NAME:

STUDENT NUMBER:

MCG2130: Thermodynamics I

Quiz 10

Instructions: 110 minutes. Closed book. Non-programmable calculators allowed.

Use methodology shown in class for full marks.

Q1 (Short Answer) (2 marks):

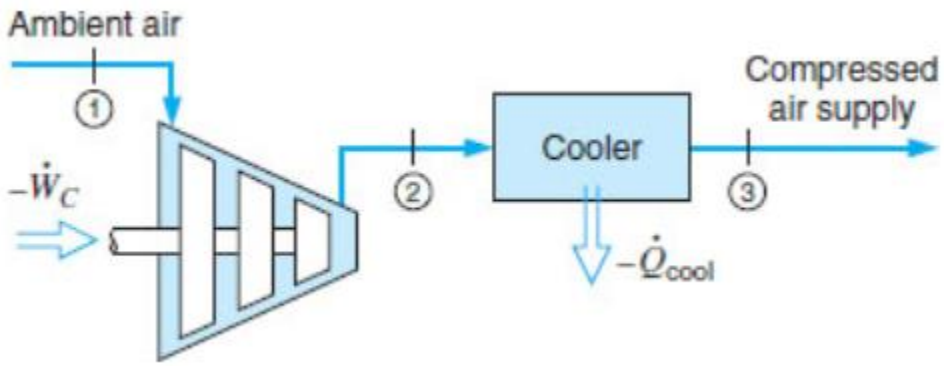
(a) Write out the second law of thermodynamics for open systems and identify all of the components.
(b) What is the general simplified equation for work for a reversible steady state process (such as a pump, compressor, or turbine)?
(c) What is the equation for work for reversible pump?

Q2 (2 Marks):

An industrial process requires a steady 0.75 kg/s supply of compressed air at 500 kPa at a maximum temperature of 30°C. This air is to be supplied by installing a compressor and an after cooler. Local ambient conditions are 100 kPa, 20°C.

Using a reversible compressor, determine:

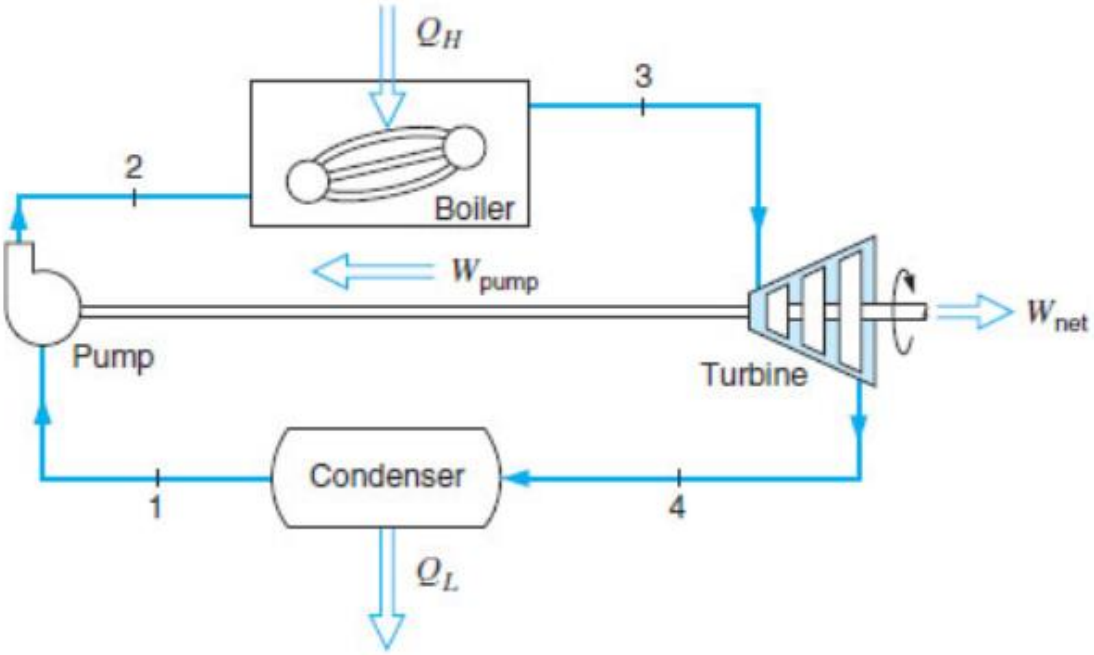
(a) The power required to drive the compressor
(b) The rate of heat rejection in the after cooler.



Q3 (4 marks):

A steam power plant (shown below) has P1 = P4 = 20 kPa, T1 = 40°C and P2 = P3 = 15MPa, T3 = 600°C.

(a) Draw a T-s diagram of the cycle.
(b) Find the specific work and exit state for the pump.
(c) Find the specific work and exit state for the turbine.
(d) Find the specific heat transfer in the boiler.
(e) Find the specific heat transfer in the condenser.
(f) What is the cycle's efficiency?



Q4 (2 marks): Two flows of air are both at 200 kPa; one has 2 kg/s at 400 K, and the other has 1 kg/s at 290 K. The two flows are mixed together in an insulated box to produce a single exit flow at 200 kPa.

(a) Find the exit temperature of the air.
(b) Find the total rate of entropy generation.