ES 202 Exam 2 Mayhew/Richards
30 Jan 00 Sections E F G

Name:_____ Campus Mail Box _____

Section:_____

Closed notes, 1 orange equation sheet (2 sides), Open tables in text.

Problem 1(a) : _____ /44

Problem 1(b) : _____ /10

Problem 2 : _____ /46

TOTAL _____ /100

NOTE FOR FULL CREDIT: If you apply the conservation of energy, conservation of mass, or the entropy balance in solving a problem, you must clearly indicate how you used the information in the problem statement to simplify the general equations for the specific conditions of the problem

Problem 1(a) (44 points)

Complete the unshaded portions of the following table for **WATER** (H_2O):

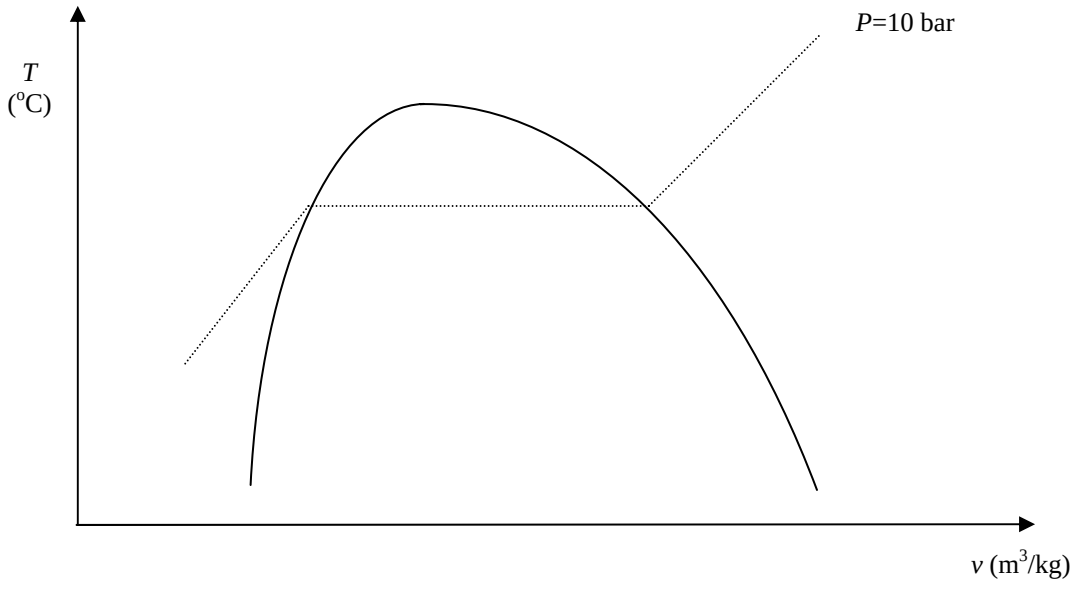
For **phase**, clearly indicate whether it is a compressed liquid (CL), saturated liquid (SL), saturated mixture (SM), saturated vapor (SV), or superheated vapor (SHV).

For **properties** and **quality**, provide a number or indicate it is not applicable (N/A).

State	**Phase**	***T*** ^oC	***P*** bar	***x***	***v*** m^3/kg	***h*** kJ/kg	***s*** kJ/(kg·K)
1		320	10				
2		170		0.1			
3			10	1.0			
4		170	10				
5			10			2412.6	

Problem 1(b) (10 points)

On the *T*-*v* diagram drawn below, locate and label all five (5) states found in Problem 1(a) above.



Problem 2 (46 points)

One of your colleagues has measured the performance of a diffuser operating with superheated steam as shown below. She indicates that the following operating conditions apply: steady state, uniform (1-D) flow at inlet and outlet, negligible change in potential energy, and negligible outlet velocity ($V_{out} << V_{in}$). The diffuser is NOT adiabatic, and heat transfer occurs at a boundary temperature of 25°C. The following properties are known:

State	T (°C)	P (bar)	V (m/sec)	υ (m^3/kg)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
1	100	0.7	300	2.434	2509.7	2680.0	7.5341
2	120	1.0	~0	1.793	2537.3	2716.6	7.4668

NOTE FOR FULL CREDIT: If you apply any of the general conservation or accounting equations, you must clearly indicate how you used the information in the problem statement to simplify the general equations for the specific conditions of the problem.

a) Find the *magnitude* and *direction* of the heat transfer rate per unit mass flow rate (kJ/kg).

b) Find the entropy generation rate per unit mass flow rate (kJ/kg-K).

c) Comment on whether you think this diffuser can operate as indicated, i.e. is the indicated performance possible? Explain why.