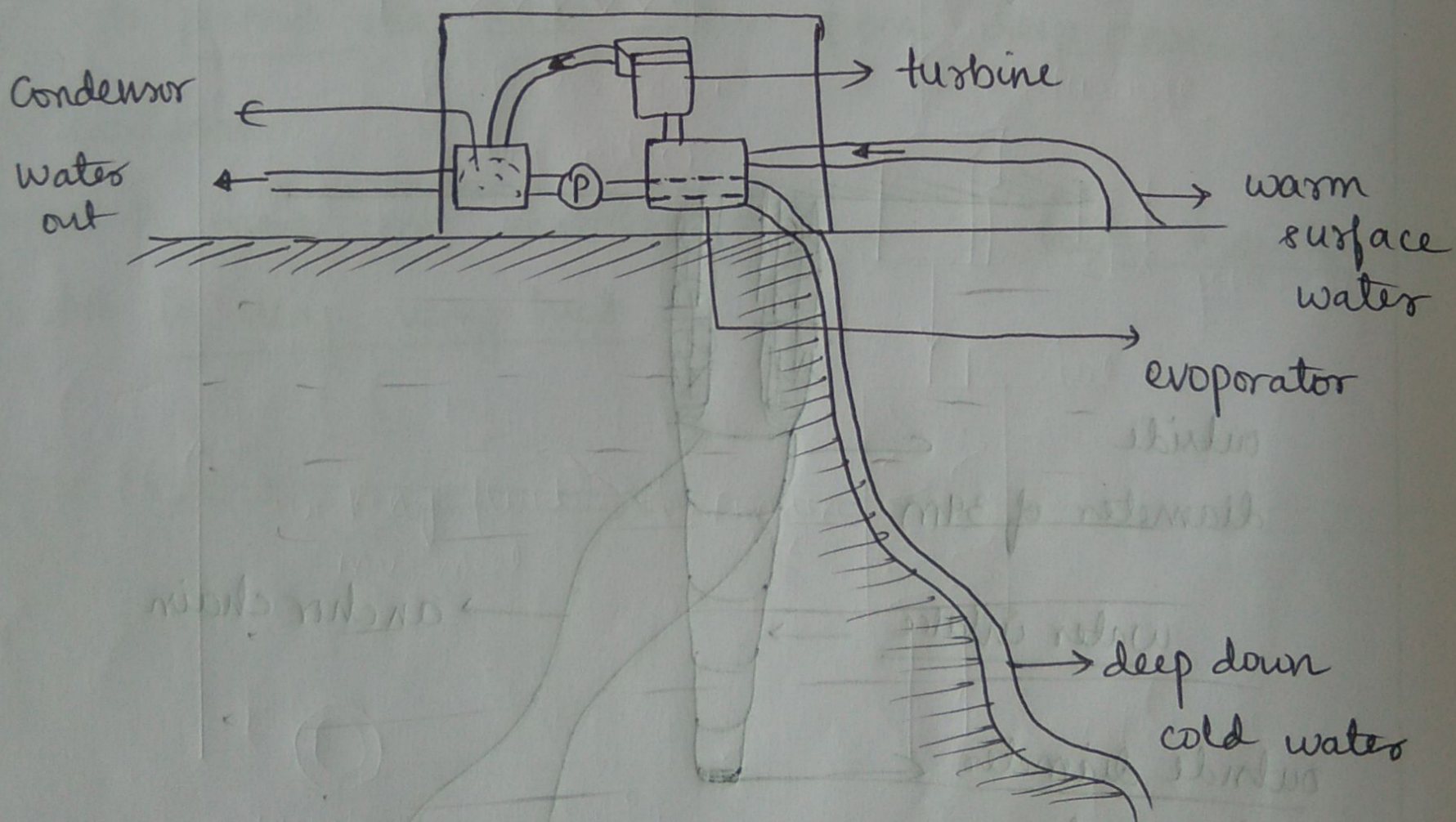
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5) • land based OTEC plants:-

- * land based OTEC plants are located near the shore (shore-on)
- * The warm water from the shore side is used to boil the water then convert into evap vapour using the evaporator.



- * The vapour rotates the turbine and generates the electricity

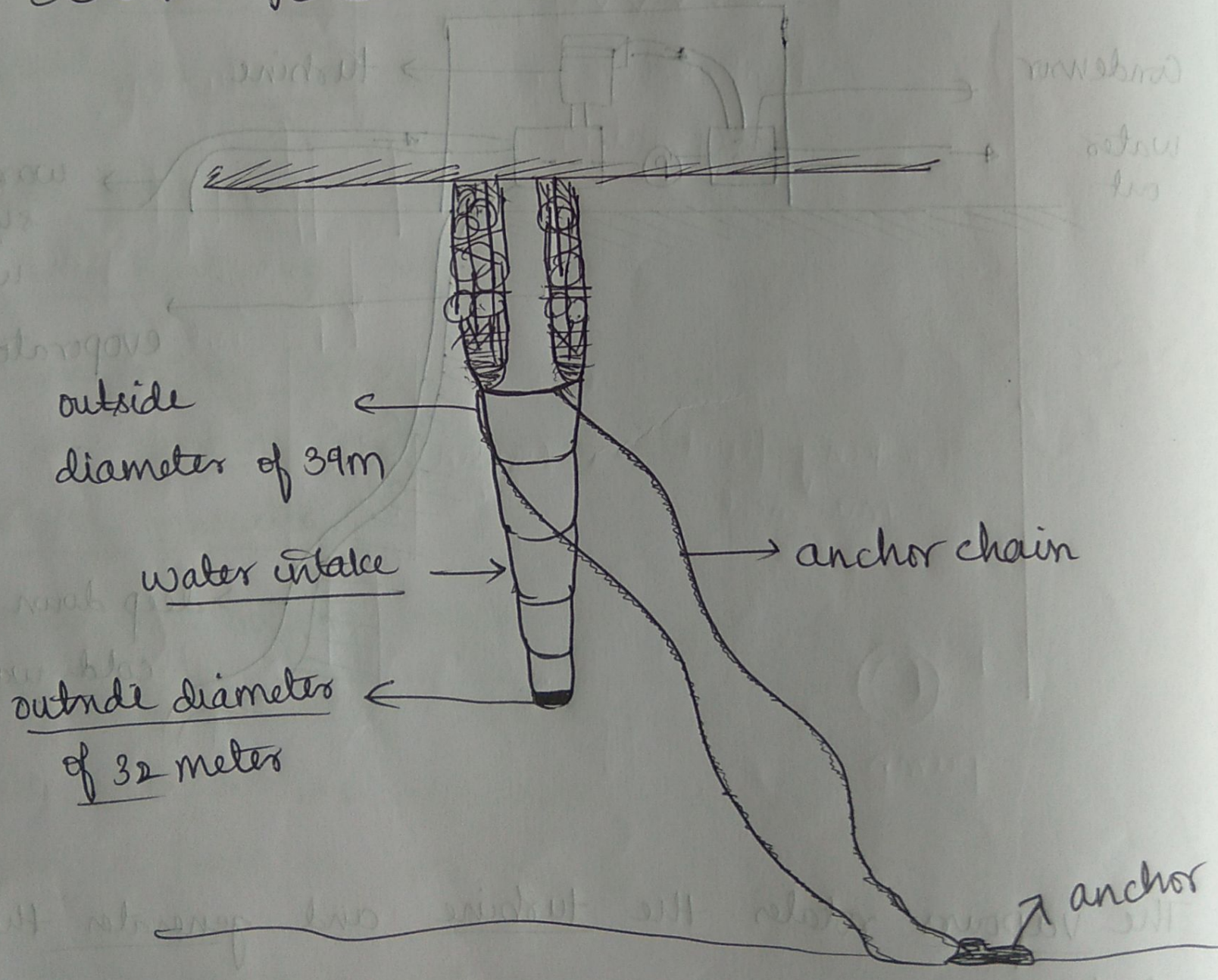
* we have 3 outlets,

1st outlet → water is taken inside the evaporator

2nd outlet → water is taken from the deep ocean using pump, which moves to condenser

3rd outlet → waste water from the turbine is let out back to sea.

• Floating type OTEC plants



* Explanation:-

- It is similar to the land based OTEC plants
- The difference is it on the offshore,
- It is placed on the ship surface or in the ship.
- Hence one can produce the thermal energy while travelling in ocean
- It has anchor chain and anchor which is used to pump the cold water from deep ocean to condensor
- It is more cost, installation cost is high, maintenance cost is very very high