Fixing questions 1-14 w/ Hints

#10 colligative property calculation.
yes, you need to know Van't Hoff factor. But the good news is the calc is much easier

$\Delta T_b = iK_b m$

#11 setting up K equil is tricky.
make sure all the ions cancel

Example $NaCl + AgNO_3 \rightleftharpoons NaNO_3 + AgCl$

$$K = \frac{[Na^+][NO_3^-][AgCl] \Leftarrow 1}{[Na^+][Cl^-][Ag^+][NO_3^-]} = \frac{1}{[Ag^+][Cl^-]}$$

#68. No longer a hideous 5 step ΔH across phases. Instead know what constants are and how to use

C_s C_ℓ C_g ΔH_f ΔH_v

15 T dependence of K_w easy definition

$K_w = [H^+][OH^-] = [K_a][K_b] = 10^{-14}$

$pK_w = pH + pOH = pK_a + pK_b = 14$

I will give 5 statements about this w.r.t. respect to T.

Important $K_w = 10^{-14}$ only at room temp.

If T ↑ K_w ↑ pH ↓

T ↓ K_w ↓ pH ↑

but not always ~ 10^{-7}

neutrality definition is that pH = pOH ≈ $[H^+] = [OH^-]$

Ranking K_a + K_b Tricky

I will give a list of acids + bases w/ K_as + K_bs. First turn all them into all acids or bases

A $K_a = 10^{-4}$ } convert to K_b

B $K_a = 10^{-7}$ }

C $K_b = 10^{-11}$

D $K_b = 10^{-2}$

Rank base strength

A (weak base) 10^{-10}

B 10^{-7}

C 10^{-11} ← weakest base

D 10^{-2} ⇐ strongest base

17. Approximations. Know that the equation $[H^+] = C_a$ or $[H^+] = (K_a C_a)^{1/2}$ or $[H^+] = K_a \frac{C_a}{C_b}$ only work at high [ ] or K_s for 'a part.

I will give you a list of solutions. you tell me which can best be solved with approximation.

Example 10^{-7} M H^+
10^{-2} M H^+ ← best solved

★ 18+19. ★ 7 step Two problems are simple pH calc.

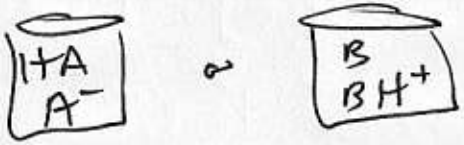
strong weak buffer

① get r.d of spect.
② strong?
③ weak?
④+⑤ no neutralization
⑥ skip to $C_a = H^+$ $H^+ = (K_a C_a)^{1/2}$ $H^+ = K_a \frac{C_a}{C_b}$
$C_b = OH^-$ $OH^- = (K_b C_b)^{1/2}$ $OH^- = K_b \frac{C_b}{C_a}$
⑦ pH

How do you know these problems? step 4 is NO

Hints $Ba(OH)_2$ has 2 OH^- so double OH^-

Ratios of buffers only need ratio, not actual [ ]

20 Buffer after neutralization. Done this a million times
* I give you 5 sets of compounds. After neutralization
* which ones are 

Example
1 mole HA + 0.5 mole OH^- ⇐ yes
1 mole HA + 1.0 mole OH^- ⇐ no
1 mole HA + 1.5 mole OH^- ⇐ no

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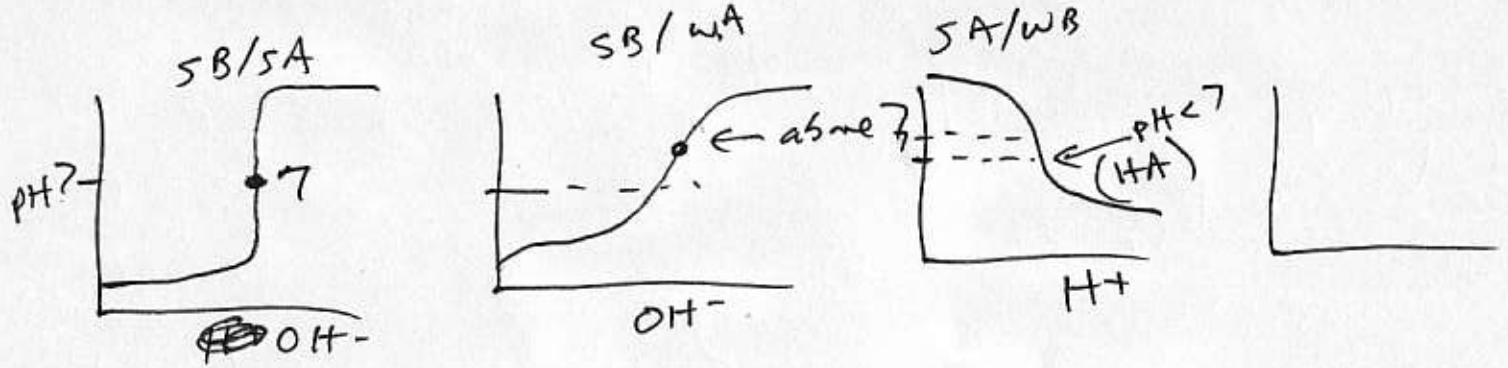
21. I will ask you to draw a titration curve and tell me about it.



23. Titrate strong w/ strong

7☆ steps ☆

1. get i.d of species

2. strong? ~~[struck out]~~ you will see only H^+ + OH^-

→ 4 yes neutralize

5. $H^+ + OH^- \rightleftharpoons H_2O$

assign moles of $H^+ + OH^-$ → ______

______ ← find limiting reagent

______ ← look at what is left

make sure you account for volume:
- H^+ = strong acid < 7
- H_2O = 7
- OH^- = strong base > 7

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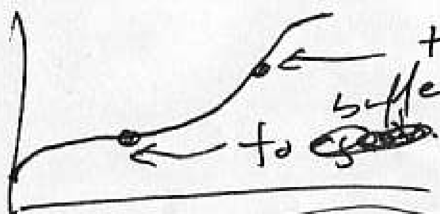
24 + 25 Titrate weak w/ strong

☆ 7 steps ☆



← to equiv. pt. ← $H^+ = (K_a C_a)^{1/2}$ or $OH^- = (K_b C_b)^{1/2}$

← to buffer pt $H^+ = K_a \frac{C_a}{C_b}$

24 ⇒ What is pH at stoichiometric point for HA w/ OH^- if $K_a = 10^{-4}$?

23 ⇒ what is pH at ½ stoichiometric point.
☆☆ buffer $H^+ = K_a \frac{C_a}{C_b}$

26. Ranking solub. I give you 5 salts w/ Ksp values.

② AB	③ AB_2	④ AB_3	⑤ A_2B_3	⇐ Find # of ions. divide exponent to get solub.
$K_{sp} = 10^{-4}$	10^{-8}	10^{-9}	10^{-12}	
$\frac{-4}{2}$	$\frac{-8}{3}$	$\frac{-9}{4}$	$\frac{-12}{5}$	
-2	$-2^{2/3}$	$-2^{1/4}$	$-2^{2/5}$	
#4	#1	#3	#2	

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27. K_{sp} calc. I give you a single K_{sp}. you tell me the solub. (coeff matters)

AB $K_{sp} = \sqrt{\ }$

AB^2 $K_{sp} = \sqrt[3]{\ /4}$

AB_3 $K_{sp} = \sqrt[4]{\ /27}$

What is solub. of MgF_2. $K_{sp} = 4 \times 10^{-12}$

you use $\sqrt[3]{\ /4}$ $K_{sp} = 4 \times 10^{-12}$ first $\div 4$

1×10^{-12} then $\sqrt[3]{\ }$

10^{-4}

28 common ion calculation.

Only salt problem w/ K_{sp} + 2 salts.

what is molar solub. of $AgBr$ + $NaBr$

2 step process. First, get rid of spectator (Na^+)

second write down the solub. eqn for the insoluble salt $AgBr \rightleftharpoons Ag^+ + Br^-$

	0	.1
	x	x
	x	.1+x

goes away

assuming amount initially #27

$K_{sp} = (x)(.1+x)$

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29. Equil Exp of polyprotic acids

I give you a Ka value for a polyprotic acid. you tell me its Ka value

$H_2A \Rightarrow K_{a1}, K_{a2}$ $H_3A \Rightarrow K_{a1}, K_{a2}, K_{a3}$

K_{a2} of a diprotic $H_2A^- \rightleftharpoons H^+ + HA^=$

H.W. They put H_2O in all the equil. Ignore it.

30. Amphiprotic case for polyprotic

$[H^+] = (K_1 K_2)^{1/2}$ or $[H^+] = (K_1 K_2)^{1/2}$ or $H^+ = (K_2 K_3)^{1/2}$

diprotic case — Easiest math in the world. — triprotic cases.

HA^- — Occurs when you have H_2A^- or $HA^=$

only things in soln.

Example what is pH if 0.1 M H_3PO_4 $K_{a_1} = 10^{-4}$, $K_{a_2} = 10^{-7}$, $K_{a_3} = 10^{-11}$

$pH = 9$ — H_3PO_4 is more

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31. Mass balance problem.

I identify a kind of element put into H_2O.

Then I write down all its forms in H_2O

.1 M NH_3 in H_2O

$C_{NH_3} = [NH_3] + [NH_4^+]$

.1 M $CO_3^=$

$C_{CO_3^=} = [H_2CO_3] + [HCO_3^-] + (CO_3^=)$

32. Dilute A/B case. Look for [ ] which is very small i.e 10^{-7}, 10^{-6}, 10^{-8}

pH is ≈ 7 (a little higher for base a little lower for acid)