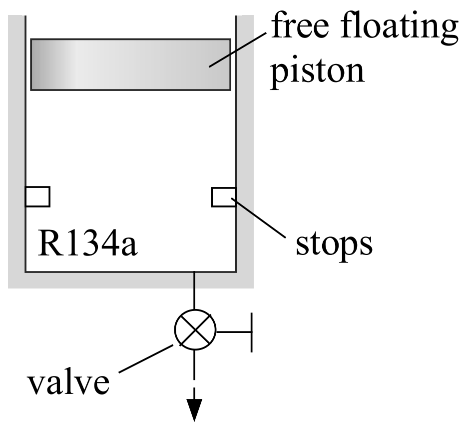
Problem Statement

The figure below illustrates a free-floating piston equipped with stops. Initially, at state 1, the piston is not resting on the stops and the volume is Vol_1 = 1 m^3. The mass of the piston is sufficient to keep the pressure within the device at P_1_kPa = 300 kPa. The device contains the fluid R134a at 20ºC.



a.) What is the mass of R134a in the piston, m_1 (kg)?

A valve is opened and R134a slowly escapes. Heat transfer keeps the temperature in the device always at 20ºC. At state 2, the piston just touches the stops (at which point the volume in the cylinder has been reduced to 20% of its original value).

b.) What mass of R134a **has been removed** from the container at the moment that the piston touches down on the stops, m_out_12 (kg)?

The valve is opened again and 50% of the remaining mass of R134a in the device (i.e., half of the mass at state 2) is slowly removed. Again, heat transfer keeps the temperature in the device always at 20ºC.

c.) What is the pressure at state 3 (after 50% of the remaining mass is removed), P_3_kPa (kPa)?

The valve is kept closed now and the device is cooled until R134a just starts to condense, at state 4.

d.) What is the temperature in the device at the moment that the first droplet of liquid starts to form, T_4_C (ºC)?

e.) What is the pressure in the device at the moment that the first droplet of liquid starts to form, P_4_kPa (kPa)?

The valve continues to be kept closed and the device is cooled until R134a reaches a temperature at state 5 of -35°C.

f.) What is the quality of the R134a in the cylinder at state 5, x_5?

Note that a starter code is available on the website for you to use – it's called HW_starter.ees. Please download this from the website and do not alter anything in the header region.