Max Shi

Professor de Rosa

E 234

September 30, 2020

I pledge my honor that I have abided by the Stevens Honor System.

Partner: Ashley McDermott

Homework 3

1a. vf = 0.0007697 + 0.0007771 / 2 = 0.0007734 m3/kg

vg = 0.072434 + 0.063681 / 2 = 0.0680575 m3/kg

vfg = 0.0680575 – 0.0007734 = 0.0672841 m3/kg

V = 14 L = 0.014 m3

v = 0.014/10 = 0.0014 m3/kg

x = (0.0014 – 0.0007734) / 0.0672841 = 0.0093

**T = -1.25 + 2.46 / 2 = 0.605°C**

hf = 50.16 + 55.14 / 2 = 52.65 kJ/kg

hg = 249.77 + 251.93 / 2 = 250.85 kJ/kg

hfg = 250.85 – 52.65 = 198.2

**h = 52.65 + 198.2\*0.0093 = 54.49 kJ/kg**

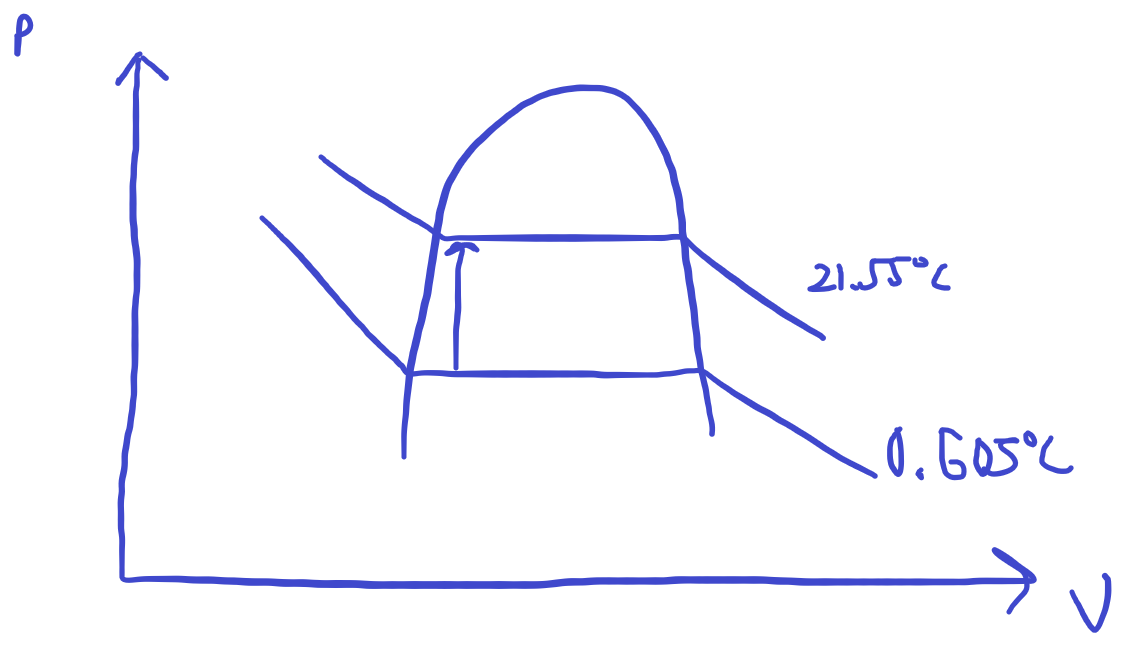
­­1b. vfg = 0.034335 – 0.0008198 = 0.0335152 m3/kg

x = (0.0014 – 0.0008198) / 0.0335152 = 0.0173

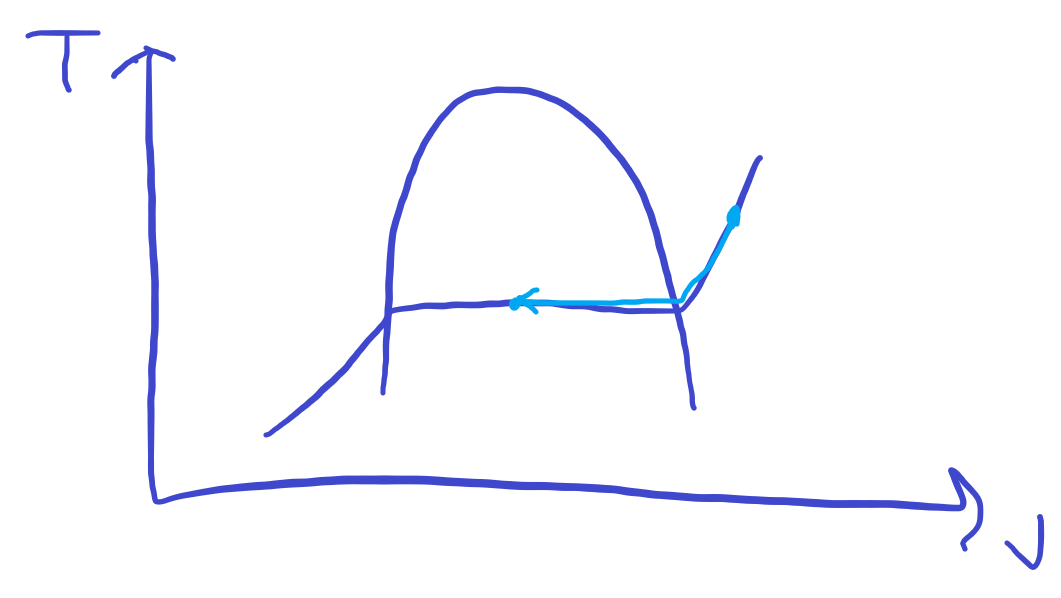
**T = 21.55°C**

**h = 81.50 + 180.95\*0.0173 = 84.63 kJ/kg**

1c.



2a.



2b. **Final temperature is 151.83°C**

2c. Specific volume for superheated water at 200**°C is 0.42503** m3/kg.

Volume of the superheated water is 0.42503 \* 0.6 = 0.255 m3

Specific volume for the mixture (x=0.5) is 0.001093 + 0.5(0.37483 – 0.001093) = 0.1880 m3/kg

Volume of the mixture is 0.113 m3, which means the change in volume is 0.142 m3.

3. Water vapor cannot be treated as an ideal gas because it is not a gas at room temperature. Furthermore, the polarity of water causes intramolecular forces to interact between water molecules, especially at lower temperatures, violating the rules of ideal gases.

4.

5a.

5b.

5c. From the table: v = 0.011481 m3/kg.

6. Volume of second tank:

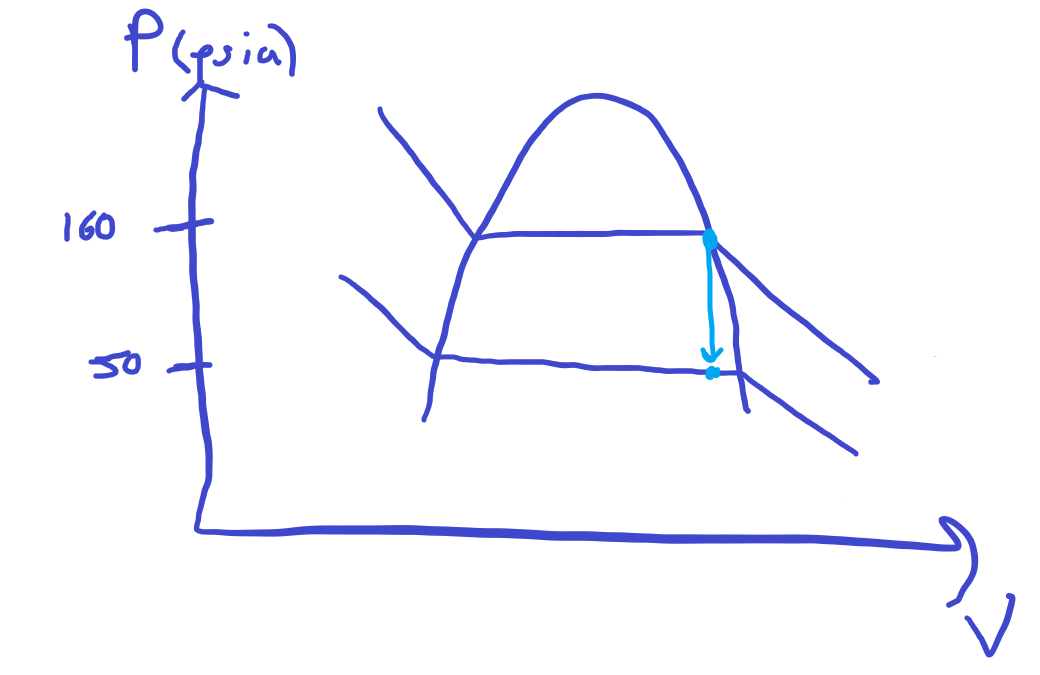
Mass of air in first tank:

Final pressure:

7. No because in order to compress an ideal gas, work needs to be put into the system. According to the law of conservation of energy:

KE and PE are 0, and because the process is isothermal, U is also 0. Because the piston cylinder is adiabatic, Q must also be 0. This leaves us with:However, to compress the system, work must be put in. Therefore, W cannot be zero and this presents a contradiction, which means that it is impossible to compress an ideal gas isothermally in an adiabatic piston-cylinder device.

8.



8a.   
Specific volume of saturated vapor at 160 psia: 0.29339 ft3/lbm = constant specific volume of our gas  
Specific volume of saturated vapor at 50 psia: 0.94909 ft3/lbm  
Specific volume of saturated liquid at 50 psia: 0.01252 ft3/lbm

Because our specific volume is still between these two values at 50 psia, it is still a mixture, and therefore the temperature is **sat. temp = 40.23°F**

8b. Mass of gas = 20 ft3 / 0.29339 ft3/lbm = 68.169 lbm  
Quality =   
**Amount condensed = mass \* (1-quality) = 47.72 lbm**

8c.