These problems are due on Monday, Oct 12.

1. Tank A has a volume of 100 liters and contains saturated vapor R134a at 20°C. The valve is cracked open, and R134a flows into cylinder B. The piston mass and atmospheric pressure are such that 200 kPa is required to raise the piston. The process ends when the pressure is uniform at 200 kPa throughout. During the process, heat is transferred so that the R134a is always at 20°C.
   a) what is the work done during this process (kJ)?
   b) What is the heat transfer for this process (kJ)?

2. Air steadily flows into a compressor at 14.0 lbf/in², 70°F with a low velocity. Air exits the compressor at 170 lbf/in², 720°F and a velocity of 300 ft/s. If the power input to the compressor is 5000 hp, determine the mass flow rate of air through the compressor.

3. Steam enters a turbine at 1000 kPa, 500°C and exits as saturated vapor at 10 kPa. Neglect kinetic and potential energy changes. Compute the work produced by the turbine (kJ/kg) if
   a) the process is adiabatic
   b) the steam loses 50 kJ/kg through heat transfer as it flows through the turbine.

4. Water enters a pump as saturated liquid at 10 kPa and is pumped to 1000 kPa. Calculate the work required (kJ/kg) using the compressed liquid approximation.

5. An adiabatic steam turbine is used to drive a nitrogen compressor. The mass flow rates are 0.25 kg/s for the steam and 0.04 kg/s for the nitrogen. The turbine delivers 42 kW to the compressor and the remainder of its output drives an electric generator. Determine:
   a) The power available to the generator (kW)
   b) The rate of heat transfer from the nitrogen as it flows through the compressor and aftercooler.