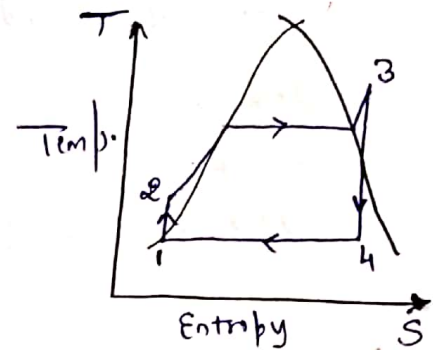
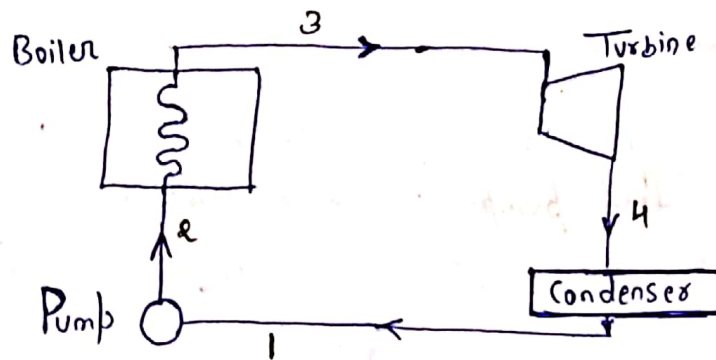


#① Steam Power generation cycle components:- (follows Simple Rankine cycle)



NOTE:- 1-2 \Rightarrow Pump \Rightarrow raises Pressure of liquid

2-3 \Rightarrow Boiler \Rightarrow High Pressure liquid Converts into **Steam**

3-4 \Rightarrow Turbine \Rightarrow Steam Expands (Temp & Pressure drops) & generates Power

4-1 \Rightarrow Condenser \Rightarrow Converts wet steam into Saturated liquids

② Boiler:- In boiler, the working fluid (Water) receives heat by Combustion of fuel & is converted into steam.

2.1 Important terms used in Boiler:-

1 \rightarrow Boiler shell:- used for containing water and steam at working pressure. Steam is produced in boiler shell. It is made up of steel plates bent into cylindrical form & riveted/welded together.

2 \rightarrow Combustion chamber:- is the space below the boiler shell meant for burning fuel in order to produce steam from water contained in the shell.

3 \rightarrow Grate:- is a platform in the combustion chamber upon which fuel ~~burnt~~ is burnt. It consists of cast iron bars which are spaced apart so that air required for combustion can pass through them.

4.7 Furnace :- is the space above the grate and below the boiler shell, in which the fuel is burnt. Furnace is also called fire box.

5.7 Heating surface :- is the part of boiler surface which is exposed to fire or hot gases from the fire.

6.7 Mountings :- are fittings which are mounted on the boiler for its **Proper & Safe functioning**. These include pressure gauge, safety valve, Water level indicator etc.

7.7 Accessories :- are integral part of a boiler but are not mounted on it. They include feed pump, economiser, Superheater etc. The accessories help in **Controlling & running the boiler efficiently**. *

#7.3.7 Selection of a Boiler :-

1.7 Rate of steam generation in kg/hour.

2.7 Pressure at which the boiler is required to operate & the quality of steam required i.e wet, dry Saturated or Superheated steam.

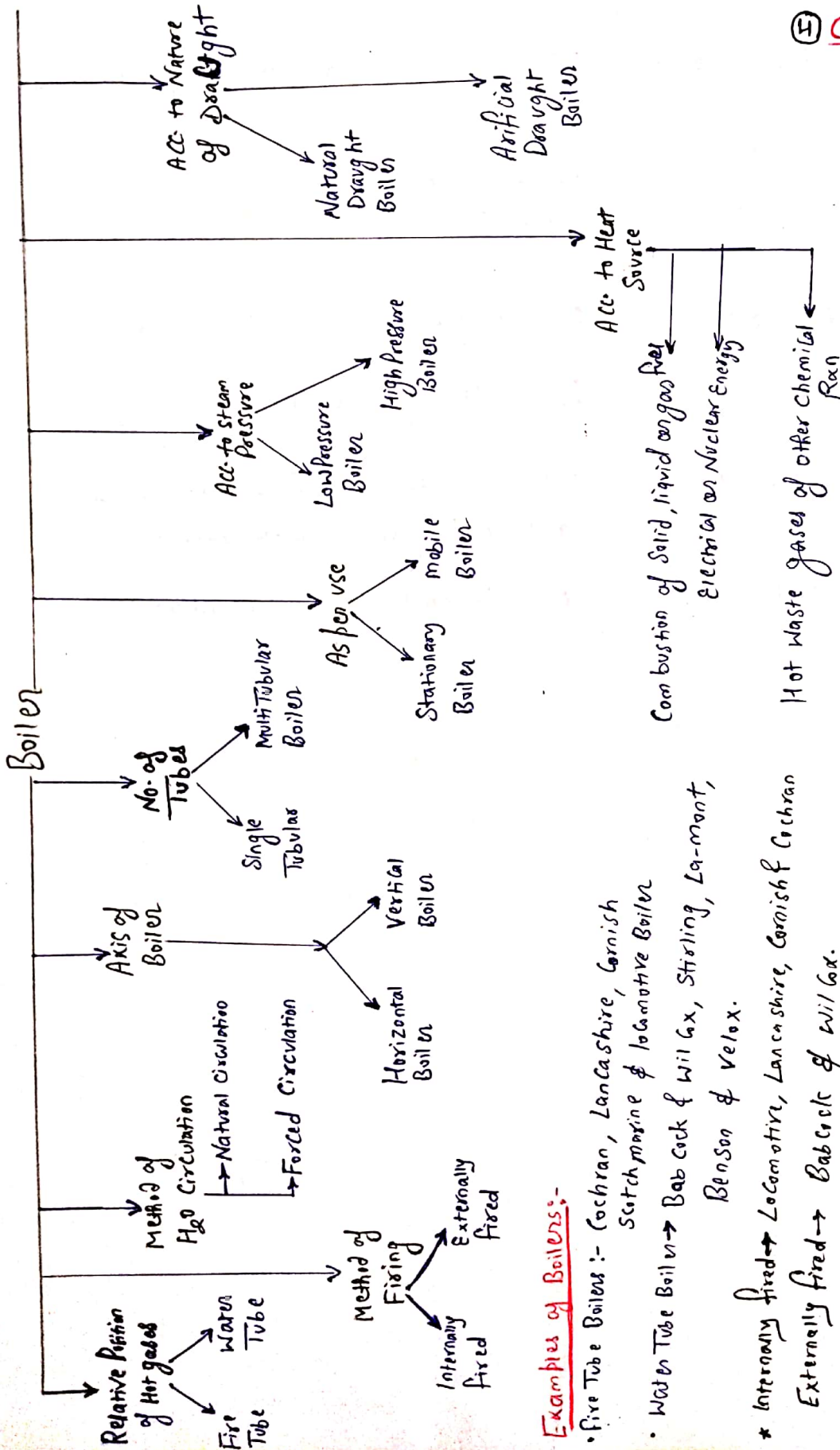
3.7 Whether the steam ~~is~~ raised is to be used at a steady or fluctuating loads.

4.7 Type of fuel to be used i.e solid, liquid or gas.

5.7 Comparative Initial cost.

6.7 Boiler efficiency.

Classification of Boilers



Examples of Boilers:-

- Fire Tube Boilers :- Cochran, Lancashire, Cornish, Scotch marine & locomotive Boiler
- Water Tube Boiler → Babcock & Wilcox, Stirling, La-mont, Benson & Velox.
- Internally fired → Locomotive, Lancashire, Cornish & Cochran
- Externally fired → Babcock & Wilcox.
- Natural Circulation - Cochran, Lancashire, Cornish, Babcock & Wilcox, Stirling
- Forced Circulation - La-mont, Benson & Velox Boiler
- Vertical - Simple Vertical & Cochran
- Horizontal -
- Pressure base -
 - Low Pressure (< 30 bar) - Cochran, Lancashire, Babcock & Wilcox
 - Medium Pressure (30-70 bar) - Stirling
 - High Pr. (> 70 bar) - La-mont, Velox, Benson Boiler

⑤ Comparison ~~of~~ between Water Tube & Fire Tube Boiler:-

Water Tube Boilers

1. > fire gases flow outside the tube, while water flows inside the tubes.
2. > Steam generated at high pressure upto 165 bar.
3. > Steam generation rate is high upto 450 tonnes per hr.
4. > overall efficiency ^{with} economiser is upto 90%.
5. > The floor area required is less.
6. > Operating Cost is high.
7. > Preferred widely for fluctuating loads.
8. > Suitable for large plants.

Fire Tube Boilers

1. > fire gases flow inside the tubes while water remain outside tubes in the shell.
2. > Steam is generated only upto 25 bar.
3. > generates upto 9 tonnes per hr only.
4. > over all efficiency with economiser upto 75%.
5. > The floor area required is more.
6. > operating cost is low.
7. > It can work with sudden increase in load but for a shorter period only.
8. > Suitable for small plants.

⑥ Boiler Mountings:- mounted for safe & proper functioning of boiler.

6.1> Safety Valve:- Whenever the pressure in the boiler exceeds the working pressure, the valves lift off their seats, thus releasing steam to atmosphere.

6.2> Steam Stop Valve:- is placed on the highest part of the steam space of a boiler & is connected to a steam pipe which supplies steam to steam engine or turbine.

6.3> Feed Check Valve:- Consists of two hand valves combined in one valve. one is the feed valve & other is the check valve. The feed valve is operated by hand, its function is to allow or to stop the supply of the water to the boiler.

The check valve is automatic in operation & its function is to prevent the water escaping from the boiler in case of failure of feed pump.

6.4> Blow off Cock:- Its fn is to remove periodically the sediments collected at the bottom of the boiler while the boiler is working & to empty the boiler while it is to be cleaned or inspected.

6.5> Water level Indicator:-

6.6> Pressure Gauge

6.7> Fusible Plug:-

7.7 Boiler Accessories :

- 1.7 Feed Pump — supply water into boiler. Water is to be pumped at a high pressure than that of boiler.
- 2.7 Economiser — used to heat feed water heater by utilizing the heat of waste flue gases before they are discharged to the chimney.
- 3.7 Air Preheater —
- 4.7 Superheater — It is in the form of pipe coils which is used to heat the dry saturated steam inside the pipe above the saturation temp.
- 5.7 Draught Equipment : required to supply required amount of air for proper combustion of fuel is known as draught equipment

5.1) Natural Draught — Chimney design

Artificial Draught [5.2a) Forced Draught — fan Placed ^{before furnace chimney} ~~at the base of cooling tower.~~
5.2b) Induced Draught — fan Placed ~~on top of the cooling tower~~ ^{before chimney.}

