State 2

EML 3002 ME Tools Example

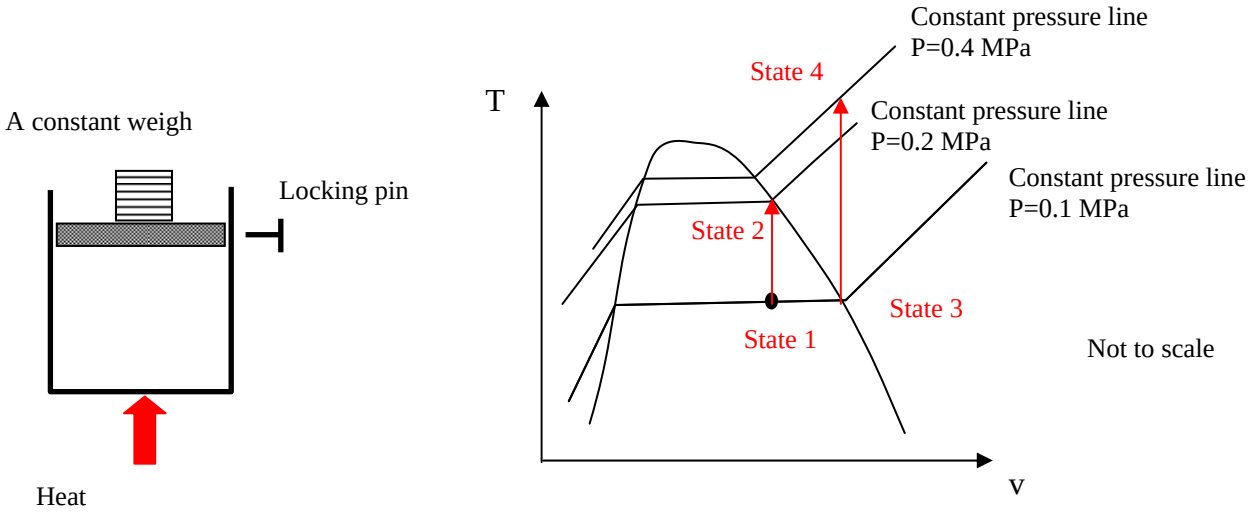
Saturated water is being heated (or cooled) in a closed piston-cylinder assembly. Initially, the heating/cooling process is taking place at a constant pressure of 0.1 MPa with a quality of 0.522 (state 1).
(a) What is the specific volume (m^3/kg) at this instant?

At the state 1, the piston is locked with a pin (piston not moving) and heat is added to heat up the system until all liquid water vaporize completely the cylinder contains 100% saturated vapor (state 2).
(b) What is the pressure at this state?

Back to the state 1, the pin is removed to allow the piston to freely expand and heat is provided to vaporize all saturated mixture into 100% saturated vapor (state 3).
(c) What is the specific volume of the steam at state 3?

Finally, the locking pin is use to lock the piston at state 3 and heat is continuously added to the piston to heat the system to a higher pressure 0.4 MPa (hint: it will assume a superheated state, state 4).
(d) What is the temperature at this state?

Note: no interpolation is necessary. An approximate value read from the table will be acceptable.



(a) Saturated vapor at 0.1 MPa, $v_{f,1}=0.001043(m^3/kg)$, $v_{g,1}=1.6940(m^3/kg)$
$v_1=(1-x)v_{f,1}+xv_{g,1}=0.885$

(b) A constant specific volume process, $v_{2\ @saturated\ vapor\ state}=v_{,1}=0.885(m^3/kg)$
From saturated steam table, at 0.2 MPa,

(c) At state 3, pressure=0.1 MPa, $v_3=v_{g,3}=1.694(m^3/kg)$

(d) From state 3 to state 4, the specific volume is again a constant. $v_4=v_3=v_{g,3}$, from the superheated table, at a pressure of 0.4 MPa, the temperature should be approximately equal to 1,200°C.