NAME_____

This examination is open book and open notes. Both problems are equally weighted. Please write your name in the space provided above.

MIDTERM EXAMINATION #1 (10/3/2002)

1. Consider a piston-cylinder system that contains 1 kg of water. The water is initially at101 kPa and 45 C. Heat, or work, is transferred to, or from, the system in the process stated below.

(A) Determine **five** intensive properties of state of the water for the following steps in the process: **(1)** Initial state; **(2)** isothermal expansion to $V_2 = 10{,}000V_1$; **(3)** isobaric heat addition to $T_3 = 400$ C; **(4)** adiabatic expansion to P_{54}=50 kPa and T_{54}= 300 C. **(5)** isothermal expansion to $V_5 = 50V_4$;

B) Sketch the process in a P-v and in a T-v diagrams, and indicate approximately the locations of the different states.

C) Calculate the heat and work exchanged in each step.

2. A steam turbine is used to power an air compressor (see figure). Steam enters the turbine at 10 MPa and 600 C at a rate of 10 kg/s and exits at 50 kPa and 100 C. Air enters the compressor at 100 kPa and 20 C and exits at 0.5 MPa and a flow rate of 5 kg/s. Assuming that both the turbine and the compressor are adiabatic and that the difference in kinetic and potential energies are negligible calculate the temperature of the air exiting the compressor.