MECH 310 Thermodynamics I (E.KINAB)

Aug 12, 2011

~~QUIZ 1~~ Final

This is an open book 100 minutes exam.
Solve 3 of the following 4 problems – Make sure your choice is clear
State any assumptions you need and provide a convincing justification.

Problem 1

500 kg of water is in a fixed-volume container. Initially, the temperature is T1 = 190°C and the pressure is P1 = 10 bar. It is desired to raise the pressure to P2 = 30 bar. This is achieved by interactions with another system that transfer energy and 1000 kJ/K of entropy into the container.

a) How much energy is transferred?

b) How much entropy is generated by irreversibility?

c) What are the possible types of interactions that could result in the given transfers of energy and entropy?

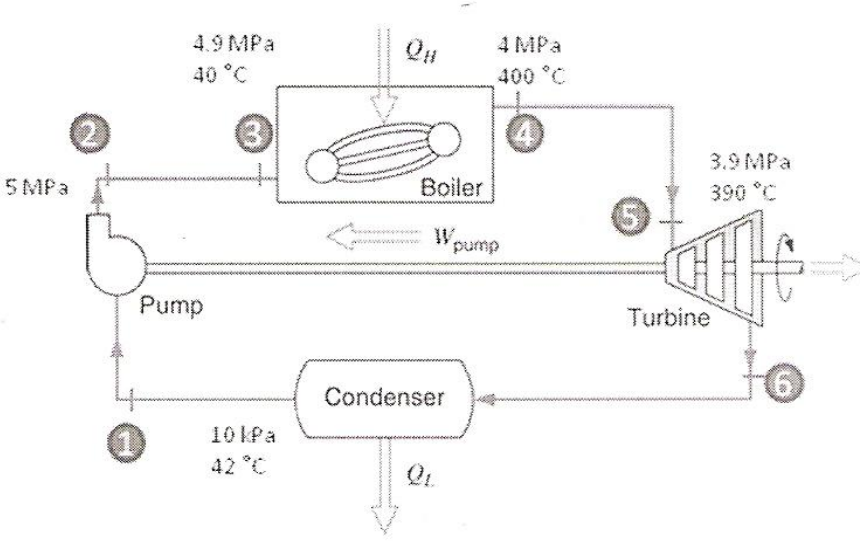
Problem 2

A steam power plant operates on a cycle with pressures and temperatures as designated in the figure. The isentropic efficiency of the turbine is 80 % and the isentropic efficiency of the pump is 86 %. Neglecting any changes in kinetic and potential energies, calculate:

a) The specific turbine work output

b) The pump work input and enthalpy

c) The thermal efficiency of the cycle



Problem 3

A tank contains air at 127 °C, 300 kPa with a volume of 2 m^3. A valve on the tank is opened to let some air escape to the ambient to a final pressure inside of 200 kPa.

a) Process a: Find the final temperature and mass assuming a reversible adiabatic process for the air remaining inside the tank.

b) Process b: Consider that the tank is heated so the air remaining has a constant temperature. What is the value of the s leaving assuming this is an internally reversible process?

Problem 4

One kilogram of ammonia (NH3) is contained in a spring-loaded piston/cylinder, as saturated liquid at −20°C. Heat is added from a reservoir at 200°C until a final condition of 800 kPa, 70°C is reached. Find the work, heat transfer, and entropy generation, assuming the process is internally reversible.