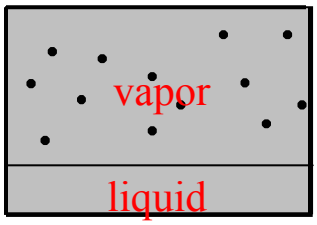
1. A closed, rigid container of volume 0.5 m^3 is placed on a hot plate. Initially, the container holds a two-phase mixture of saturated liquid water and saturated water vapor at a pressure of 1 bar with a quality of 0.5. After heating, the pressure in the container is 1.5 bar.

   a. Determine the temperature and mass of vapor at the initial and final states.



   b. If heating continues, determine the pressure when the container holds only saturated vapor.

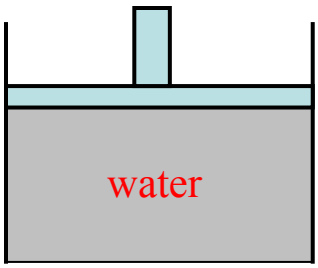
   c. Sketch the process paths on a *P-v*, a *T-v* and a *P-T* diagram (clearly indicates the two-phase region.)

2. Water contained in a piston-cylinder assembly undergoes two processes in series from an initial state where the pressure is 10 bar and the temperature is 400 deg C.

   Process 1: The water is cooled as it is compressed at a constant pressure of 10 bar to the saturated vapor state.
   Process 2: The water is further cooled at constant volume to 150 deg C.

   a. Determine the overall work for the overall process.

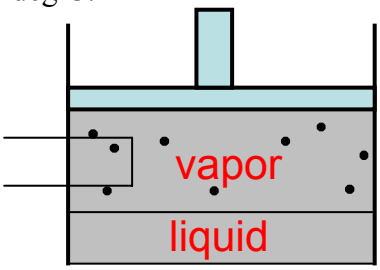
   b. Determine the overall heat transfer for the overall process.



   c. Sketch the whole process path on a *P-v*, a *T-v* and a *P-T* diagram (clearly indicates the two-phase region.)

3. A mass of 12 kg of saturated refrigerant-134a vapor is contained in a piston-cylinder device at 200 kPa. Now 150 kJ of heat is transferred to the refrigerant at constant pressure while a 110V source supplies current to a resistor within the cylinder for 6 minutes. (Process A)

   a. Determine the current supplied if the final temperature is 70 deg C.



   b. If a latch is placed on the wall of the cylinder to restrain motion of the piston (Process B) from the beginning, what do you expect to be the main difference? Determine the current in this case.

   c. Show the process on a *P*-*v*, a *T*-*v* and a *P*-*T* diagram (clearly indicates the two-phase region).

   d. If the refrigerant is replaced by an ideal gas, how would you solve the problem differently?