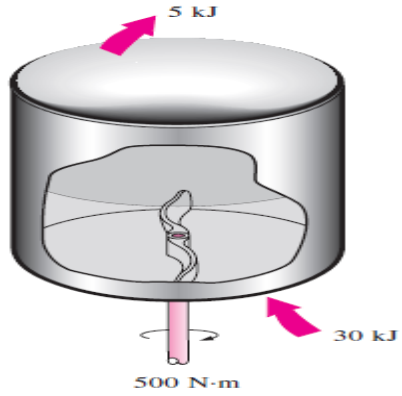
Wollo University
Kombolcha institute of technology
Thermodynamics assignment two
2nd year Garment engineering

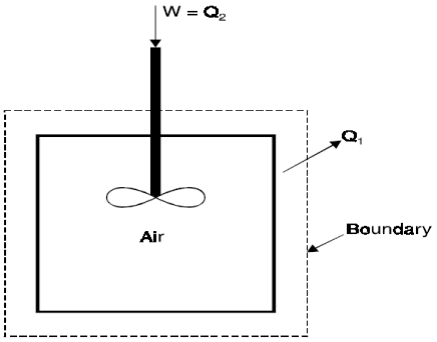
1. Water is being heated in a closed pan on top of arange while being stirred by a paddle wheel. During theprocess, 30 kJ of heat is transferred to the water, and 5 kJ ofheat is lost to the surrounding air. The paddle-wheel workamounts to 500 N · m. Determine the final energy of the systemif its initial energy is 10 kJ.



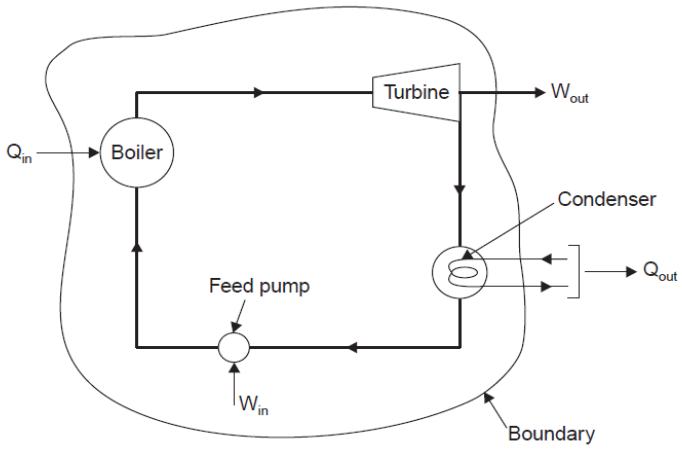
2. A tank containing air is stirred by a paddle wheel. The work input to thepaddle wheel is 9000 kJ and the heat transferred to the surroundings from the tank is 3000kJ.Determine :

(i) Work done ;

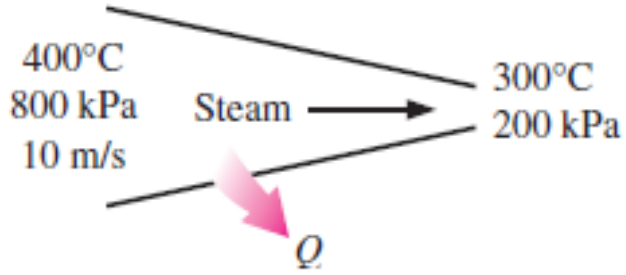
(ii) Change in internal energy of the system.



3.The power developed by a turbine in a certain steam plant is 1200 kW. Theheat supplied to the steam in the boiler is 3360 kJ/kg, the heat rejected by the system to coolingwater in the condenser is 2520 kJ/kg and the feed pump work required to pump the condensateback into the boiler is 6 kW.Calculate the steam flow round the cycle in kg/s.



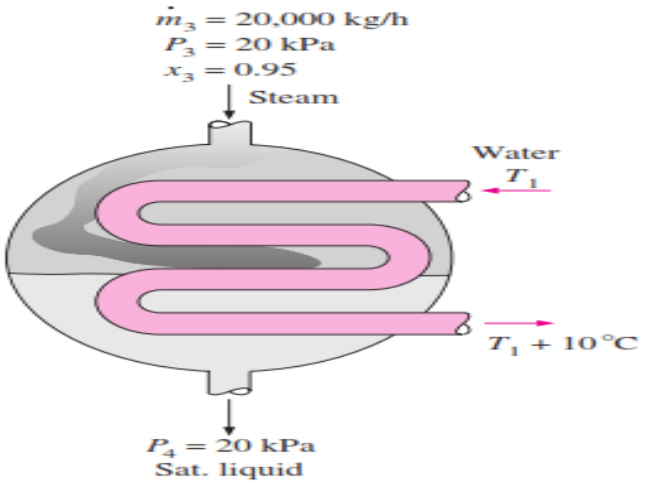
4.Steam enters a nozzle at 400°C and 800 kPa with avelocity of 10 m/s, and leaves at 300°C and 200 kPa whilelosing heat at a rate of 25 kW. For an inlet area of 800 cm2,determine the velocity and the volume flow rate of the steamat the nozzle exit.



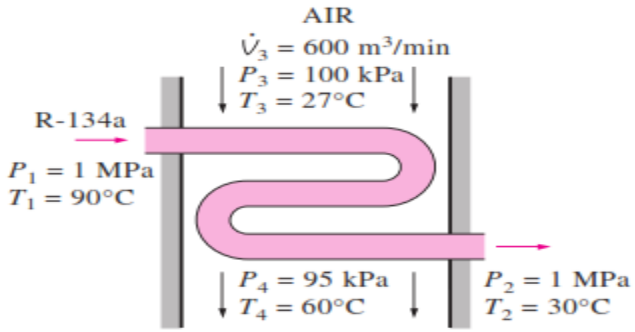
5. Air enters an adiabatic nozzle steadily at 300 kPa, 200°C, and 30 m/s and leaves at 100 kPa and 180 m/s. The inlet area of the nozzle is 80 cm. Determine (*a*) the mass flow rate through the nozzle, (*b*) the exit temperature of the air, and (*c*) the exit area of the nozzle**.**

The gas constant of air is 0.287 kPa.m^3 /kg.K and C_{pave} = 1.02 kJ/kg.K

6. Steam enters the condenser of a steam power plant at 20 kPa and a quality of 95 percent with a mass flow rate of 20,000 kg/h. It is to be cooled by water from a nearby river by circulating the water through the tubes within the condenser.To prevent thermal pollution, the river water is not allowed to experience a temperature rise above 10°C. If the steam is to leave the condenser as saturated liquid at 20 kPa, determine the mass flow rate of the cooling water required.



7. Refrigerant-134a at 1 MPa and 90°C is to be cooled to 1 MPa and 30°C in a condenser by air. The air enters at 100 kPa and 27°C with a volume flow rate of 600 m/min and leaves at 95 kPa and 60°C. Determine the mass flow rate of the refrigerant



8. .Find the co-efficient of performance and heat transfer rate in the condenserof a refrigerator in kJ/h which has a refrigeration capacity of 12000kJ/h when power input is 0.75 kW.

9.What is the highest possible theoretical efficiency of a heat engine operatingWith a hot reservoir of furnace gases at 2100°C when the cooling water available is at 15°C ?

10.300 kJ/s of heat is supplied at a constant fixed temperature of 290°C to aheat engine. The heat rejection takes place at 8.5°C. The following results were obtained :

(i) 215 kJ/s are rejected.

(ii) 150 kJ/s are rejected.

(iii) 75 kJ/s are rejected.

Classify which of the result report a reversible cycle or irreversible cycle or impossible