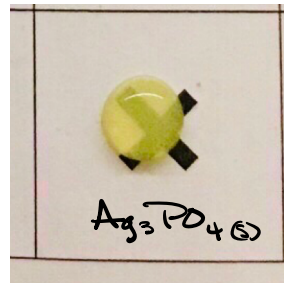
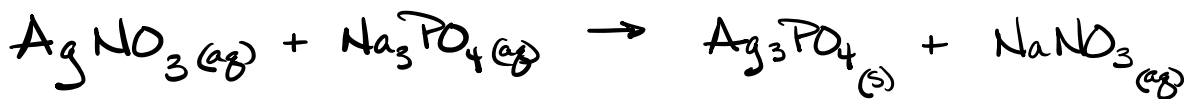


# Solubility lab

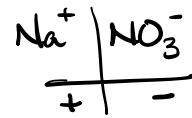
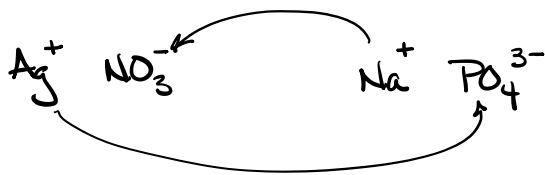


PPT yellow turbid solid

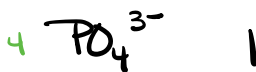
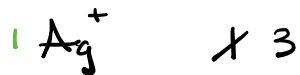
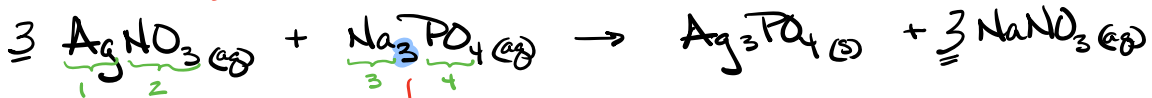
## Chemical Equation



Balancing Compound Formulas



## Balancing Equation



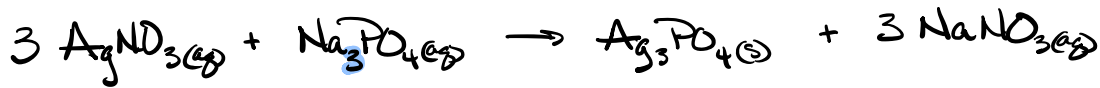
3

x 3

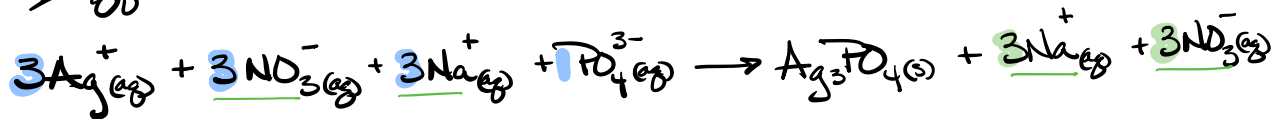
x 3

1

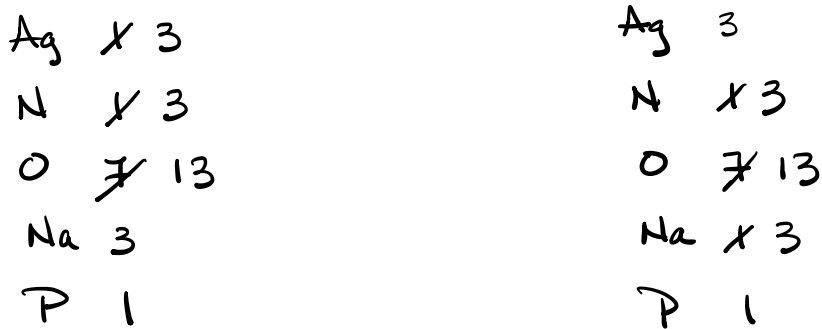
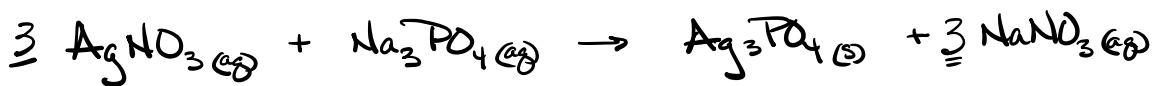
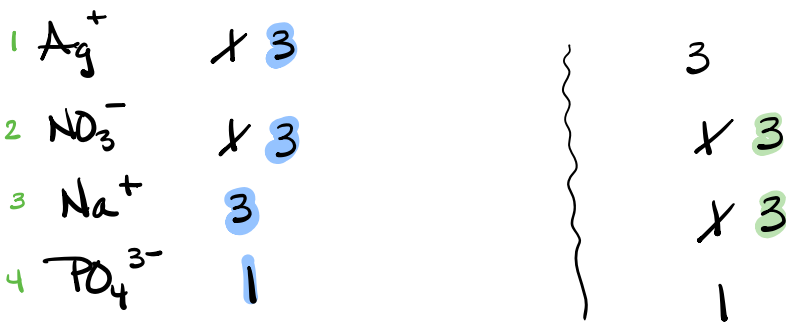
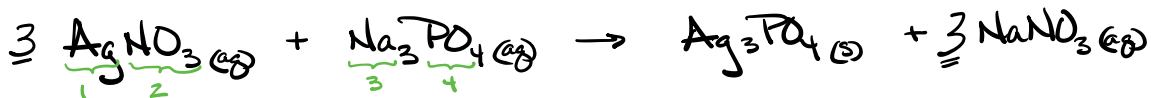
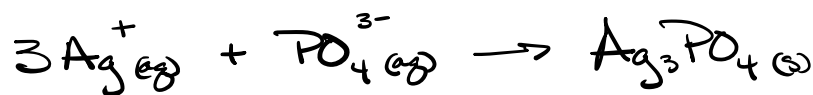
Chemical



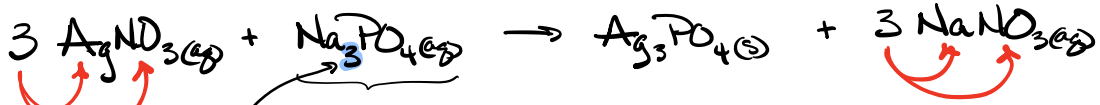
Ionic Equation



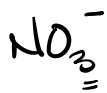
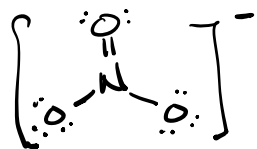
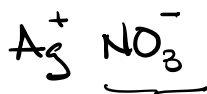
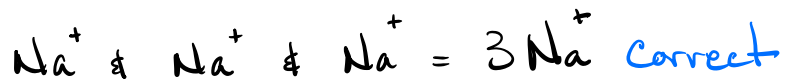
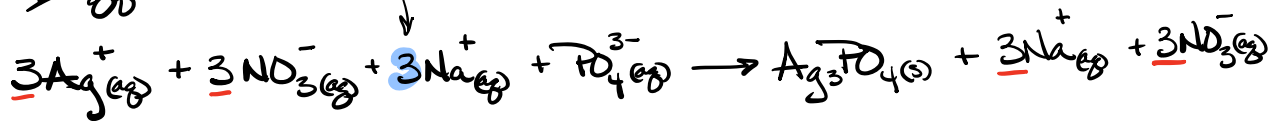
Net Ionic



Chemical



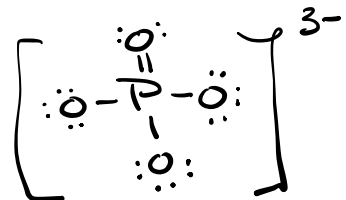
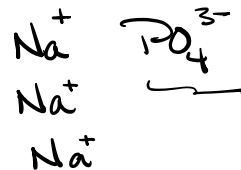
Ionic Equation



monatomic  
subscript  
not  
part  
of  
monatomic



polyatomic  
subscript  
part of  
polyatomic







## Actual Exp

blow air past the droplet to complete the mixing.

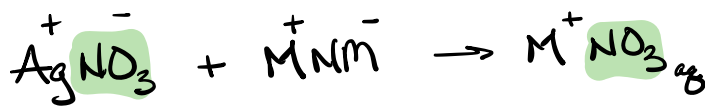
Sol'ns	Na <sub>2</sub> CO <sub>3</sub>	NaCl	NaOH	NaNO <sub>3</sub>	Na <sub>3</sub> PO <sub>4</sub>	Na <sub>2</sub> SO <sub>4</sub>
AlCl <sub>3</sub>	X	X	X	X	X	X
NH <sub>4</sub> Cl	X	X	X	X	X	X
CaCl <sub>2</sub>	X	X	X	X	X	X
CuSO <sub>4</sub>	X	X	X	X	X	X
FeCl <sub>3</sub>	X	X	X	X	X	X
Pb(NO <sub>3</sub> ) <sub>2</sub>	X	X	X	X	X	X
KI	X	X	X	X	X	X
AgNO <sub>3</sub>	X	X	X	X	X	X

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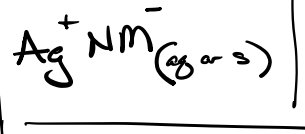
## Results of Exp

	Na <sub>2</sub> CO <sub>3</sub>	NaCl	NaOH	NaNO <sub>3</sub>	Na <sub>3</sub> PO <sub>4</sub>	Na <sub>2</sub> SO <sub>4</sub>
AlCl <sub>3</sub>	PPT		PPT		PPT	
NH <sub>4</sub> Cl						
CaCl <sub>2</sub>	PPT		PPT		PPT	PPT
CuSO <sub>4</sub>	PPT		PPT		PPT	
FeCl <sub>3</sub>	PPT		PPT		PPT	
Pb(NO <sub>3</sub> ) <sub>2</sub>	PPT	PPT	PPT		PPT	PPT
KI						
AgNO <sub>3</sub>	PPT	PPT	PPT		PPT	

Good test → Has easy to identify outcome



Assessment Based only on this half



Ions

Rule

Exceptions

Group 1A (Li<sup>+</sup>, Na<sup>+</sup>, K<sup>+</sup>) & NH<sub>4</sub><sup>+</sup>

Always sol Catton

None

NO<sub>3</sub><sup>-</sup> & C<sub>2</sub>H<sub>3</sub>O<sub>2</sub><sup>-</sup>

Always Sol. Anion

None

Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>

Usually Soluble

Pb<sup>2+</sup>, Ag<sup>+</sup>, Hg<sub>2</sub><sup>2+</sup>

F<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>

Usually Soluble

Pb<sup>2+</sup>, Ca<sup>2+</sup>, Ba<sup>2+</sup>

OH<sup>-</sup>, CO<sub>3</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>

Usually Insoluble

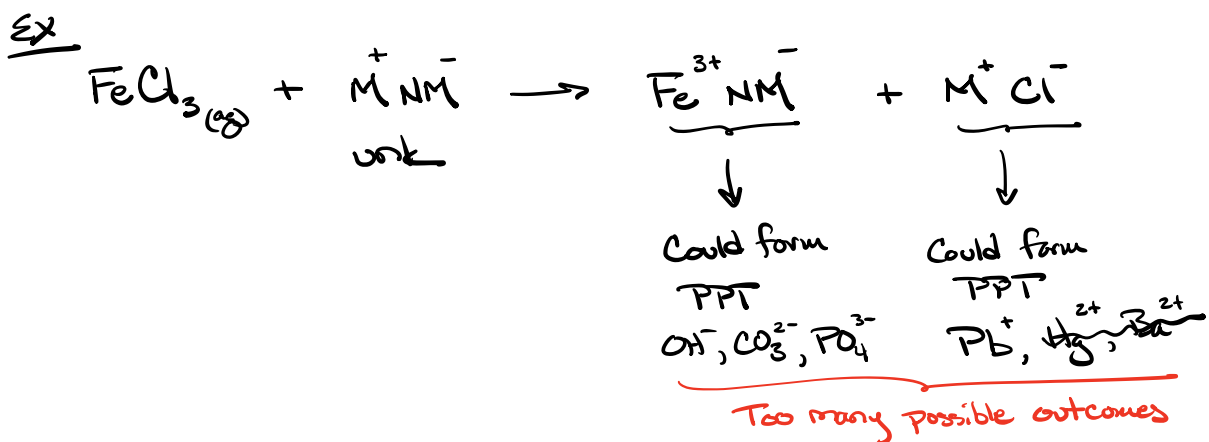
Group 1A or NH<sub>4</sub><sup>+</sup>

## 1 Possible Method

- mix unknown w/ all 14 chemicals & hope to see a pattern that we recognize & helps to ID the compound.

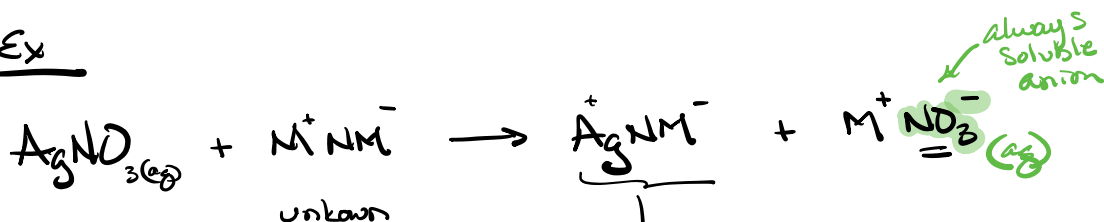
2<sup>nd</sup> method - Design experiments to rule out certain options. We can create a flow chart (dicotamus key)

Bad Test - A difficult to describe outcome. outcome has too many options



Good Test - has fewer outcomes & may use color in addition to ppt to narrow the field.

Ex



Only part that can form PPT

Yes PPT	No PPT
$\text{CO}_3^{2-}$	$\text{SO}_4^{2-}$
$\text{OH}^-$	$\text{NO}_3^-$
$\text{PO}_4^{3-}$	
$\text{Cl}^-$	
$\text{I}^-$	

⇒ Result: No PPT formed

- $\text{Na}_2\text{SO}_4$   ~~$\text{Na}_3\text{PO}_4$~~   $\text{NaNO}_3$   ~~$\text{NaOH}$~~   ~~$\text{NaCl}$~~   ~~$\text{Na}_2\text{CO}_3$~~   ~~$\text{AlCl}_3$~~   
 ~~$\text{NH}_4\text{Cl}$~~   ~~$\text{CaCl}_2$~~   $\text{CuSO}_4$   ~~$\text{FeCl}_3$~~   $\text{Pb}(\text{NO}_3)_2$   ~~$\text{KI}$~~   $\text{AgNO}_3$

Possible unknowns

- $\text{Na}_2\text{SO}_4$   $\text{NaNO}_3$   $\text{CuSO}_4$   $\text{Pb}(\text{NO}_3)_2$   $\text{AgNO}_3$

$\text{Na}_2\text{SO}_4$   
 $\text{CuSO}_4$

$\text{NaNO}_3$   
 $\text{Pb}(\text{NO}_3)_2$   
 $\text{AgNO}_3$



$\text{Pb}(\text{NO}_3)_2$  test

PPT

no PPT

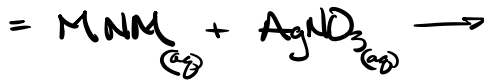
$\text{Na}_2\text{SO}_4$   
 $\text{CuSO}_4$

$\text{NaNO}_3$   
 $\text{Pb}(\text{NO}_3)_2$   
 $\text{AgNO}_3$

# Test 1



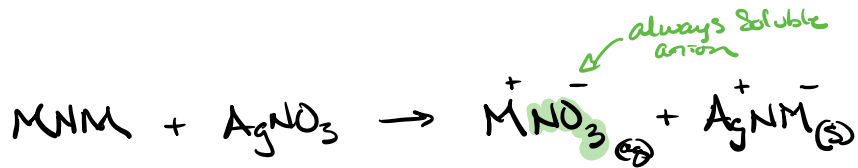
Clear & Colorless



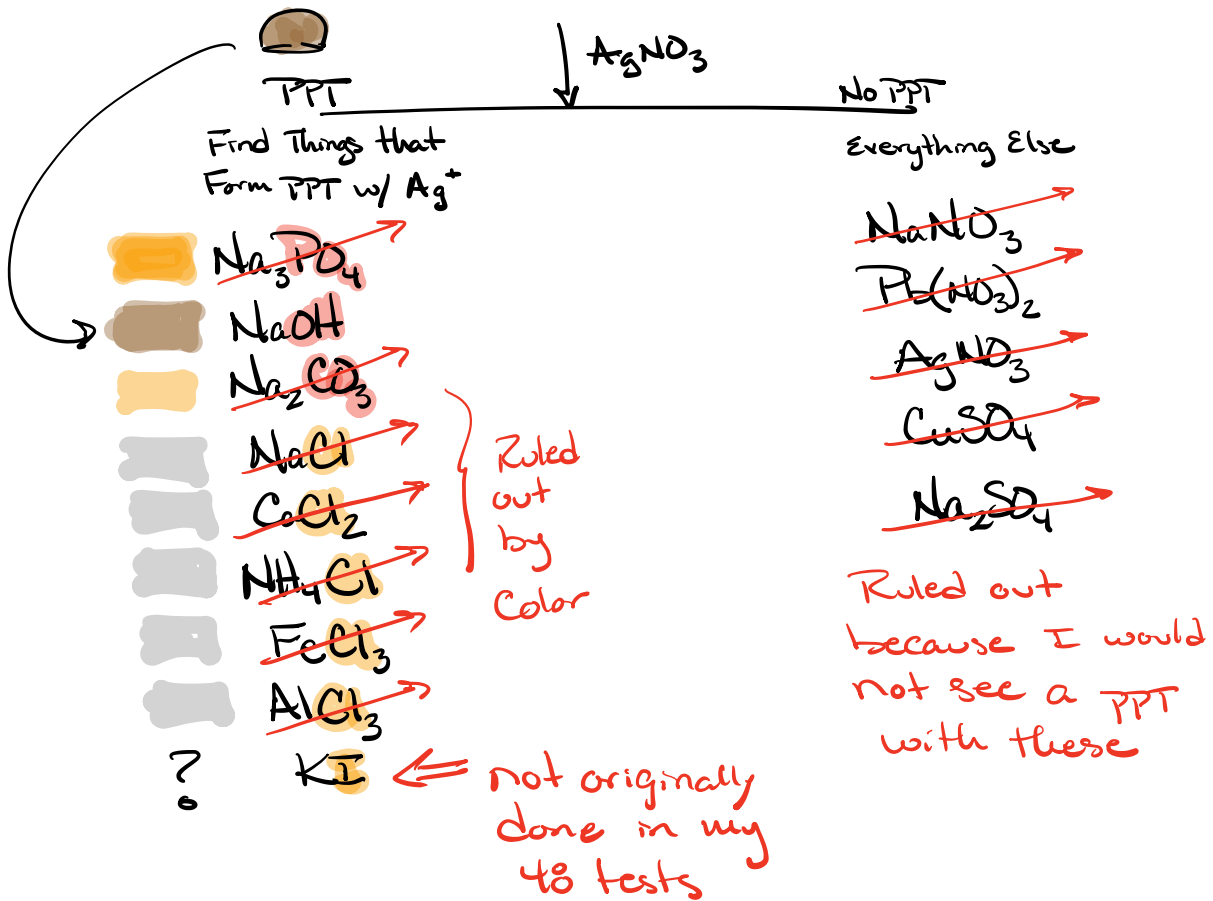
Result



Brown PPT



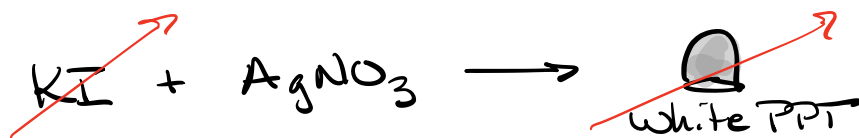
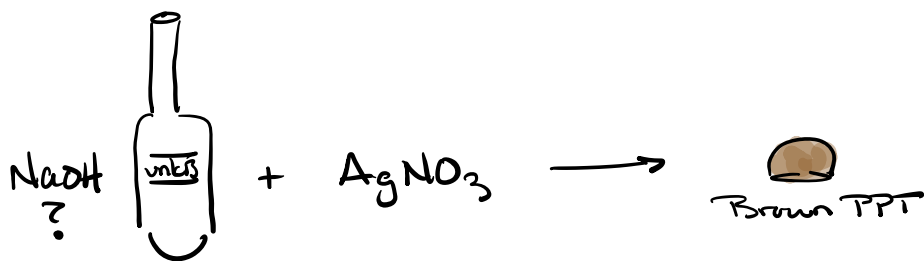
MNM unknowns



## Test number 2

Test both the unknown & KI  
with  $\text{AgNO}_3$ .

Two possible unknowns are: NaOH & KI

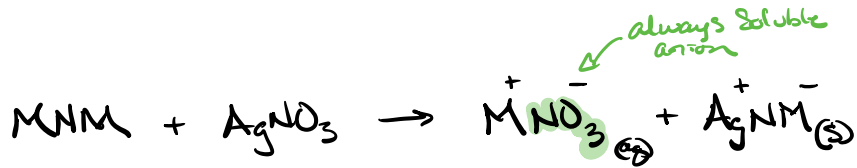


Conclusion: Unknown is  
NaOH

Test # 1  $\text{AgNO}_3$



Result  
Clear & Colorless Solution  
No PPT



MNM unknowns



PPT

Find Things that Form PPT w/  $\text{Ag}^+$

- ~~  $\text{Na}_3\text{PO}_4$~~
- ~~  $\text{NaOH}$~~
- ~~  $\text{Na}_2\text{CO}_3$~~
- ~~  $\text{NaCl}$~~
- ~~  $\text{CaCl}_2$~~
- ~~  $\text{NH}_4\text{Cl}$~~
- ~~  $\text{FeCl}_3$~~
- ~~  $\text{AlCl}_3$~~
- ~~ ?  $\text{KI}$~~

No PPT

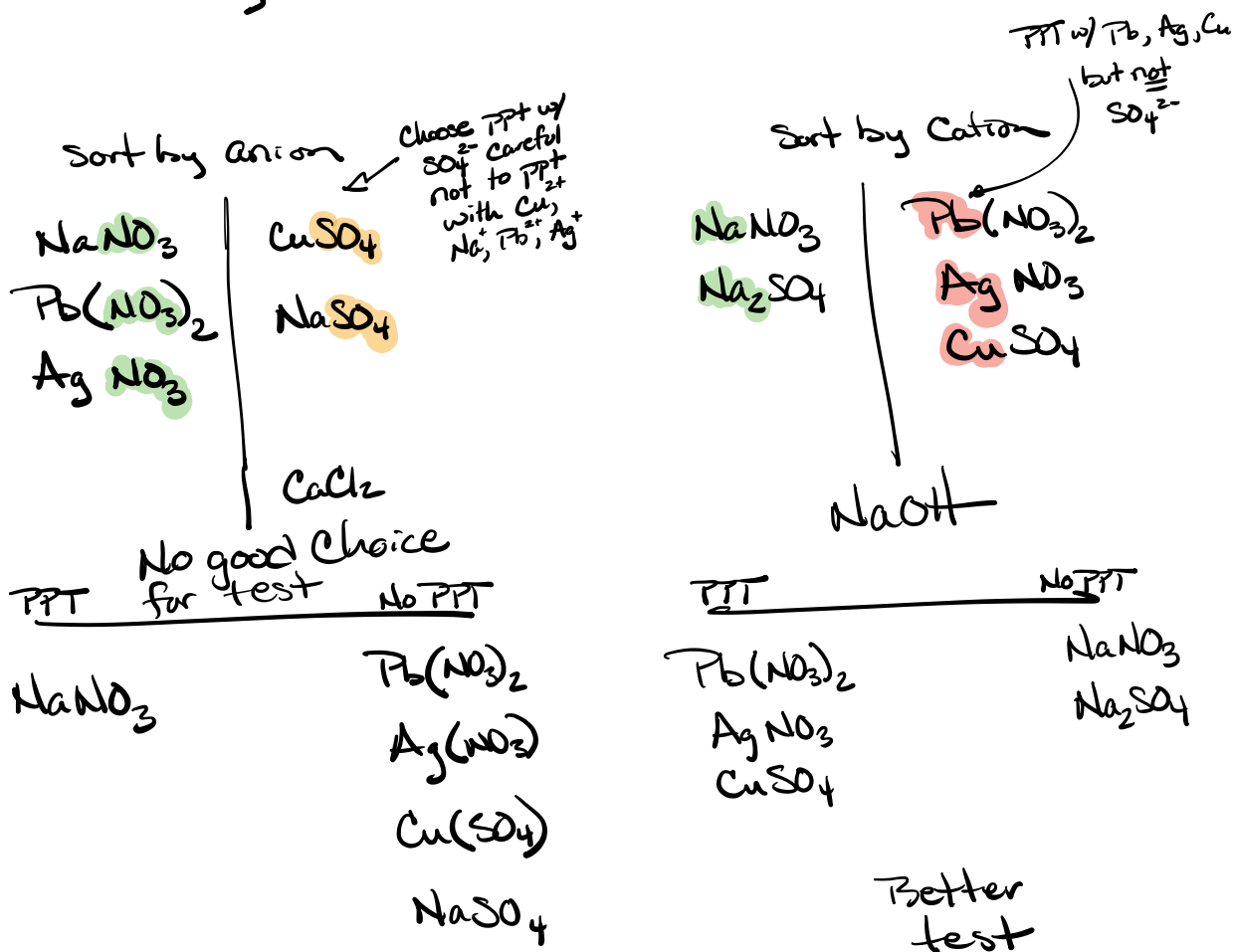
Everything Else

- $\text{NaNO}_3$
- $\text{Pb}(\text{NO}_3)_2$
- $\text{AgNO}_3$
- $\text{CuSO}_4$
- $\text{Na}_2\text{SO}_4$

Remaining Compounds after test #1:



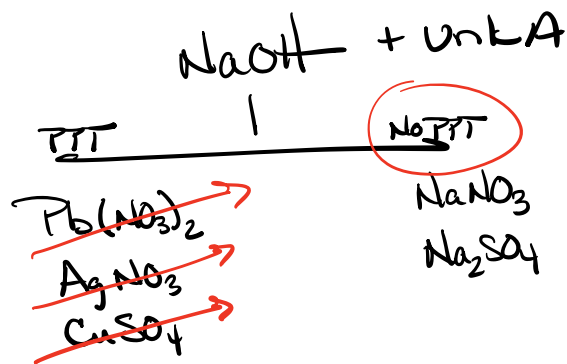
ways to sort



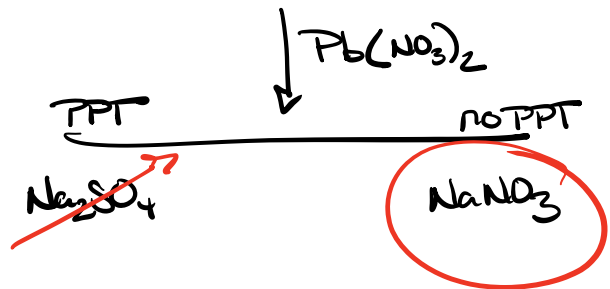
Test # 2 w/  $\text{NaOH}$

Result  $\Rightarrow$  Clear & Colorless w/ no ppt





Two possible are NaNO<sub>3</sub> Na<sub>2</sub>SO<sub>4</sub>



Test #3 w/ Pb(NO<sub>3</sub>)<sub>2</sub>

Result: Clear & Colorless no ppt formed

Conclusion unk A = NaNO<sub>3</sub>

<u>Ions</u>	<u>Rule</u>	<u>Exceptions</u>
Group 1A ( $\text{Li}^+$ , $\text{Na}^+$ , $\text{K}^+$ ) & $\text{NH}_4^+$	Always Sol. Cation	None
$\text{NO}_3^-$ & $\text{C}_2\text{H}_3\text{O}_2^-$	Always Sol. Anion	None
$\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$	Usually Soluble	$\text{Pb}^{2+}$ , $\text{Ag}^+$ , $\text{Hg}_2^{2+}$
$\text{F}^-$ , $\text{SO}_4^{2-}$	Usually Soluble	$\text{Pb}^{2+}$ , $\text{Ca}^{2+}$ , $\text{Ba}^{2+}$
$\text{OH}^-$ , $\text{CO}_3^{2-}$ , $\text{PO}_4^{3-}$	Usually Insoluble	Group 1A or $\text{NH}_4^+$