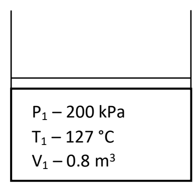
Spring Midterm 1 - 2021

1. Air is contained in a piston cylinder device at an initial state of 200 kPa and 127 °C and 0.8 m^3 as shown. The air is compressed isothermally to 0.4 m3. Then the air is expanded at constant pressure until the volume is 1.6 m^3. Assume that air is an ideal gas, and its internal energy is function of temperature only.

    a. Sketch and label the system. Show and number the processes on a Pv diagram including directions of heat and work for each process.

    b. Determine the total amount of heat transferred in the processes.



2. A steam turbine with an inlet flow of steam at 4.85 kg/sec, 500 °C, and 10 MPa does 5000 kW of work. The steam exits at 10 kPa. Kinetic and potential energy changes are negligible. Find the exit temperature of the steam and quality if saturated. Draw the process on the diagram below and on a two-dimensional projection of the diagram below.