LEDGENDS

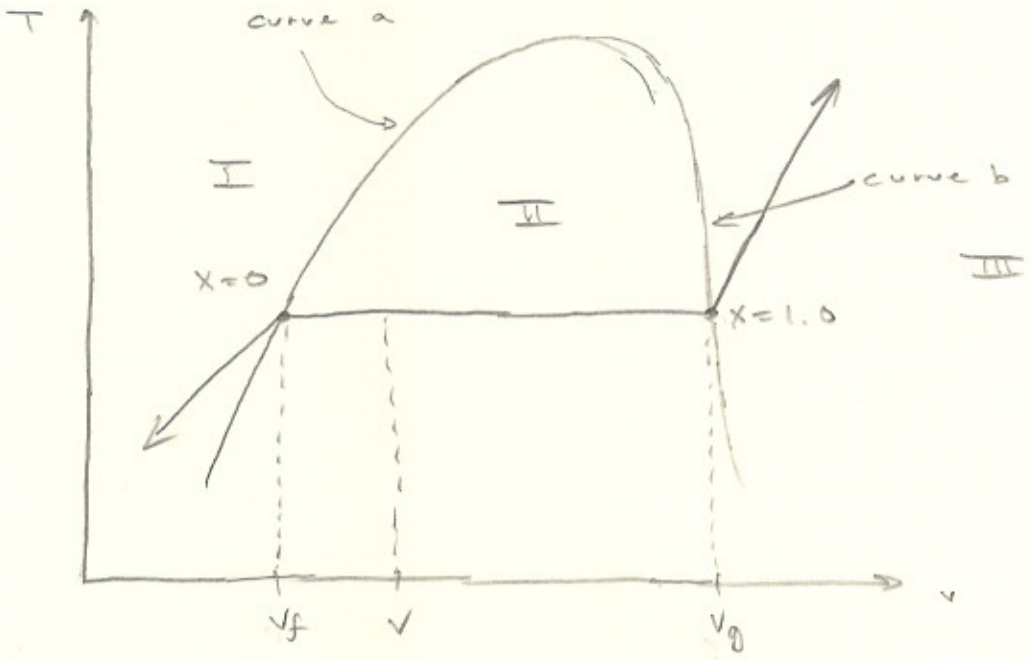
REGIONS

I - compressed (subcooled) liquid Region.
II - Two phase mixture region (vapour & Liquid)

$$0 < x < 1.0$$

III - Superheated vapour region

Curve A - Saturated liquid line. (s-L line)
Curve B -



note: given constant pressure.

$$V_{fg} = V_g - V_f$$

x : thermodynamic quality (only defined in the two phase vapour liquid region (II)

$$x \equiv \frac{m_{gas}}{m_{total}}$$

the thermodynamic 2 phase quality x, can also be defined or expressed by the specific volumes v, v_f, and v_g as follows.

$$\forall_{TOTAL} = \forall = \forall_f + \forall_g$$

$$v = (1-x)v_f + x v_g$$

$$v = v_f + x(v_g - v_f)$$

$$v = v_f + x v_{fg}$$

$$x = \frac{v - v_f}{v_{fg}} = \frac{v - v_f}{v_g - v_f}.$$

REMARKS: x is only defined (meaningful) in Region II

the following relationships are also valid for x

internal ~~energy~~ (u) (specific)

$$u = (1-x)u_f + x u_g$$

$$u = u_f + x u_{fg}.$$

$$x = \frac{u - u_f}{u_{fg}}.$$

sp. enthalpy (h)

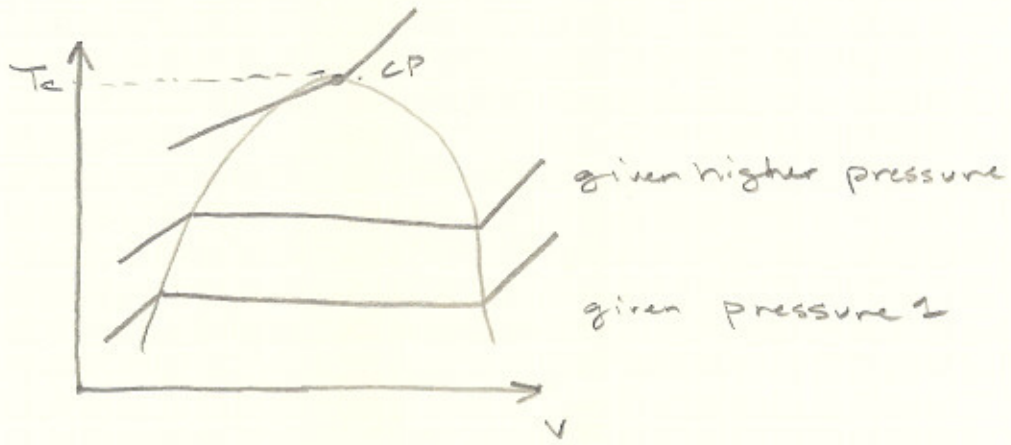
put in h for u.

sp. entropy (s)

put in s for u

FOR DIFFERENT PRESSURE VALUES.

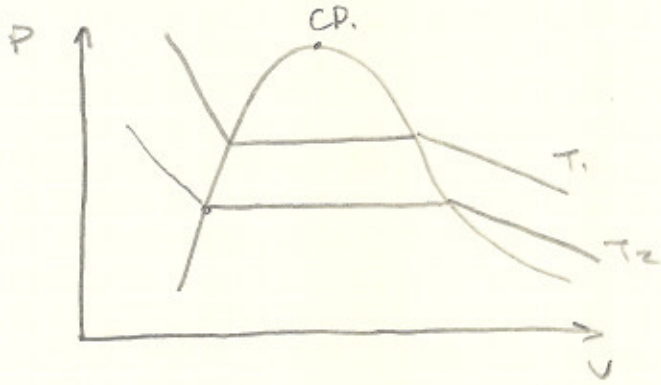
the diagram looks like.



T_c: critical temperature
CP: critical point

note: at the critical point the substance does not pass through region II, and turns directly into a superheated vapour.

SPECIFIC GRAVITY vs. PRESSURE



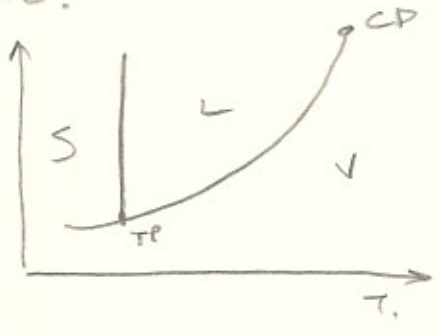
$T_1 > T_2$

note: each line is a different temp.

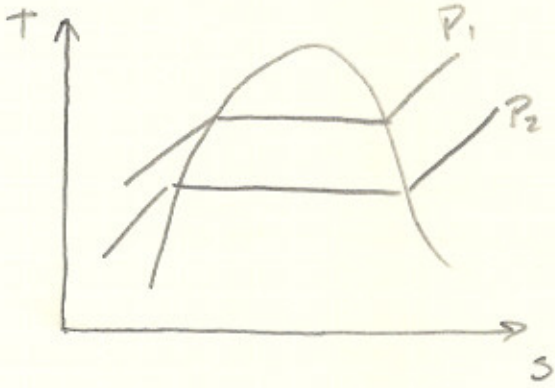
regions remain the same.

PRESSURE vs TEMPERTURE.

S. - solid region
L - Liquid region
V = Vapour region
T.P. - TRIPLE POINT



TEMPERTURE VS ENTROPY.



$P_1 > P_2$

Remark: the data obtained to make these graphes is experimental. this info is used to make things like steam tables.

the data obtained is an acual experiment can be plotted in 3D. P(v,t), from this we can ge P-T, v-T, P-v.

EX.

Calculate the SV of water at (A) T = 160°C (B) T = 221°C if the quality x = 85%

(A)

$$v = v_f + x v_{fg} = v_f + x(v_g - v_f)$$

from the saturated water tables (B.1.1) we find that v_f at 160° C = 0.001102 kg/m³

from the same table. $v_{fg}(160°) = 0.30596$

$$\therefore \quad v = 0.001102 + 0.85(0.30596) = 0.2612 \text{ m}^3/\text{kg}$$

H/W DUE FRIDAY

CH3 QUES 18, 21, 24, 32.