

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

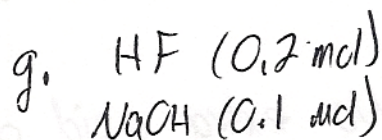
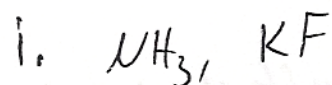
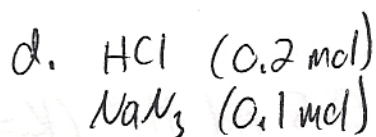
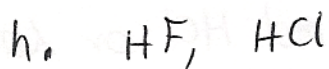
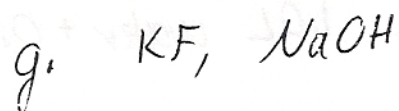
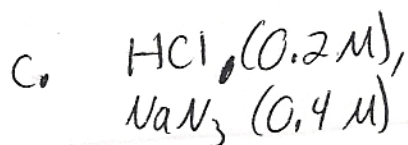
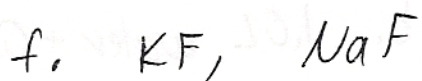
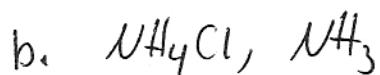
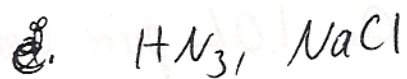
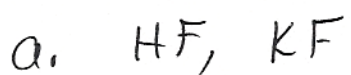
Reaction:

I

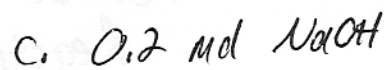
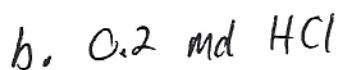
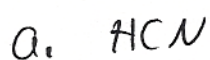
C

E

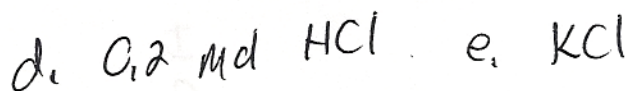
① Which combos would make a buffer soln?



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



③ Which could be added to $0.4 \text{ mol H}_3\text{PO}_4$ to give a buffer?



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

$$K_a(\text{HNO}_2) = 4.5 \times 10^{-4}$$

2. ~~An acid~~ HA $[\text{HA}] = 0.11 \text{ M}$ $[\text{NaA}] = 0.13 \text{ M}$

What is K_a for HA if $\text{pH} = 5.18$?

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

(17-9)

① Given a 1.0 L 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.

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

$$\text{p}K_a = 3.17$$

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

E

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

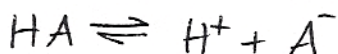
③ An initial pH = 1.3 and an equivalence point of 7 corresponds to a titration curve in which a base is added to a acid.

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 .

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

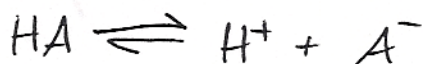
① 0.10 mol HCl is added to 1.0 L of 0.20 M weak acid HA ($K_a = 5.3 \times 10^{-5}$). (Assume no volume change).

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



$$\begin{array}{r} I \\ C \\ \hline E \end{array}$$

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



$$\begin{array}{r} I \\ C \\ E \end{array}$$

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 $[\text{HCl}]$ of the original solution?

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

Calculator Practice

(17-17)

$$x^3 = 125 \quad \underline{x \text{ equals}}$$

$$12^3 = x$$

$$\underline{x \text{ equals}}$$

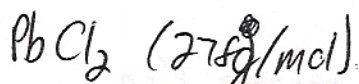
$$x^3 = 100$$

$$8^4 = x$$

$$x^4 = 12.7$$

$$3.2^3 = x$$

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



$$K_{sp} = 1.6 \times 10^{-5}$$

- calculate $[\text{Pb}^{2+}]$ and $[\text{Cl}^-]$ for saturated soln.
- " " molar solubility (mol/L)
- " " solubility (g/L)
- what mass is dissolved in 140 mL?

1. Molar solubility $\rightarrow K_{sp}$

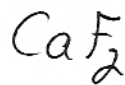
Find K_{sp} for CaF_2 whose molar solubility is $2.1 \times 10^{-4} \text{ mol/L}$.

2. Gram solubility $\rightarrow$ molar sol $\rightarrow K_{sp}$

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

How Would Solubility be Affected?

17-20

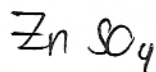
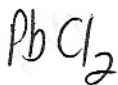
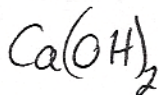
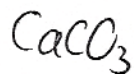


Added
 $\text{Ca}(\text{NO}_3)_2$

Added
 NaF

Added
 HNO_3

More Soluble at
Low or High pH?



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 $\text{Mg}(\text{OH})_2$ ($K_{sp} = 1.5 \times 10^{-11}$) at the following pH's:

a. $\text{pH} = 12.00$

b. $\text{pH} = 6.00$

Common Ion Effect on Acids

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