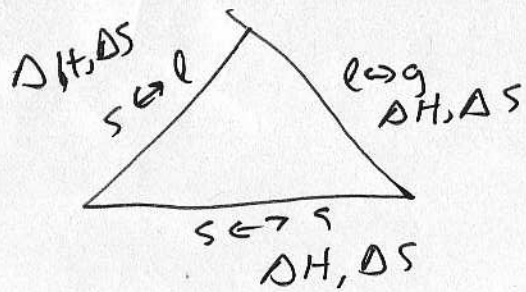
① T dependence of physical equilibria



Thermodynamics

$\Delta G = \Delta H - T\Delta S = 0$

one example developed in detail

vapor + temperature = Clausius Clapeyron

$$\ln \frac{P_2}{P_1} = \frac{\Delta H_v}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

↑ exponential relationship between T and V.P.

Words

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② Theory: dissolve s, l, g

dissolve sol'd → liquid "like dissolve like"

Words

but the case we examine is salts (ionic) → H_2O polar

know the detail of salts in H_2O

ΔG_{soln} = $\Delta H_{soln} - T\Delta S_{soln}$

ΔG_{soln}: dissolving salt

ΔH_{soln}: endo or exo

$-T\Delta S_{soln}$: usually pos. because entropy increases with mixing

$\Delta H_{soln} = \Delta H_{Hyd} + \Delta H_{c.l.}$ ← change due to T means $\uparrow \Delta H_{c.l.,Hyd}$

These compete.

Example: salt (NaCl) is endothermic but dissolves in H_2O as T increases because of Le Chatelier

(3) Theory: dissolve g, l, s
g are dissolve because
- like dissolves like ($NH_3 \rightarrow H_2O$)
- rxn $CO_2 \rightarrow H_2O$
- nonpolar due to ΔS_{mix} so small molecule like O_2, N_2, H_2, He dissolve, a little, in H_2O.

O_2 in H_2O is exothermic.

$O_{2(g)} \rightarrow O_{2(aq)}$ + heat

Heat for 2 ts.
NaCl is endo, O_2 is exo ΔH_{sol}

so according to LeChatelier
as T ↑, reaction shifts left and O_2 leaves H_2O, fish die

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(4) Rank miscibility of liquids easy problem.

I will give you a list of molecules. you rank based upon how polar or nonpolar.

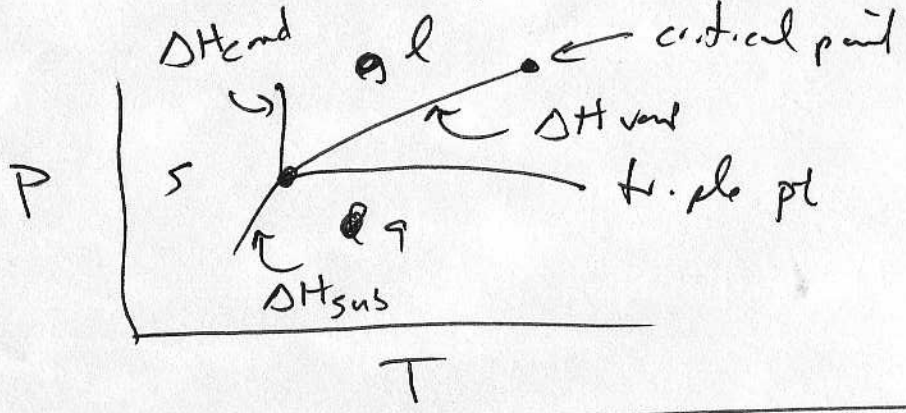
so build your IMF buckets

Rank CH_3OH, CH_3CH_2OH, CH_4

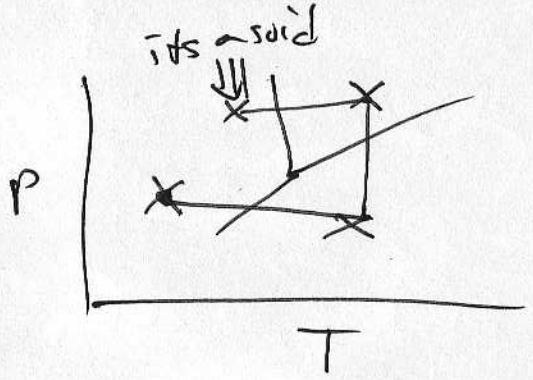
least polar goes in C_6H_{14} CH_4, CH_3CH_2OH, CH_3OH most polar goes in H_2O

5. Phase diagram navigation.

- know your phase diagram terminology

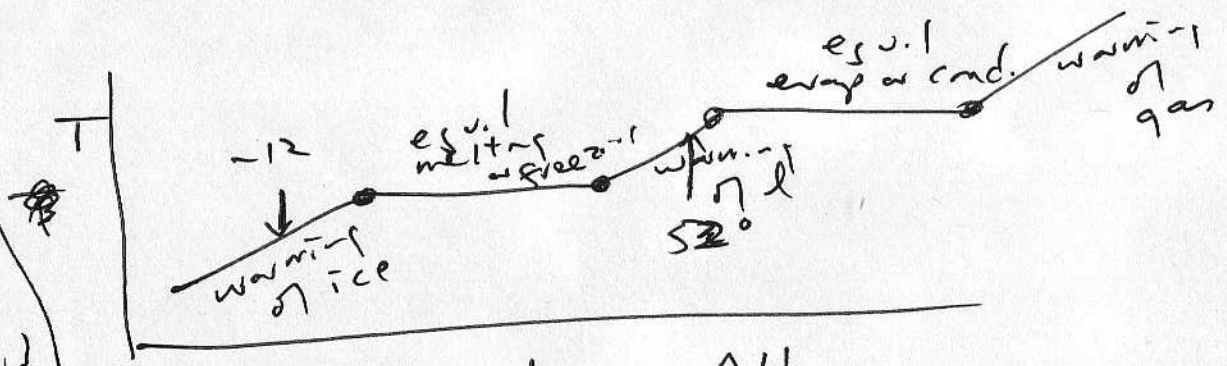


- be able to follow ΔS in T + P



6. calc. ΔH across phase boundary

Hint: 5 regions on this test



warming region: $\Delta H = mC\Delta T$

equil region: $\Delta H = mC$

Look, it's just addition + multiplication, you don't need a calculator

I have some ice at $-12^\circ C \rightarrow 52^\circ C$.

$\Delta H_{heating} = \Delta H_{warming\ ice} + \Delta H_{melting} + \Delta H_{warming\ H_2O}$

$mC\Delta T \qquad mC \qquad mC\Delta T$

7. V.P. in a binary system.

You use Dalton Law of Partial Pressures

$P_{TOT} = P_{\text{one kind of gas}} + P_{\text{second kind of gas}}$ $\quad P^0 =$ pure V.P. always given

Raoult's Law done twice

$P_{one} = P^0 X$ $\qquad P_{second} = P^0 X$ $\qquad X =$ mole fraction and have it is given.

But $X_{second} = 1 - X_{first}$

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8. Calculation: Clausius Clapeyron

Trans took mercy on you. This is not a calculation but an "understanding C.C." problem. Be able to say 4 or 5 Things about what C.C. is and does.

- exp. relation of T + V.P.
- tells you how T determine V.P.
- assumptions like ideal gas and l + s are not compressed
- use it to tell us one P + T given another P + T
- a function of ΔH_f which scales with IMF.

9. Van't Hoff + soln conc

When you put compounds in solution, if the concentration matters rather than the chemistry, then you correct for it.

	# particles	
NaCl ⟶	$\bar{i} = 2$	This corrects for all coll. prop. amounts ΔT_b, ΔT_f, Π, P_v
$Mg(OH)_2$ ⟶	$\bar{i} = 3$	
sugar ⟶	$\bar{i} = 1$	you will rank $\bar{i}$ in this problem, no calc.

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10 colligative property calc.

$\Delta T_f = K_f m$ $\Delta T_b = K_b m$ $\Pi = MRT$ $P = P^o X$
n.o

so do a simple plug + chug

NO

11

Set up K eq.l.

This is really easy. from balanced eqn

$$aA + bB \rightleftharpoons cC \Rightarrow K = \frac{[C]^c}{[A]^a[B]^b}$$

remember that

solids + pure liquids $\Rightarrow$ 1 activity

12

Calc. eq.l. conc from K

So simple you will get it wrong

If $K = 10$ and $[A] = 5$ & $[B] = 3$

what is $[C]$ if $2A + B \rightarrow C$?

Hint you are given $\equiv$ not C to start.

13

Reaction Direction from Q + K

I will give you a K value for a reaction and some starting amounts. From these you find Q. If Q < K, shifts R

If Q > K, shifts L

$$Q = \frac{(\text{Right})}{(\text{left})}$$

14

Le Chatelier + Rxn Direction

If a system is at equil +

- a stress is applied
- rxn shifts L or R to counter stress

[ ] stress	P stress	T stress
$A \rightleftarrows B$	$A(g) \rightleftarrows B(s)$	$A(g) \rightarrow B(s) + \text{heat}$
if B ↑ then reaction shifts left to make A	if I increase P, then rxn shifts R to decrease P	if T ↑ then reaction shifts L to get away from heat