Note: Draw $T - s$ diagrams wherever possible!

H6.1 A gas initially at 2.8 bar and 60°C is compressed to a final pressure of 14 bar in an isothermal internally reversible process. Determine the work and heat transfer [kJ/kg] if the gas is (a) Refrigerant 134a, (b) air as an ideal gas. Sketch the process on both $p - v$ and $T - s$ diagrams.

H6.2 Air in a piston cylinder assembly undergoes a Carnot power cycle. Heat is received at temperature $T_1 = 1400$ K and rejected at $T_3 = 350$K. At the beginning and end of the heat rejection process, the pressures are $p_3 = 100$ kPa and $p_4 = 500$ kPa, respectively. Assume the air behaves as an ideal gas with variable specific heats. Determine:
   a. pressures [kPa] at beginning and end of the isothermal heat addition process
   b. heat transfer and work [kJ/kg] for each process
   c. thermal efficiency

H6.3 Water in a piston cylinder assembly undergoes a Carnot power cycle. Heat addition from a high temperature source at 300°C causes the water to change from saturated liquid (state 1) to saturated vapor (state 2). Heat rejection occurs at a temperature of 25°C. Determine:
   a. thermal efficiency of the cycle
   b. heat input from high temperature source [kJ/kg]
   c. net work output of cycle [kJ/kg]

H6.4 1.5 kilograms of air, initially at 1 bar and 27°C, is contained in an insulated piston-cylinder assembly. The air is compressed to 10 bar. Determine:
   a. minimum possible work [kJ] required to compress air (clearly justify your result, that it is the minimum possible)
   b. actual work [kJ] and entropy produced during process [kJ/K] if the final temperature of the air is 377°C
   c. show both processes on $T - s$ diagram

H6.5 Two kg of air contained in a piston-cylinder assembly are initially at 1.5 bar and 400K. Can a final state at 6 bar and 500 K be attained in an adiabatic process?

H6.6 In a heat-treating process, a 1-kg metal part, initially at 1075 K, is quenched in a tank containing 100 kg of water, initially at 295 K. There is negligible heat transfer between the contents of the tank and their surroundings. The metal part and the water can be modeled as incompressible substances with constant specific heats 0.5 kJ/kg K and 4.2 kJ/kg K, respectively. Determine:
   a. the final equilibrium temperature [deg F]
   b. amount of entropy produced within the tank [kJ/K]