ES 202 – Fluid & Thermal Systems Winter 2004-2005

Exam I

Name:____ CM Box: ___________________

Please circle your section

Richards – 8th period **Mayhew – 8th period**

Richards – 9th period **Mayhew – 9th period**

Problem 1 (60 points) ___________

Problem 2 (18 points) ___________

Problem 3 (22 points) ___________

Total (100 points) ___________

NOTE:

- Show all work (and reasoning) to receive full credit.
- Open Appendices, unit conversion information, and one note page (single side)
- Laptops allowed; however, they must not be connected to the network and no files written BEFORE class can be opened.

Problem 1 (60 points)

Complete the table of thermodynamics property information shown below for **Refrigerant 134a.** Skip the shaded boxes. You are encouraged to use the blank space on this page and the next page as work space.

Numerical answers should be provided with an accuracy of at least 4-significant figures.

Please use the following abbreviations as needed:

CL = compressed (subcooled) liquid
SL = saturated liquid
SM = saturated mixture
SV = saturated vapor
SHV = superheated vapor

NA = not applicable
INSUF = insufficient information

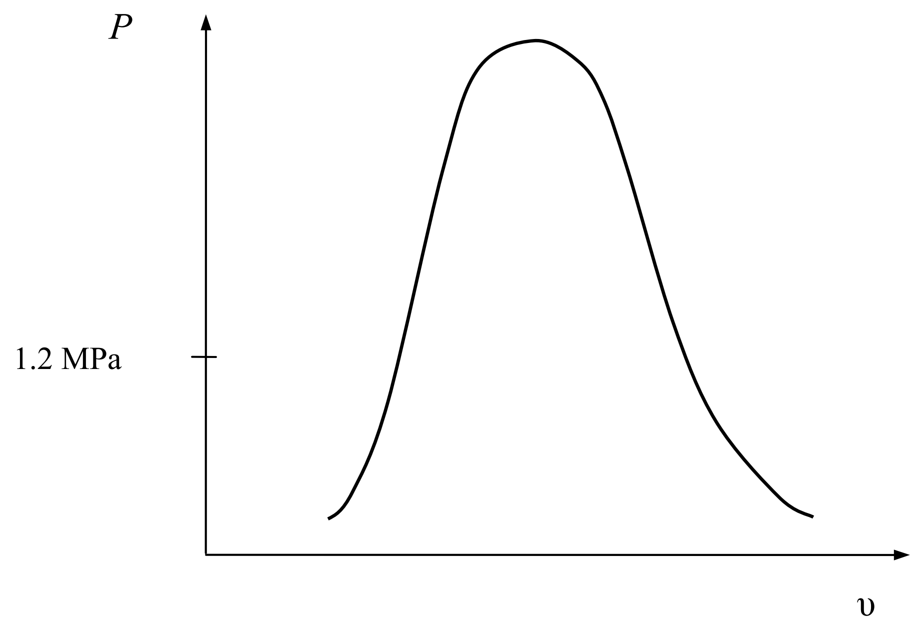
State	Pressure P (MPa)	Temperature T (°C)	Phase	Specific Volume υ (m³/kg)	Specific Enthalpy h (kJ/kg)	Quality, x
1	1.2					0.2
2	1.2	70				
3	1.2	20				
4		20				1.0
5		20			200	
6		20		0.100		

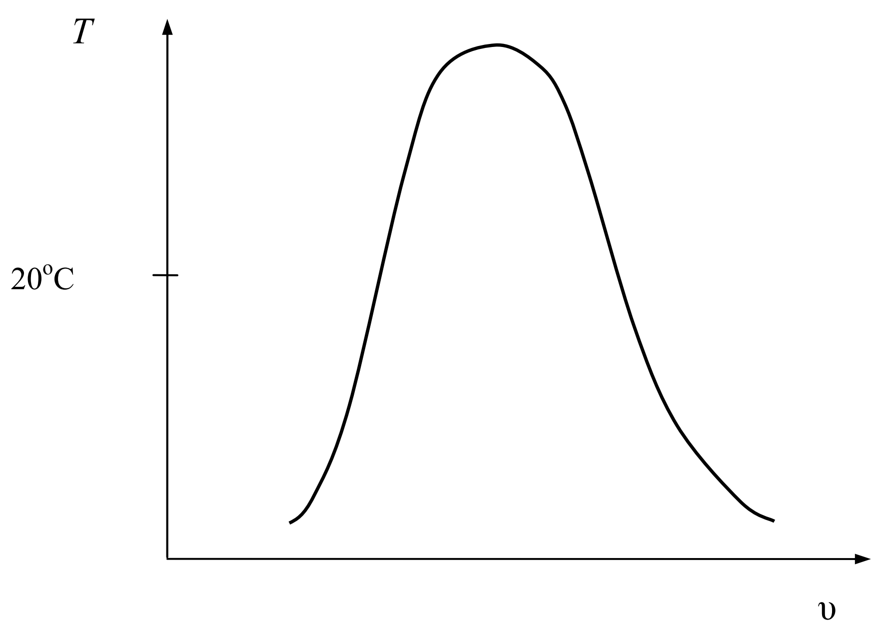
Workspace

Problem 1 Workspace (continued)

Problem 2 (18 points)

Carefully locate all six states (1-6) found in Problem 1 on the two process diagrams shown below. Take care to sketch all pertinent isotherms and isobars *and* correctly locate the states relative to the saturation curves.





Problem 3 (22 points)

Air undergoes a process between two knowns states: State 1 and State 2.

State 1	State 2
P_1 = 200 kPa	P_2 = 400 kPa
T_1 = 127°C	T_2 = 627°C

(a) (12 points) Assuming air can be modeled as an ideal gas, determine the following information using the ***ideal gas tables*****:**

Change in specific entropy: $s_2 - s_1$ = ________________ kJ/(kg-K)

Change in specific enthalpy: $h_2 - h_1$ = _________________ kJ/kg

Specific volume of the air at state 1: υ_1 = _________________ m^3/kg

Problem 3 (continued)

(b) (4 points) Assuming air can be modeled as an ideal gas, determine the following information using the method of **average specific heats**:

Change in specific internal energy: $u_2 - u_1 =$ ____________________ kJ/kg

(c) (6 points) Can air be accurately modeled as an ideal gas at $T = 100$ K and $P = 1000$ kPa? Explain your reasoning.