Name: Joseph Specht Net-ID: jspecht3

Quiz 4 (Total: 30 points) **Due back on Wed. Feb. 15 at 10 p.m., in Canvas**

- *Assignments will only be graded if the honor code statement is completed and signed.*
- *Save your entire assignment as one **PDF document** and upload it in the appropriate assignment folder on Canvas.*

Honor Code Statement

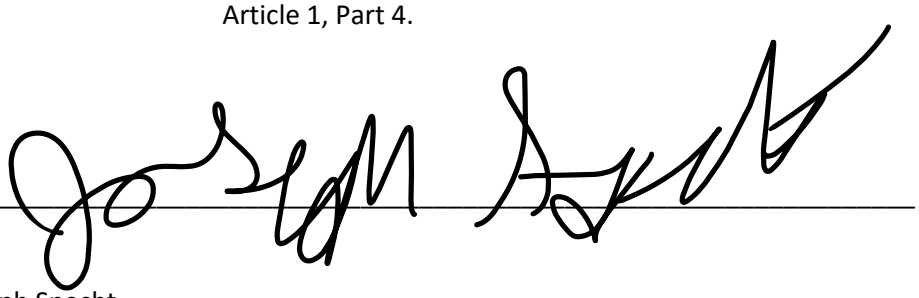
ME 200, Quiz 4

Being a student of high standards, I pledge to embody
the principles of *academic integrity*.

This quiz is my own work. I did not seek (or get) outside help or collaboration with any of the questions and their solutions. I did not post any of the questions on an electronic platform (like Chegg) nor did I solicit answers or solutions from any electronic platform (like Chegg). I also did not offer my solutions or answers to any other student.

I understand that this quiz is "open book" and "open notes" which means that I was permitted to use my prescribed textbook and lecture notes when addressing any of the questions. I have properly cited any other resources, with full cognizance of the regulations pertaining to plagiarism, copyright infringement, academic cheating, etc., as stipulated in the Student Code.

I acknowledge that academic violations will be dealt with according to the UIUC Student Code, Article 1, Part 4.

Student's signature: 

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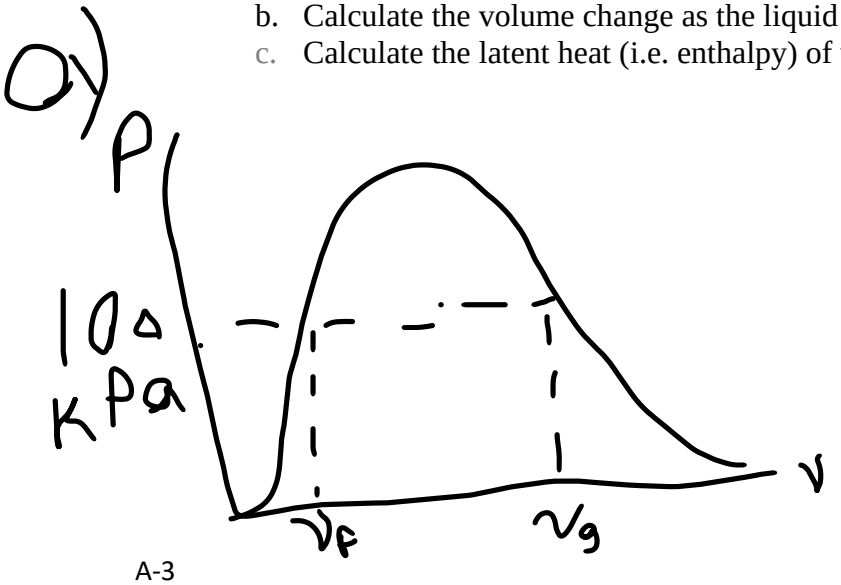
Date: 2/15/23

1. 0.5 kg of water evaporates at 100 kPa in a piston-cylinder device.
    a. Show this process on a *p*-*v* diagram and indicate salient values. (2)
    b. Calculate the volume change as the liquid changes to vapor. (5)
    c. Calculate the latent heat (i.e. enthalpy) of vaporization. (3)



A-3

vf = 1.0432e-3 m^3/kg

vg = 1.694 m^3/kg

B) dV = m(vg – vf) = .5kg * (1.694 m^3/kg - 1.0432e-3 m^3/kg) = .8465 m^3

C) enthalpy is found from table A-3 under hfg. @ 100kpa hfg = 2258.0 kJ/kg

2. Complete the following table (rows a – c) for water. Show all relevant calculations for Questions a to c in the space provided beneath the table. Mention in your calculations for each case (a – c) from which property table you determined the unknown values, i.e. Table A-2, Table A-3, Table A-4, or Table A-5. (3 points for tabulated values and 7 points for calculations = 10 points total)

	***T*, °C**	***p*, kPa**	***v*, m^3/kg**	**Phase description (e.g. "saturated", "subcooled", or "superheated"**
(a) A-2	50	7.924	7.72	Saturated mixture
(b) A-4	250	500	.4743	Superheated Vapor
(c) A-3	172.9	850	.2277	Saturated vapor

A) Table A-2 because we are given Temp and Specific Volume.

@T=50

X = v-vf / (vg – vf) = (7.72 – 1.0121e-3) / (12.032 – 1.0121e-3) = .6416

Take this x and multiply it by the pressure at T=50 to get

P = .6416 * 12.35 kPa = 7.924 kPa

B) Table A-4 because it has the pressure 500 kPa and temp, but need to interpolate

@P=500 kPa

250-240 / (v-.04646) = 280 – 240 / (.05034 - .4646)
40(v-.4646) = 0.388
v = .4743 m^3/kg

C) Table A-3 because it is the saturated mixture table.

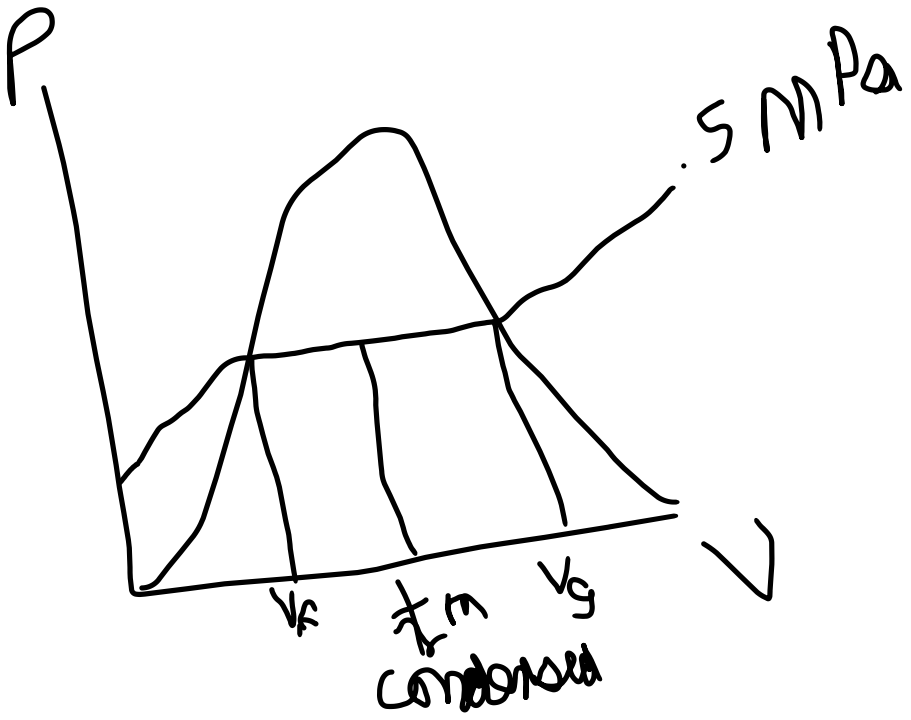
@Since sat vapor, we know v=vg

Temp:
(T-170.4) / (850-800) = (175.4-170.4) / (900 – 800)
100(T-170.4) = 250
T = 172.9 *C

v:
(v – .2404) / (850-800) = (.2150 - .2404) / (900 – 800)
100(v - .2404) = -1.27
v = .2277 m^3 / kg

3. A piston-cylinder device contains 0.6 kg of steam at 200°C and 0.5 MPa. The steam is cooled at constant pressure until one-half of the mass condenses.
    a. Show the process on a *T*-*v* diagram. (5)
    b. Find the final temperature. (1)
    c. Determine the change in volume. (4)

a)



vf = 1.0926e-3 m^3/kg

vg = .3748 m^3/kg

Since we have steam condensing, we know it is saturated, so Tsat = 151.86*C @ 5bar (A-3)

b) T = Tsat = 151.86 *C because it is cooled to where half the mass is fluid and gas, which means it is saturated because they both exist at the same time.

C) Table A-4

Vinitial = .4249 * .6 = .25494 m^3

A-3, we know that it is saturated, so

Vfinal = (vf + x * vg) *m

X = mg/mtot = ½ from the problem

Vf = ((1.0926e-3) + .5*(.3749 – 1.0926e-3)) * .6kg = .1128 m^3

dV = Vf – Vo = .112798 - .25494 = -.1421 m^3