1. Unbuffered: Find pH

a. 1.0 L pure water

b. 1.0 L water + 0.1 mol HCl

c. 1.0 L water + 0.1 mol NaOH

0.1 mol HCl or NaOH makes big difference!

2. Buffer: 1.0 L water with 0.5 mol HF ($K_a = 6.8 \times 10^{-4}$) and 0.5 mol NaF.

a. No extra acid or base added:

b. Add 0.1 mol HCl

Reaction:

I

C

E

c. Add 0.1 mol NaOH

Reaction:

I

C

E

① Which combos *would* make a buffer soln?

a. HF, KF

b. NH_4Cl, NH_3

c. HCl (0.2 M), NaN_3 (0.4 M)

d. HCl (0.2 mol), NaN_3 (0.1 mol)

e. HN_3, $NaCl$

f. KF, NaF

g. KF, $NaOH$

h. HF, HCl

i. NH_3, KF

g. HF (0.2 mol), $NaOH$ (0.1 mol)

② Which could be added to 0.4 mol $NaCN$ to give a buffer?

a. HCN b. 0.2 md HCl c. 0.2 md $NaOH$

③ Which could be added to 0.4 md H_3PO_4 to give a buffer?

a. NaH_2PO_4

b. 0.2 md $NaOH$

c. 0.4 md $NaOH$

d. 0.2 md HCl e. KCl

1. Find pH for buffer 0.12 M HNO_2, 0.16 M $NaNO_2$.

$K_a (HNO_2) = 4.5 \times 10^{-4}$

2. ~~An acid~~ HA $[HA] = 0.11$ M $[NaA] = 0.13$ M

What is K_a for HA if pH = 5.18?

3. How much NaF (42 g/mol) should be added to 612 mL solution of 0.4 M HF ($K_a = 6.8 \times 10^{-4}$) to produce a pH = 3.10 buffer?

① Given a 1.0L solution that is initially 0.2 M in both HF and KF assess the situation and find the pH after the following acids or bases are added.

$K_a(HF) = 6.8 \times 10^{-4}$

$pK_a = 3.17$

a. 0.1 mol HCl added

Assess:

Reaction:

I

C

E

b. 0.2 mol HCl added

Assess:

Reaction:

I

C

E

c. 0.3 mol HCl added

Assess:

Reaction:

I

C

E

d. 0.1 mol NaOH added

Assess:

Reaction:

I

C

E

e. 0.2 mol NaOH added

Assess:

Reaction:

I

C

What is pH after:

① 22 mL of 0.10 M NaOH is added to 22 mL of 0.10 M HClO ($K_a = 3.0 \times 10^{-8}$)

② 20 mL of 0.10 M NaOH is added to 10 mL of 0.10 M HClO?

③ 20 mL of 0.10 M NaOH is added to 30 mL of 0.10 M HClO? ($K_a = 3.0 \times 10^{-8}$)

① Would pH at endpoint be acidic, basic, or neutral when titrated with NaOH?

a. HCN

b. HNC_3

c. HF

② Would pH at endpoint be acidic, basic, or neutral when titrated with HCl?

a. NaOH

b. NaF

③ An initial pH = 1.3 and an equivalence point of 7 corresponds to a titration curve in which a [ ] base is added to a [ ] acid.

④ An initial pH = 9.3 and an endpoint of pH = 4.7 corresponds to a titration curve in which a [ ] is added to a [ ].

17-14b

Weak Acid + Strong Acid (Weak base/strong base analogous)

① 0.10 mol HCl is added to 1.0 L of 0.20 M weak acid HA ($K_a = 5.3 \times 10^{-5}$). (Assume no volume change).

a. Determine $[H^+]$, $[A^-]$, and pH <u>before</u> HCl.

$$HA \rightleftharpoons H^+ + A^-$$

I
C
E

b. Determine $[H^+]$, $[A^-]$, and pH <u>after</u> HCl.

$$HA \rightleftharpoons H^+ + A^-$$

I
C
E

17-15

1. What volume of 0.12 M NaOH is needed to titrate 36 mL of 0.14 M HCl?

2. When 42 mL of aqueous HCl is titrated by 0.10 M NaOH, it takes 25 mL of the NaOH solution to reach the endpoint. What is the [HCl] of the original solution?

3. How many grams of KOH (56 g/mol) would it take to neutralize 86 mL of 1.2 M HNO_3?

Calculator Practice

	x equals		x equals
$x^3 = 125$		$12^3 = x$	
$x^3 = 100$		$8^4 = x$	
$x^4 = 12.7$		$3.2^3 = x$	

1. $K_{sp} \rightarrow$ mol/L $\rightarrow$ g/L

$PbCl_2$ (278 g/mol) $K_{sp} = 1.6 \times 10^{-5}$

a) Calculate $[Pb^{2+}]$ and $[Cl^-]$ for saturated soln.

b) " " molar solubility (mol/L)

c) " " solubility (g/L)

d) What mass is dissolved in 140 mL?

(17-18)

1. Molar solubility → K_{sp}

Find K_{sp} for CaF_2 whose molar solubility is 2.1×10^{-4} mol/L.

2. Gram solubility → molar sol → K_{sp}

$BaCO_3$ has a solubility of 0.014 g/L. Find K_{sp}. (197 g/mol)

How Would Solubility be Affected? (17-20)

	Added $Ca(NO_3)_2$	Added NaF	Added HNO_3	More Soluble at Low or High pH?
CaF_2				
$CaCO_3$				
$Ca(OH)_2$				
ZnF_2				
$PbCl_2$				
AgI				
$ZnSO_4$				

17-21

1. What is molar solubility of $AgBr$ ($K_{sp} = 3.3 \times 10^{-13}$) in a solution with 0.20 M $NaBr$?

dissolves fully →

(what would $AgBr$ solubility be without $NaBr$ present?)

2. Determine molar solubility for $Mg(OH)_2$ ($K_{sp} = 1.5 \times 10^{-11}$) at the following pH's:

a. pH = 12.00

b. pH = 6.00

Common Ion Effect on Acids

3. What is $[CNO^-]$ for a solution that is 0.22 M in $HCNO$ (a weak acid) and also contain 0.25 M HCl?