



Complete Qualitative Analysis



Complete Qualitative Analysis

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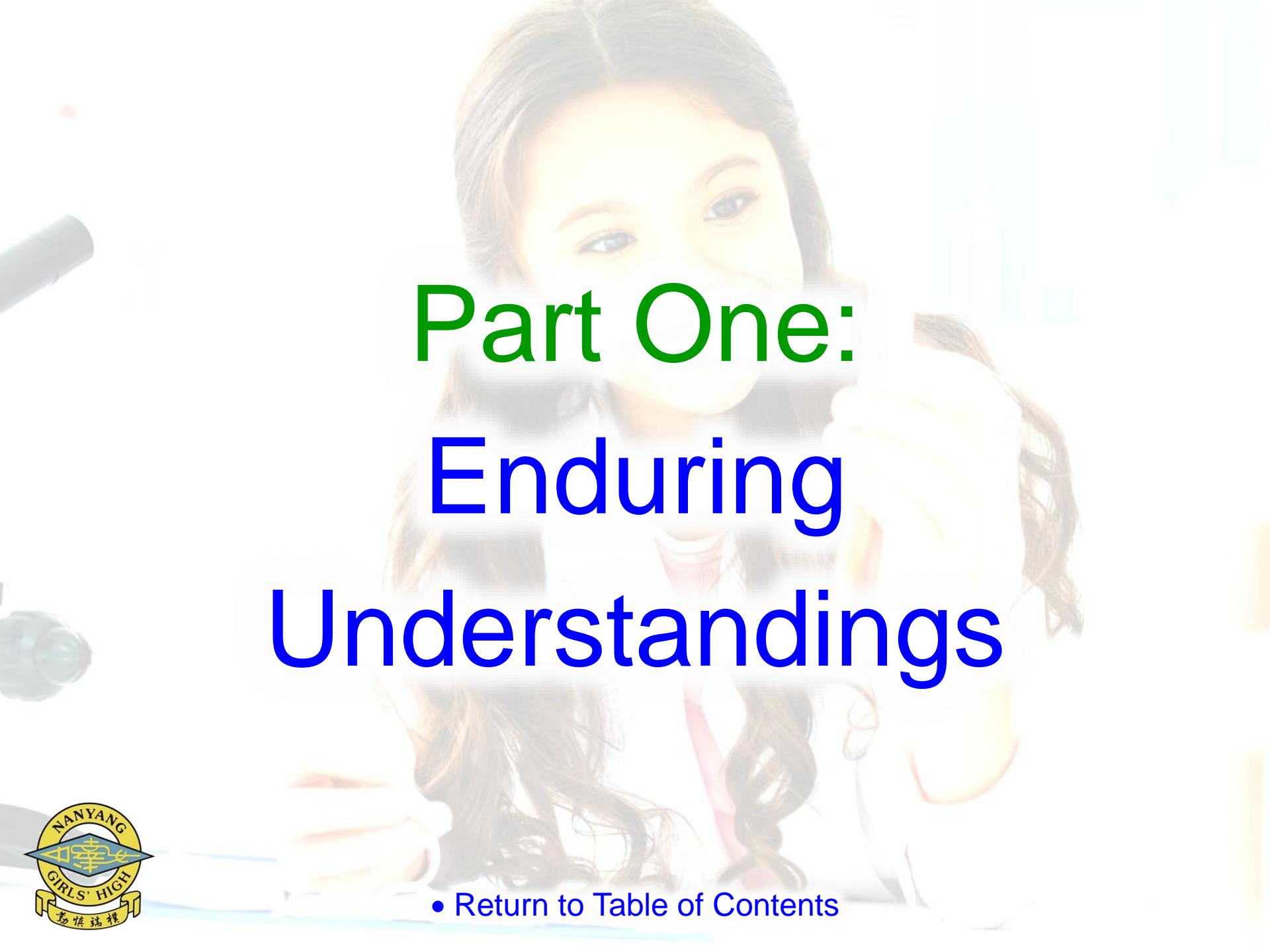
1. Enduring Understandings

2. Essential Knowledge

3. Qualitative Analysis of all Important Salts

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Part One: Enduring Understandings

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Complete Qualitative Analysis



- Chemicals respond to *changes* in their *environment*, e.g. the simple addition of an acid or an alkali may cause a *change* to take place.
- Based upon the compound's unique chemical properties, each *change* and its observable outcome will be different, allowing the compound to be *identified*.



Complete Qualitative Analysis



- Chemical reactions are *systems* that follow certain *rules*, e.g., if an *acid* is added to a *carbonate*, then *carbon dioxide gas* will be produced.
- Any *observable change* that takes place during a chemical reaction, coupled with a knowledge of some simple *rules* (e.g. solubility rules) allows a chemical to be *identified*.



Complete Qualitative Analysis



- Why is qualitative analysis useful?
- Why is learning qualitative analysis useful to *you*?
- What will you remember about qualitative analysis in *two* year's time? *Five* year's time? *Ten* year's time?



Complete Qualitative Analysis



- Imagine that you want to become a doctor, lawyer or veterinarian.
- What *skills* and *abilities* do you need to perform your job?
- You need to understand and make sense of many *pieces of evidence* in order to draw valid and reliable conclusions, e.g. what condition is your patient suffering from?

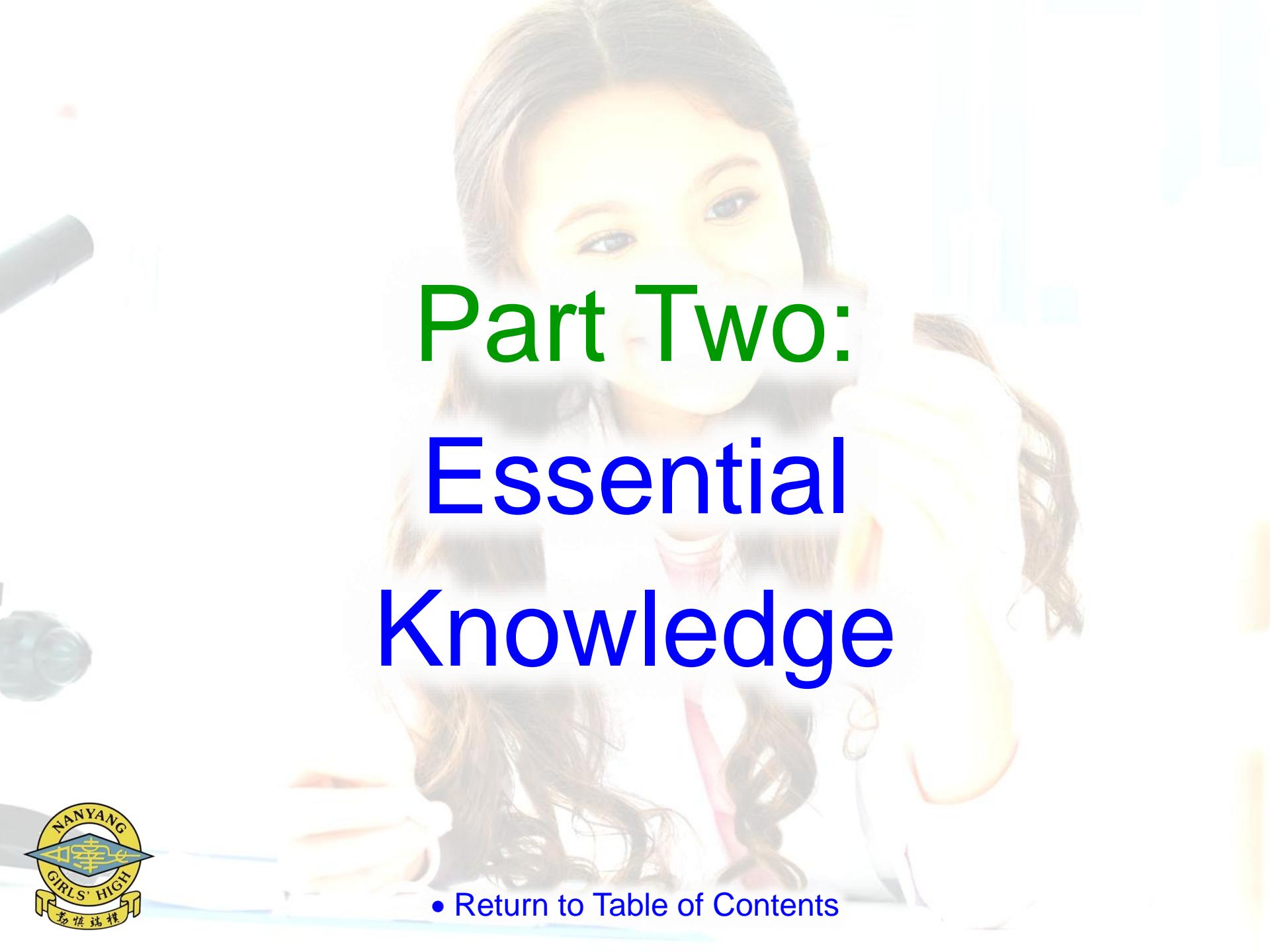


Complete Qualitative Analysis



- Qualitative analysis is more than just memorising many facts in order to solve problems in Chemistry. It is also an important way of *thinking*. It teaches *reasoning* and *logic* (also seen in Math).
- Over time, you may forget the tests for anions and cations, but the persistence, *critical thinking* and *reasoning skills* that you develop will be *enduring* and *transferable*.





Part Two: Essential Knowledge

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Complete Qualitative Analysis a)

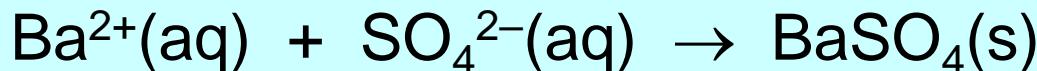
- The presence of which anion can be tested using an acidified solution of barium chloride, $\text{BaCl}_2(\text{aq})$, or an acidified solution of barium nitrate, $\text{Ba}(\text{NO}_3)_2(\text{aq})$?



Complete Qualitative Analysis a)

- The presence of which anion can be tested using an acidified solution of barium chloride, $\text{BaCl}_2(\text{aq})$, or an acidified solution of barium nitrate, $\text{Ba}(\text{NO}_3)_2(\text{aq})$?
- Acidified solutions of barium chloride, $\text{BaCl}_2(\text{aq})$, and barium nitrate, $\text{Ba}(\text{NO}_3)_2(\text{aq})$, are used to test for *sulfate ions*, $\text{SO}_4^{2-}(\text{aq})$.

- Ionic equation:



A *white precipitate* of barium sulfate, $\text{BaSO}_4(\text{s})$, is observed.



Complete Qualitative Analysis b)

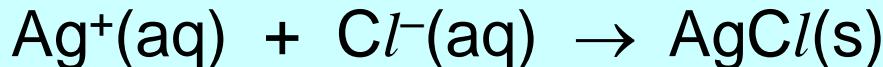
- The presence of which two anions can be tested using an acidified solution of silver nitrate, $\text{AgNO}_3(\text{aq})$?



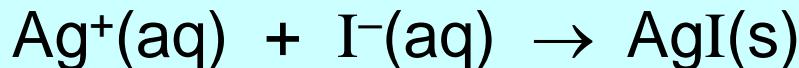
Complete Qualitative Analysis b)

- The presence of which two anions can be tested using an acidified solution of silver nitrate, $\text{AgNO}_3\text{(aq)}$?
- An acidified solution of silver nitrate, $\text{AgNO}_3\text{(aq)}$, is used to test for *chloride ions*, $\text{Cl}^-(\text{aq})$, and *iodide ions*, $\text{I}^-(\text{aq})$.

- Ionic equations:



A *white precipitate* of silver chloride, AgCl(s) , is observed.



A *yellow precipitate* of silver iodide, AgI(s) , is observed.



Complete Qualitative Analysis c)

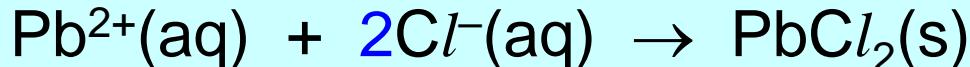
- The presence of which two anions can be tested using an acidified solution of lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2(\text{aq})$?



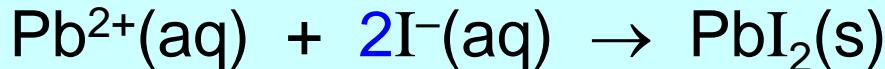
Complete Qualitative Analysis c)

- The presence of which two anions can be tested using an acidified solution of lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2(\text{aq})$?
- An acidified solution of lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2(\text{aq})$, is used to test for *chloride ions*, $\text{Cl}^-(\text{aq})$, and *iodide ions*, $\text{I}^-(\text{aq})$.

- Ionic equations:



A *white precipitate* of lead(II) chloride, $\text{PbCl}_2(\text{s})$, is observed.



A *yellow precipitate* of lead(II) iodide, $\text{PbI}_2(\text{s})$, is observed.



Complete Qualitative Analysis c)

- **Note:** If given a choice, an acidified solution of *silver nitrate*, $\text{AgNO}_3\text{(aq)}$, should be used *in preference* to an acidified solution of *lead(II) nitrate*, $\text{Pb}(\text{NO}_3)_2\text{(aq)}$, when testing for aqueous chloride ions, $\text{Cl}^-\text{(aq)}$, and iodide ions, $\text{I}^-\text{(aq)}$.
- This is because compounds containing lead are *toxic* and *harmful* to the development and functioning of the central nervous system, hence exposure to compounds containing lead should be avoided.



Complete Qualitative Analysis d)

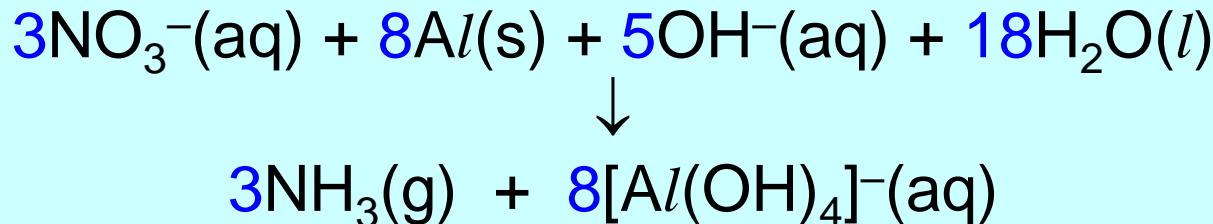
- The presence of which anion can be tested using a mixture of hot aqueous sodium hydroxide, NaOH(aq), and aluminium foil, Al(s)?



Complete Qualitative Analysis d)

- The presence of which anion can be tested using a mixture of hot aqueous sodium hydroxide, NaOH(aq), and aluminium foil, Al(s)?
- A mixture of hot aqueous sodium hydroxide, NaOH(aq), and aluminium foil, Al(s), is used to test for *nitrate ions*, $\text{NO}_3^-(\text{aq})$.

- Ionic equation:



The *colourless* and *pungent* ammonia gas will turn damp red litmus paper *blue*.



Complete Qualitative Analysis e)

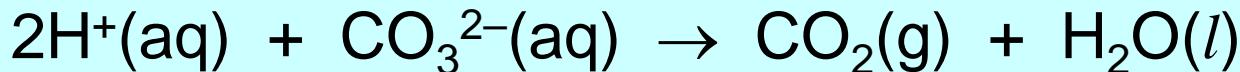
- The presence of which anion can be tested using a dilute acid, e.g. nitric acid, $\text{HNO}_3(\text{aq})$?



Complete Qualitative Analysis e)

- The presence of which anion can be tested using a dilute acid, e.g. nitric acid, $\text{HNO}_3(\text{aq})$?
- A dilute acid, e.g. nitric acid, $\text{HNO}_3(\text{aq})$, is used to test for *carbonate ions*, $\text{CO}_3^{2-}(\text{aq})$.

- Ionic equation for *soluble* carbonate:



- Ionic equation for *insoluble* carbonate:



For both reactions, there is *effervescence* of a *colourless* and *odourless* gas which produces a *white precipitate* when bubbled through lime water.



Complete Qualitative Analysis f)

Test for Cations Using Aqueous Sodium Hydroxide

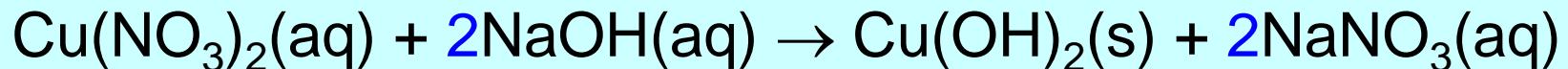
Cation	Effect of Aqueous Sodium Hydroxide
Aluminium cation – $\text{Al}^{3+}(\text{aq})$	White ppt., soluble in excess giving a colourless solution.
Ammonium cation – $\text{NH}_4^+(\text{aq})$	Ammonia produced on warming.
Calcium cation – $\text{Ca}^{2+}(\text{aq})$	White ppt., insoluble in excess.
Copper(II) cation – $\text{Cu}^{2+}(\text{aq})$	Blue ppt., insoluble in excess.
Iron(II) cation – $\text{Fe}^{2+}(\text{aq})$	Green ppt., insoluble in excess.
Iron(III) cation – $\text{Fe}^{3+}(\text{aq})$	Red-brown ppt., insoluble in excess.
Lead(II) cation – $\text{Pb}^{2+}(\text{aq})$	White ppt., soluble in excess giving a colourless solution.
Zinc cation – $\text{Zn}^{2+}(\text{aq})$	White ppt., soluble in excess giving a colourless solution.



Complete Qualitative Analysis f)

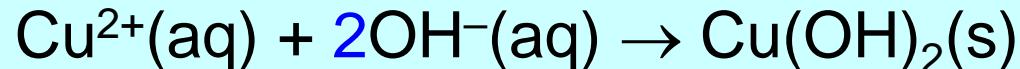
Test for Cations Using Aqueous Sodium Hydroxide

- In the example given below, aqueous sodium hydroxide is used to test for the presence of $\text{Cu}^{2+}(\text{aq})$:



A blue precipitate, which is insoluble in excess aqueous sodium hydroxide, is observed.

- Ionic equation for the reaction:



Complete Qualitative Analysis g)

Test for Cations Using Aqueous Ammonia

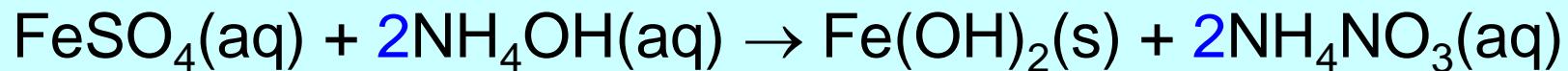
Cation	Effect of Aqueous Ammonia
Aluminium cation – $\text{Al}^{3+}(\text{aq})$	White ppt., insoluble in excess.
Ammonium cation – $\text{NH}_4^+(\text{aq})$	Not applicable.
Calcium cation – $\text{Ca}^{2+}(\text{aq})$	No observed reaction, no ppt. observed.
Copper(II) cation – $\text{Cu}^{2+}(\text{aq})$	Blue ppt., soluble in excess giving a dark blue solution.
Iron(II) cation – $\text{Fe}^{2+}(\text{aq})$	Green ppt., insoluble in excess.
Iron(III) cation – $\text{Fe}^{3+}(\text{aq})$	Red-brown ppt., insoluble in excess.
Lead(II) cation – $\text{Pb}^{2+}(\text{aq})$	White ppt., insoluble in excess.
Zinc cation – $\text{Zn}^{2+}(\text{aq})$	White ppt., soluble in excess giving a colourless solution.



Complete Qualitative Analysis g)

Test for Cations Using Aqueous Ammonia

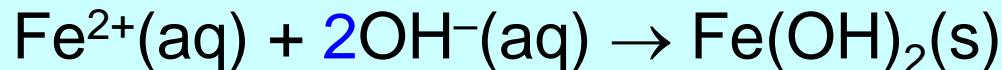
- In the example given below, aqueous ammonia is used to test for the presence of $\text{Fe}^{2+}(\text{aq})$:



A green precipitate, which is insoluble in excess aqueous ammonia, is observed.

Note: In balanced chemical equations, the formula for aqueous ammonia is written as $\text{NH}_4\text{OH}(\text{aq})$, not $\text{NH}_3(\text{aq})$.

- Ionic equation for the reaction:



Complete Qualitative Analysis h)

Summary of the Tests for Cations

- $\text{Ca}^{2+}(\text{aq})$

This is the only cation that gives a white precipitate with $\text{NaOH}(\text{aq})$, and the precipitate is *insoluble* in excess reagent.

- $\text{Al}^{3+}(\text{aq})$, $\text{Pb}^{2+}(\text{aq})$ and $\text{Zn}^{2+}(\text{aq})$

The hydroxides of these three cations are *amphoteric* in nature. All three cations give a white precipitate with $\text{NaOH}(\text{aq})$ which dissolve in excess reagent to give a colourless solution.

Only $\text{Zn}^{2+}(\text{aq})$ gives a white precipitate with $\text{NH}_3(\text{aq})$ which dissolves in excess reagent to give a colourless solution.



Complete Qualitative Analysis h)

Summary of the Tests for Cations

- $\text{Cu}^{2+}(\text{aq})$, $\text{Fe}^{2+}(\text{aq})$ and $\text{Fe}^{3+}(\text{aq})$

These are cations of transition metal elements, and the precipitates of their hydroxides are coloured – blue $\text{Cu}(\text{OH})_2(\text{s})$, green $\text{Fe}(\text{OH})_2(\text{s})$ and reddish-brown $\text{Fe}(\text{OH})_3(\text{s})$.

- $\text{H}^+(\text{aq})$

This cation gives $\text{CO}_2(\text{g})$ when reacted with a carbonate ($\text{CO}_3^{2-}(\text{aq})$ gives a white ppt. with limewater) and $\text{H}_2(\text{g})$ when reacted with magnesium ($\text{H}_2(\text{g})$ extinguishes a burning splint with a ‘pop’).

- $\text{NH}_4^+(\text{aq})$

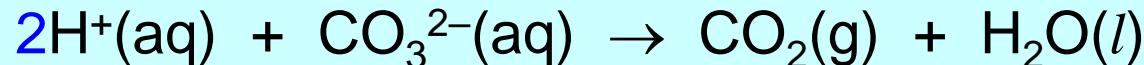
This cation gives $\text{NH}_3(\text{g})$ when warmed with an alkali ($\text{NH}_3(\text{g})$ turns damp red litmus paper blue).

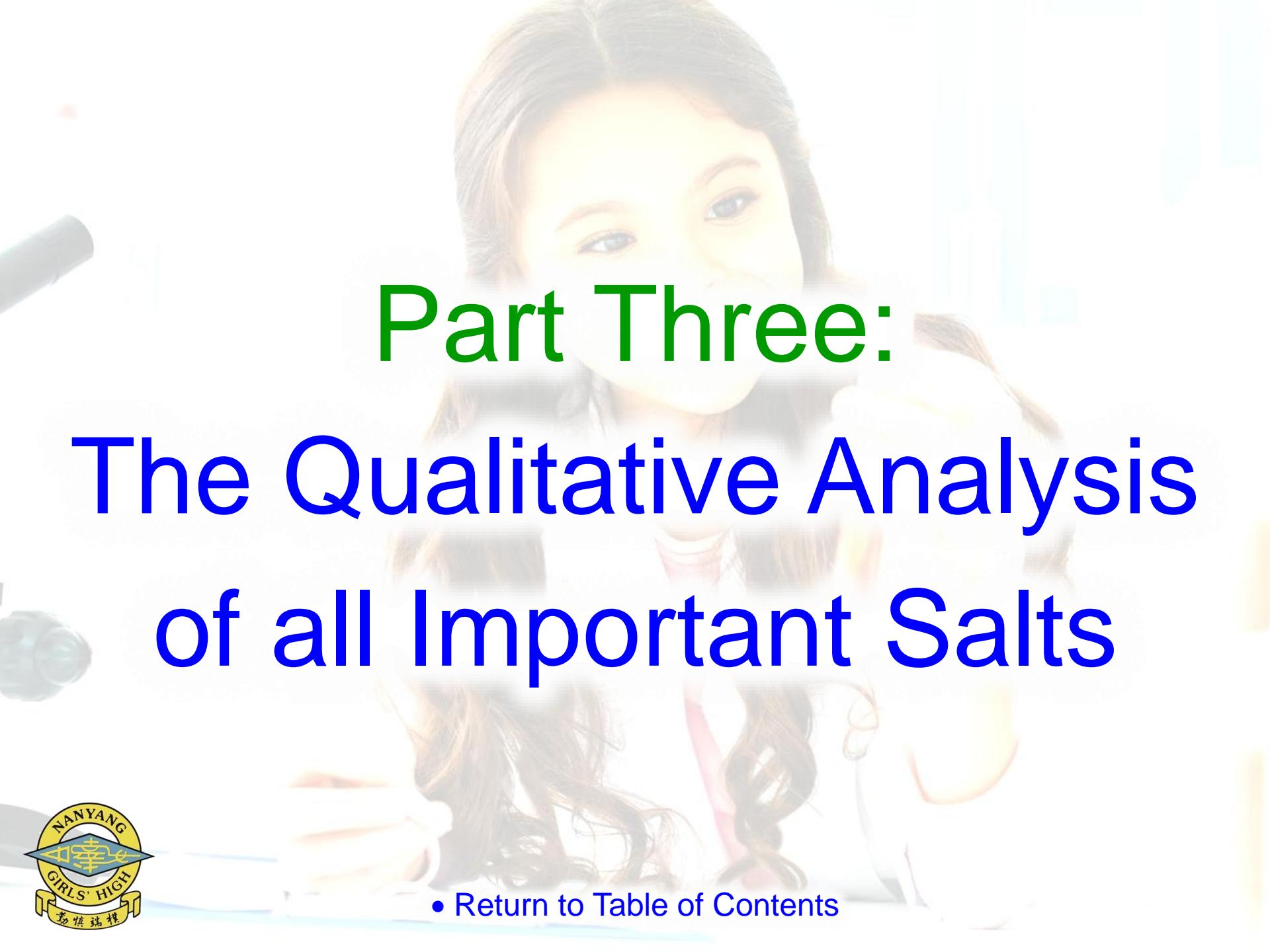


Complete Qualitative Analysis i)

The Flexible nature of Qualitative Analysis

- It is worth remembering that if reagent **A** is used to test for reagent **B**, then reagent **B** can also be used to test for reagent **A**.
- For example, if an *acid* can be used to test for a *carbonate*, then a *carbonate* can also be used to test for an *acid*.
- If a *carbonate* is added to an unknown solution and $\text{CO}_2(\text{g})$ is produced, then the unknown solution is an *acid* – $\text{H}^+(\text{aq})$.
 - If an *acid* is added to an unknown solution and $\text{CO}_2(\text{g})$ is produced, then the unknown solution is a *carbonate* – $\text{CO}_3^{2-}(\text{aq})$.





Part Three: The Qualitative Analysis of all Important Salts



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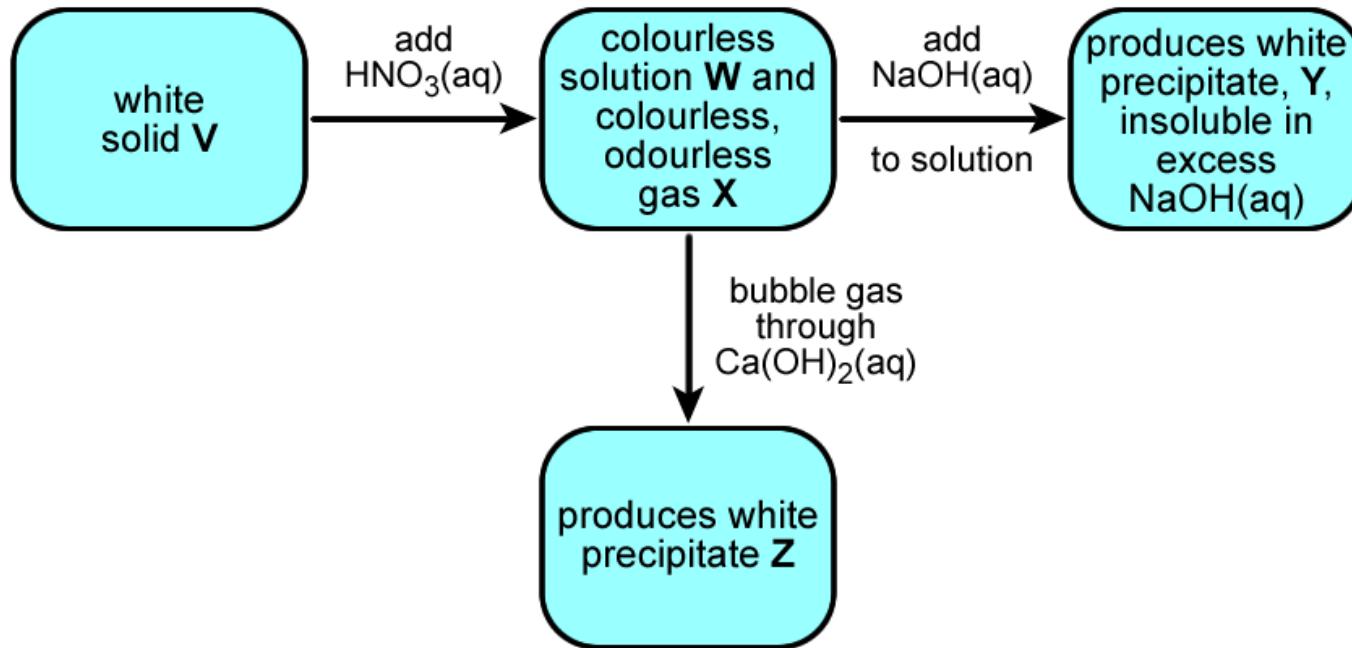
Complete Qualitative Analysis

	Anions					
	Cl^-	CO_3^{2-}	I^-	NO_3^-	SO_4^{2-}	
Cations	Al^{3+}	AlCl_3	not applicable (unstable)	AlI_3	$\text{Al}(\text{NO}_3)_2$	$\text{Al}_2(\text{SO}_4)_3$
	Ca^{2+}	CaCl_2	CaCO_3	CaI_2	$\text{Ca}(\text{NO}_3)_2$	not applicable (no tests)
	Cu^{2+}	CuCl_2	CuCO_3	not applicable (unstable)	$\text{Cu}(\text{NO}_3)_2$	CuSO_4
	Fe^{2+}	FeCl_2	FeCO_3	FeI_2	$\text{Fe}(\text{NO}_3)_2$	FeSO_4
	Fe^{3+}	FeCl_3	$\text{Fe}_2(\text{CO}_3)_3$	FeI_3	$\text{Fe}(\text{NO}_3)_3$	$\text{Fe}_2(\text{SO}_4)_3$
	NH_4^+	NH_4Cl	$(\text{NH}_4)_2\text{CO}_3$	NH_4I	NH_4NO_3	$(\text{NH}_4)_2\text{SO}_4$
	Pb^{2+}	not applicable (no tests)	PbCO_3	not applicable (no tests)	$\text{Pb}(\text{NO}_3)_2$	not applicable (no tests)
	Zn^{2+}	ZnCl_2	ZnCO_3	ZnI_2	$\text{Zn}(\text{NO}_3)_2$	ZnSO_4

- You can test for all of these salts!
- It is easier to remember the individual tests for the anions and cations, rather than remember the test for every salt!



Complete Qualitative Analysis 1.

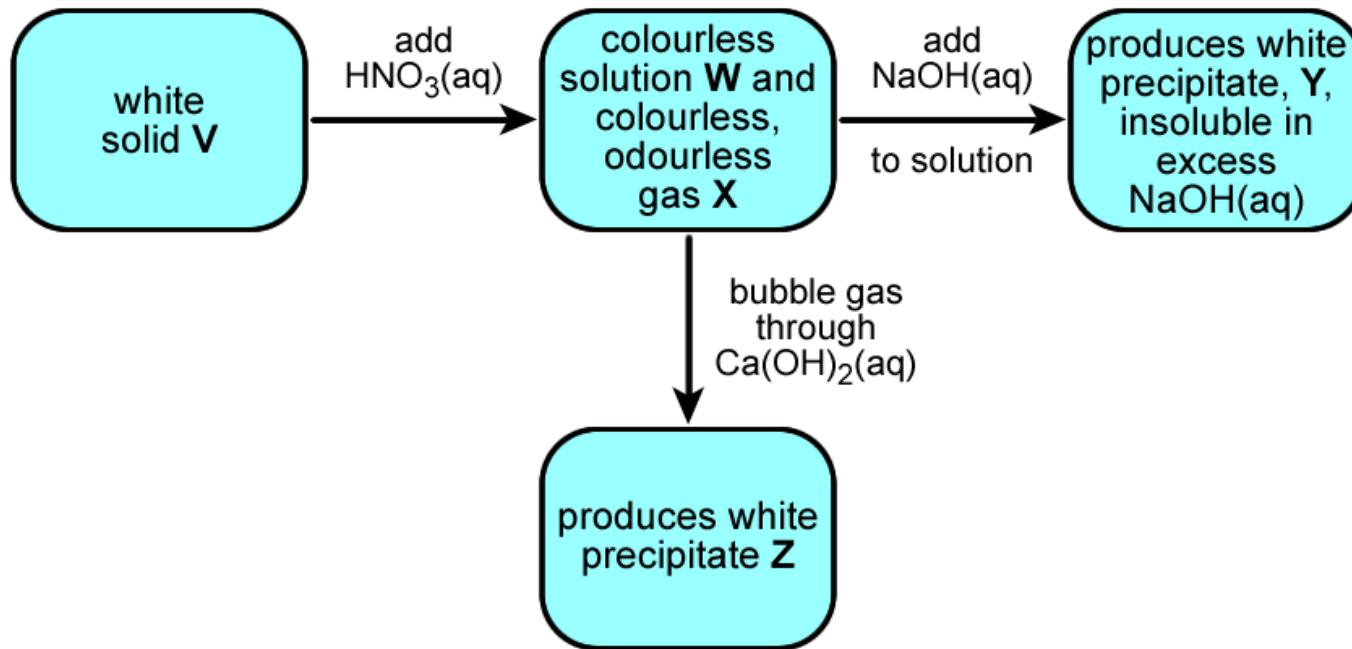


- Identify **V**, **W**, **X**, **Y** and **Z**.

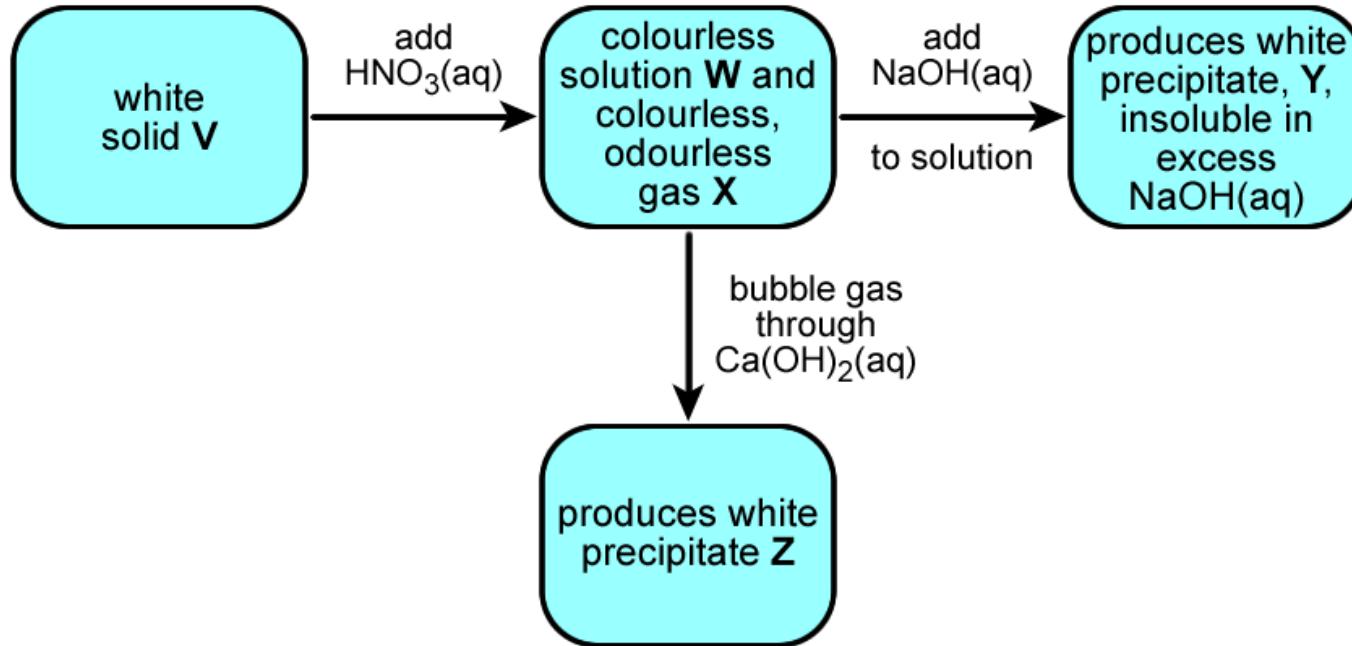


- Return to Index of Salts

Complete Qualitative Analysis 1.



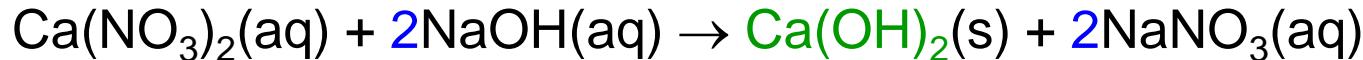
Complete Qualitative Analysis 1.



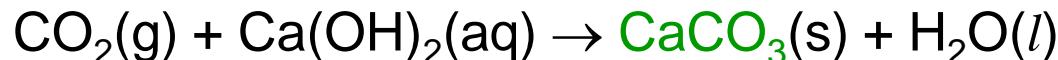
- Formation of **W** and **X**



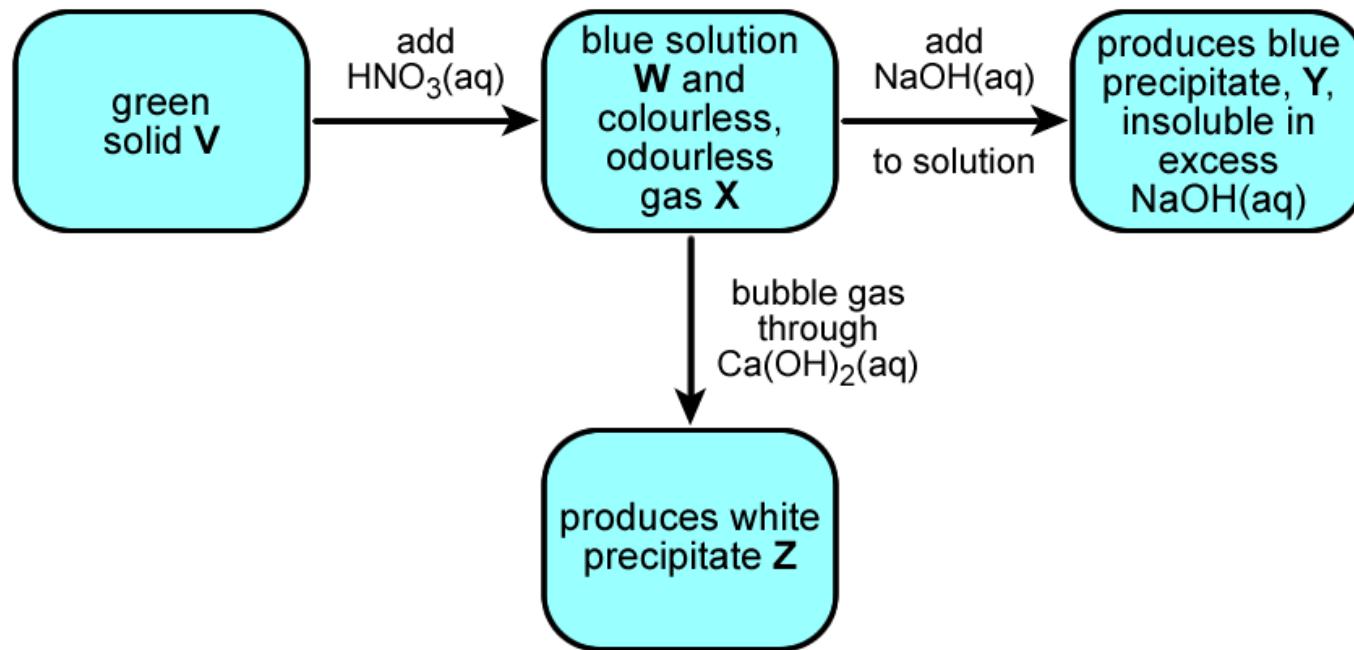
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 2.

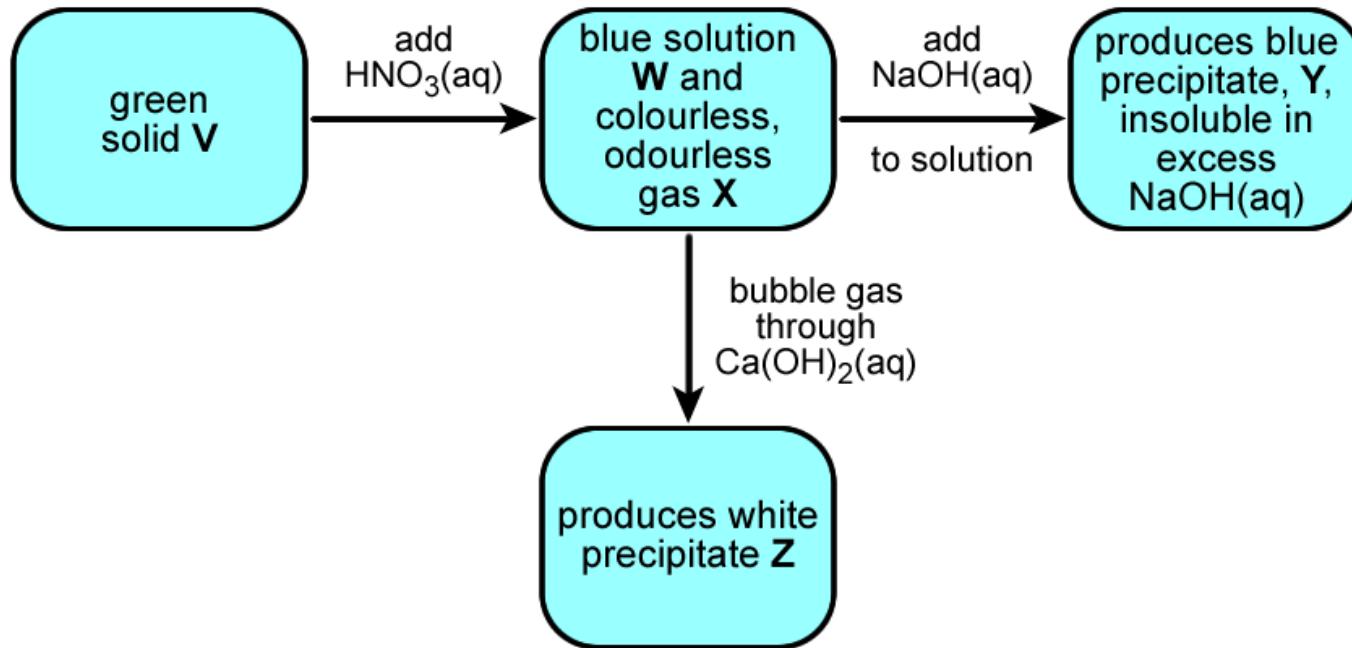


- Identify **V**, **W**, **X**, **Y** and **Z**.

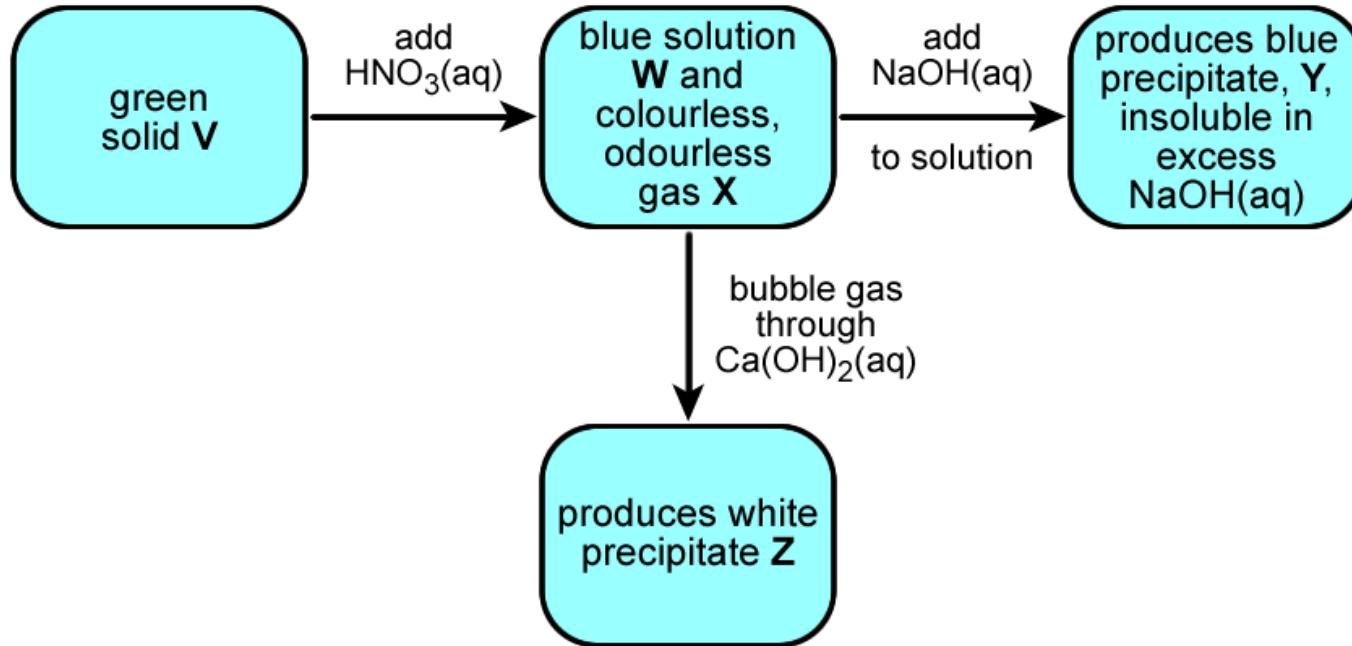
- Return to Index of Salts



Complete Qualitative Analysis 2.



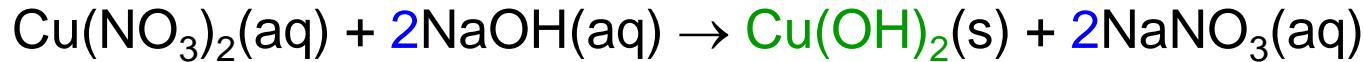
Complete Qualitative Analysis 2.



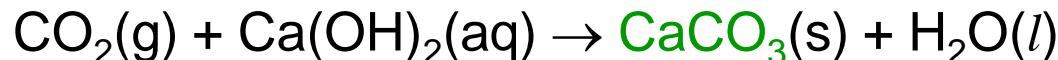
- Formation of W and X



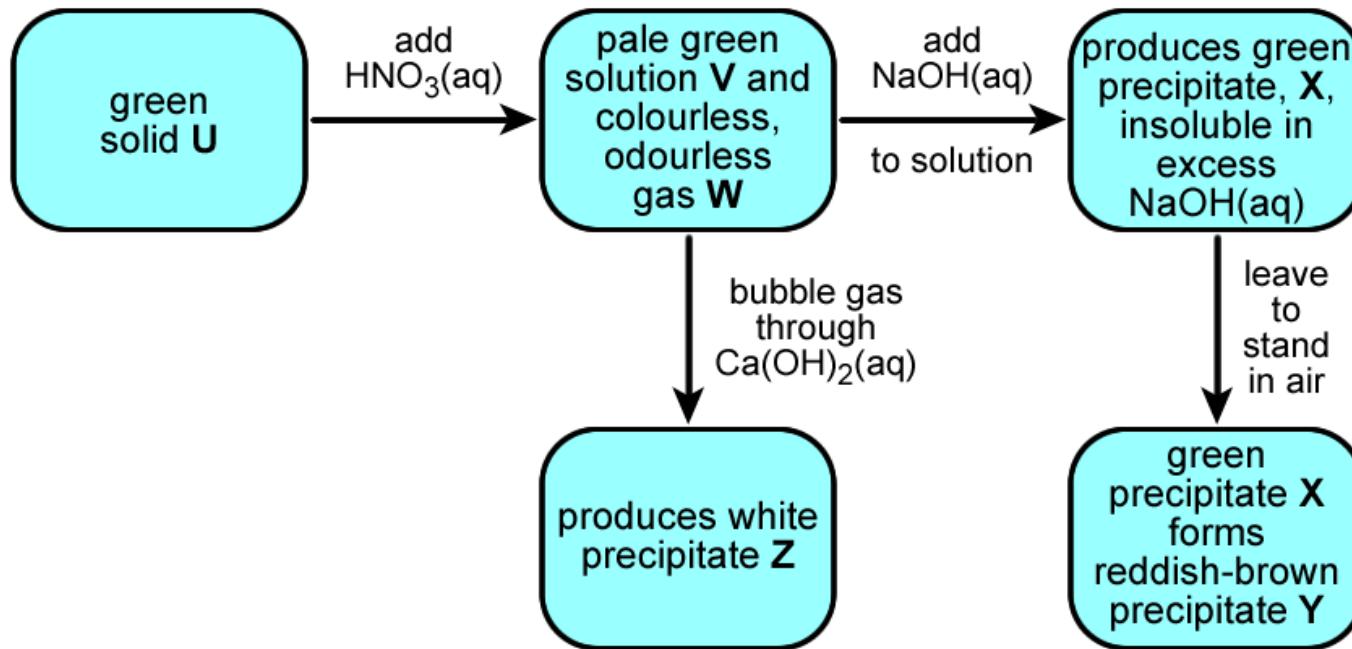
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 3.

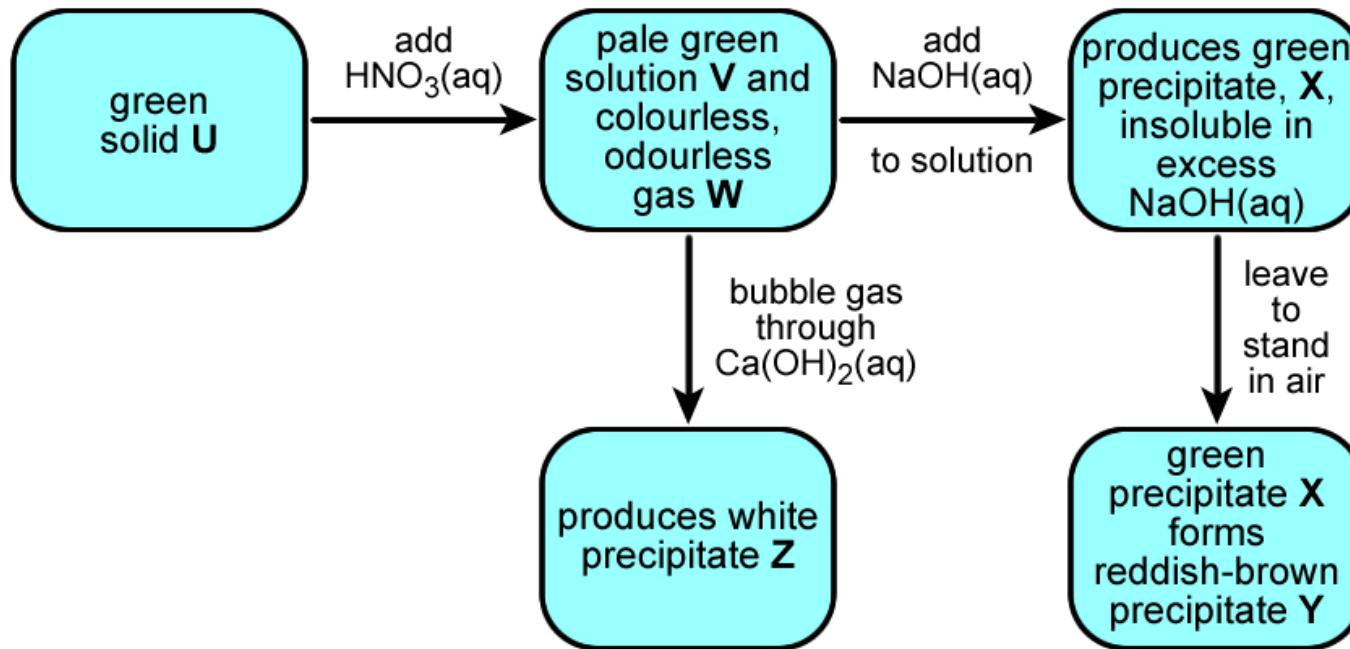


- Identify **U**, **V**, **W**, **X**, **Y** and **Z**.

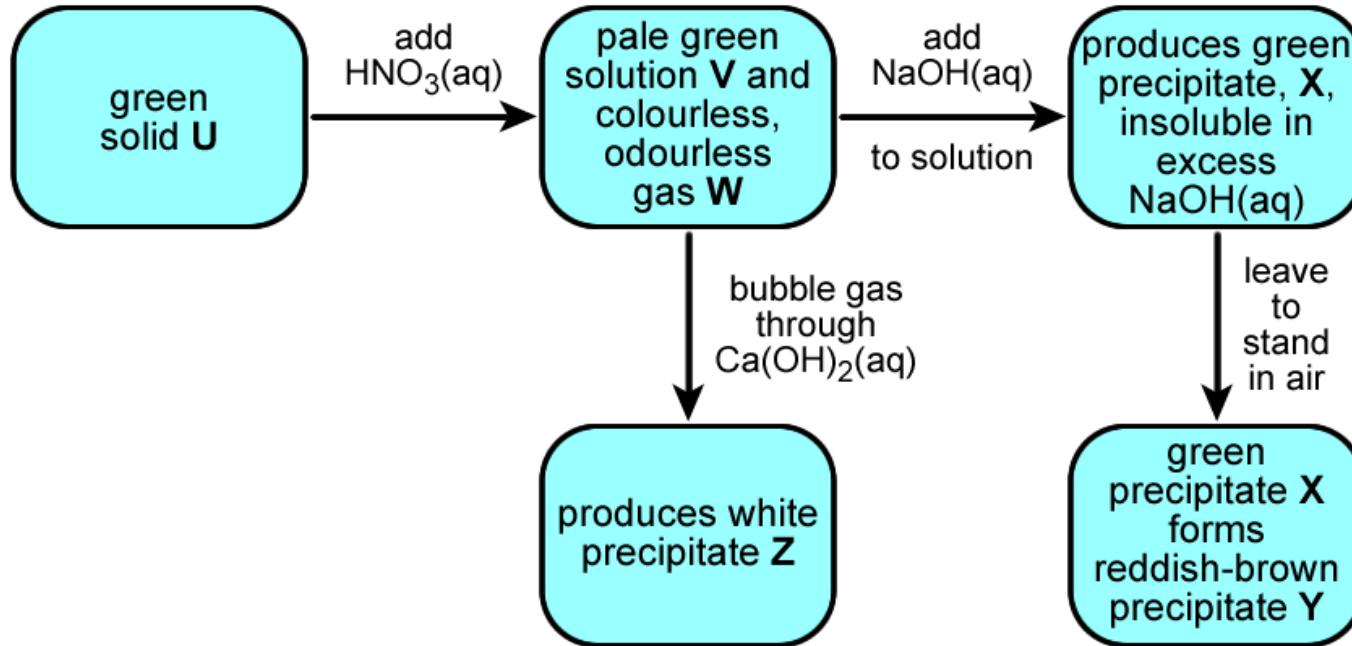


- Return to Index of Salts

Complete Qualitative Analysis 3.



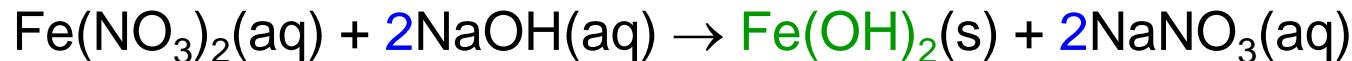
Complete Qualitative Analysis 3.



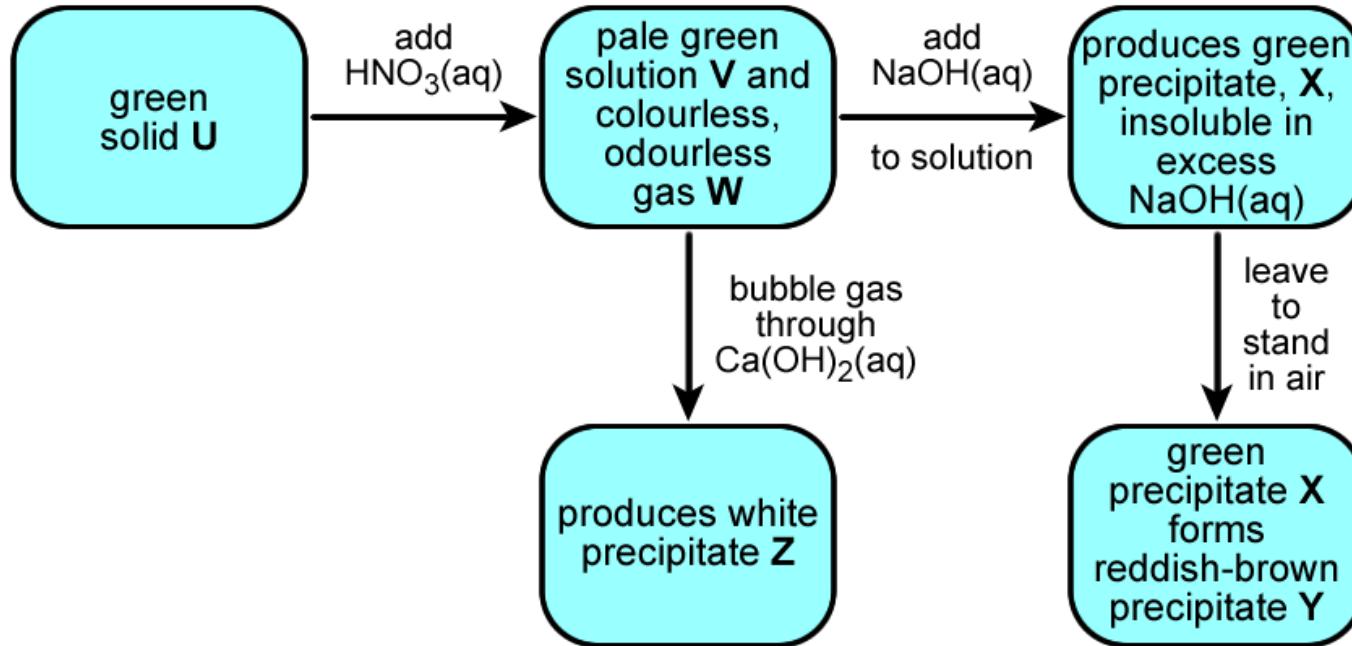
- Formation of **V** and **W**



- Formation of **X**



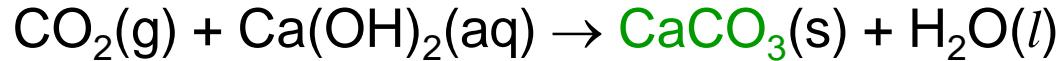
Complete Qualitative Analysis 3.



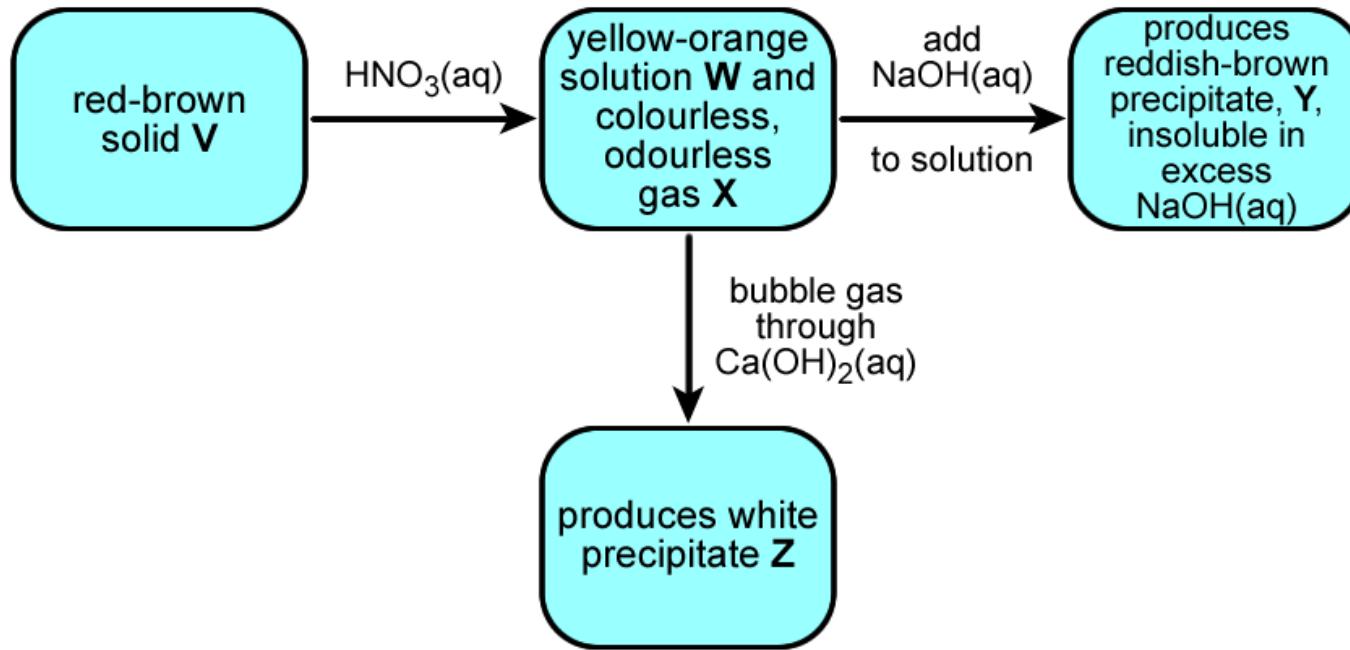
- Formation of **Y** – the aerial oxidation of Fe²⁺(aq) to Fe³⁺(aq):



- Formation of **Z**



Complete Qualitative Analysis 4.

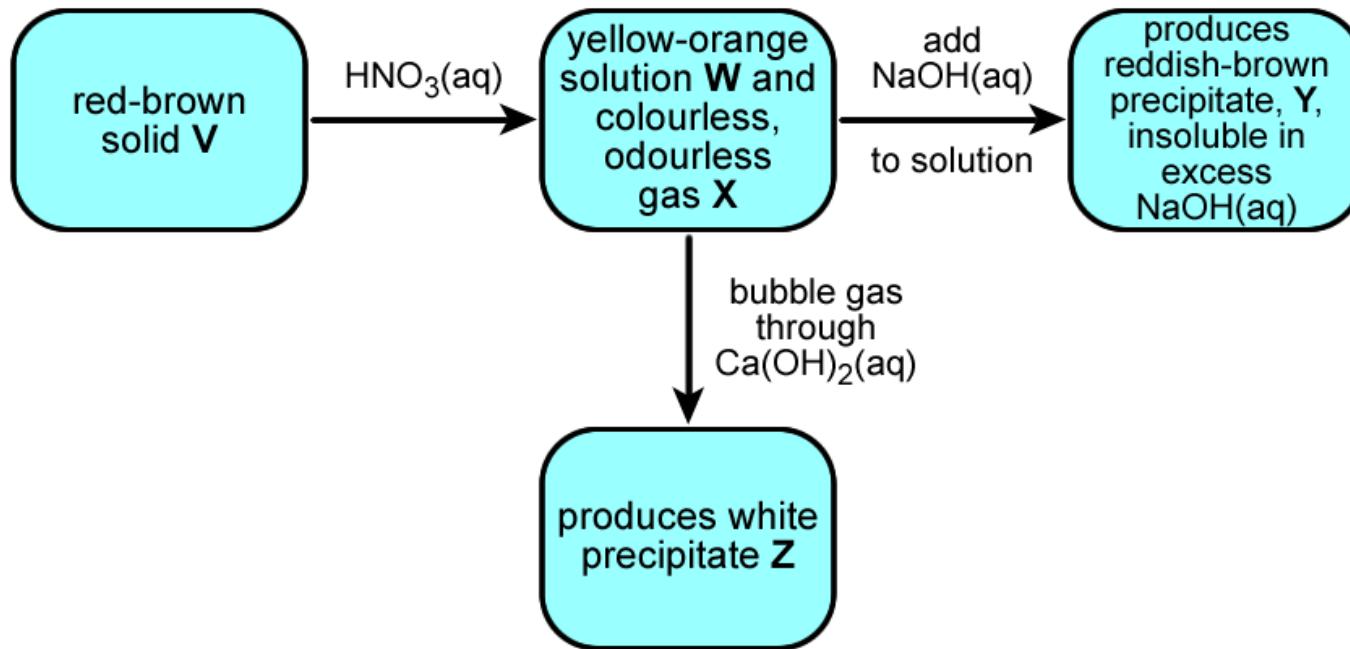


- Identify **V**, **W**, **X**, **Y** and **Z**.

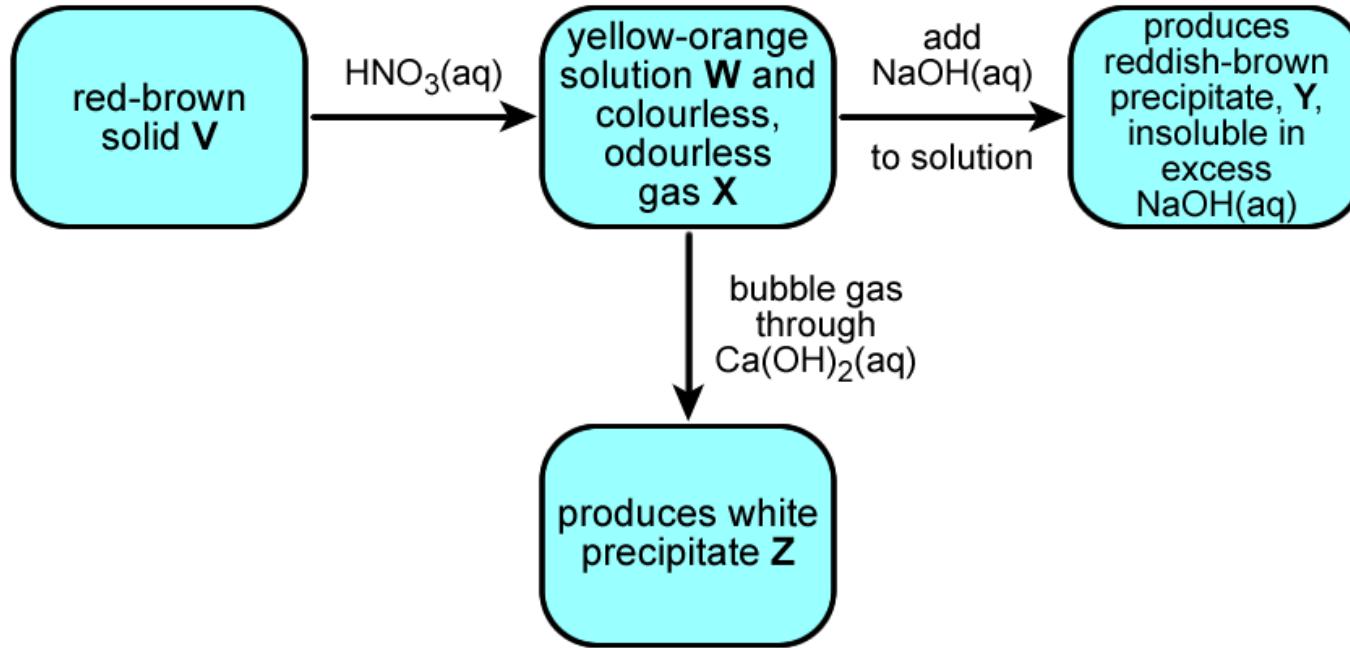


- Return to Index of Salts

Complete Qualitative Analysis 4.



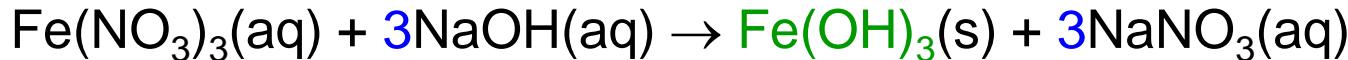
Complete Qualitative Analysis 4.



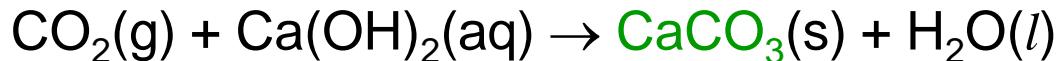
- Formation of **W** and **X**



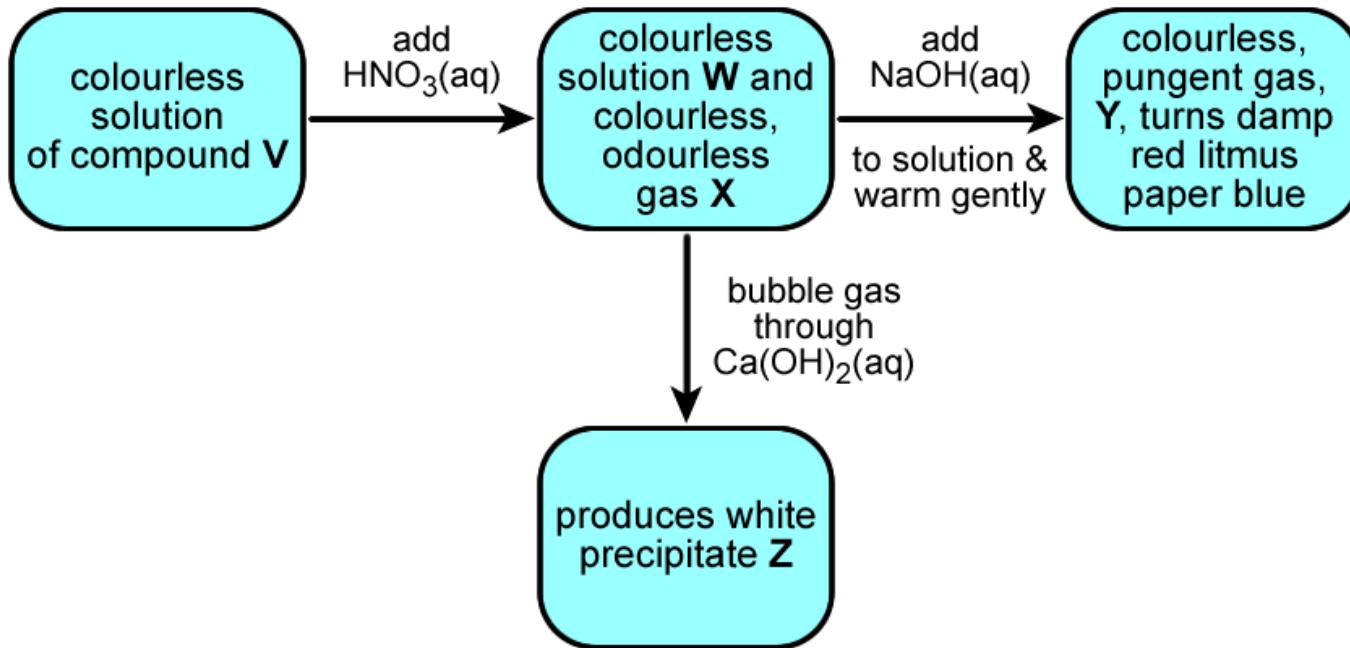
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 5.

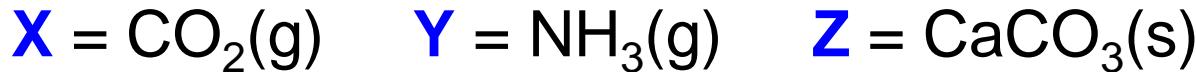
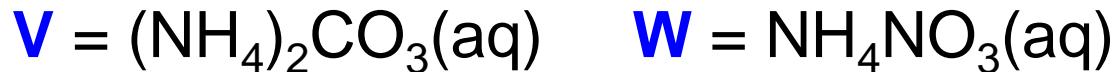
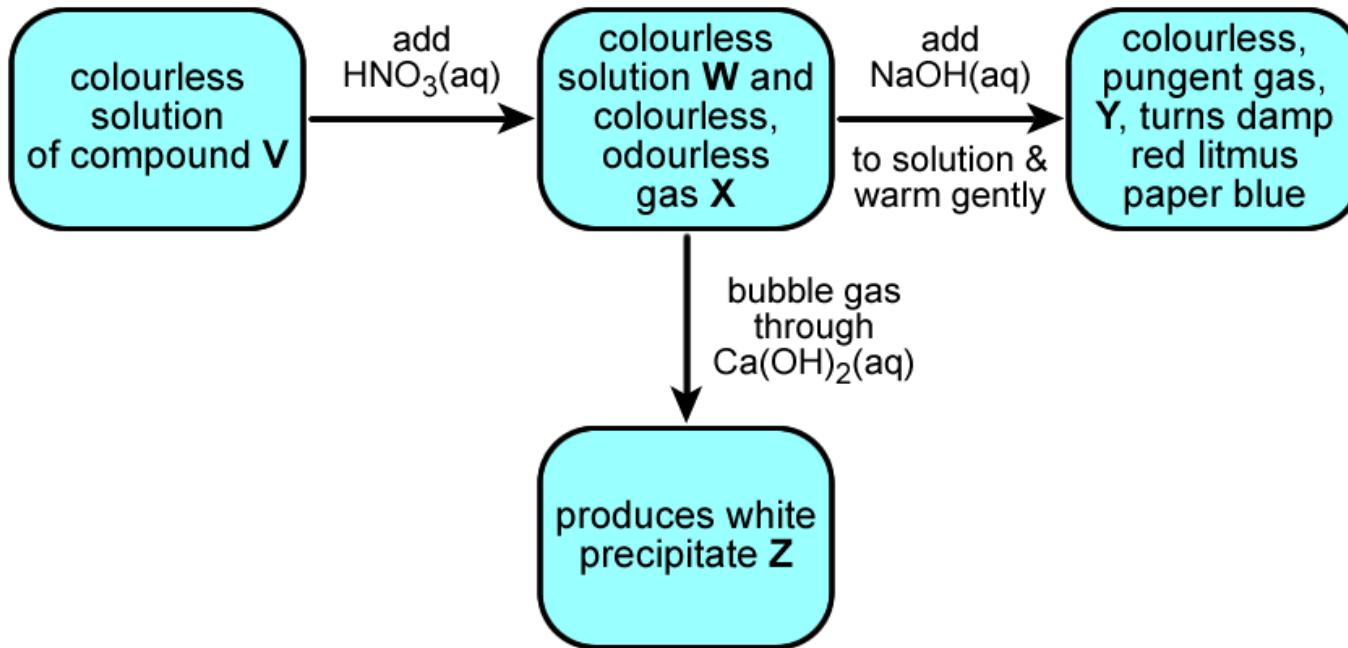


- Identify **V**, **W**, **X**, **Y** and **Z**.

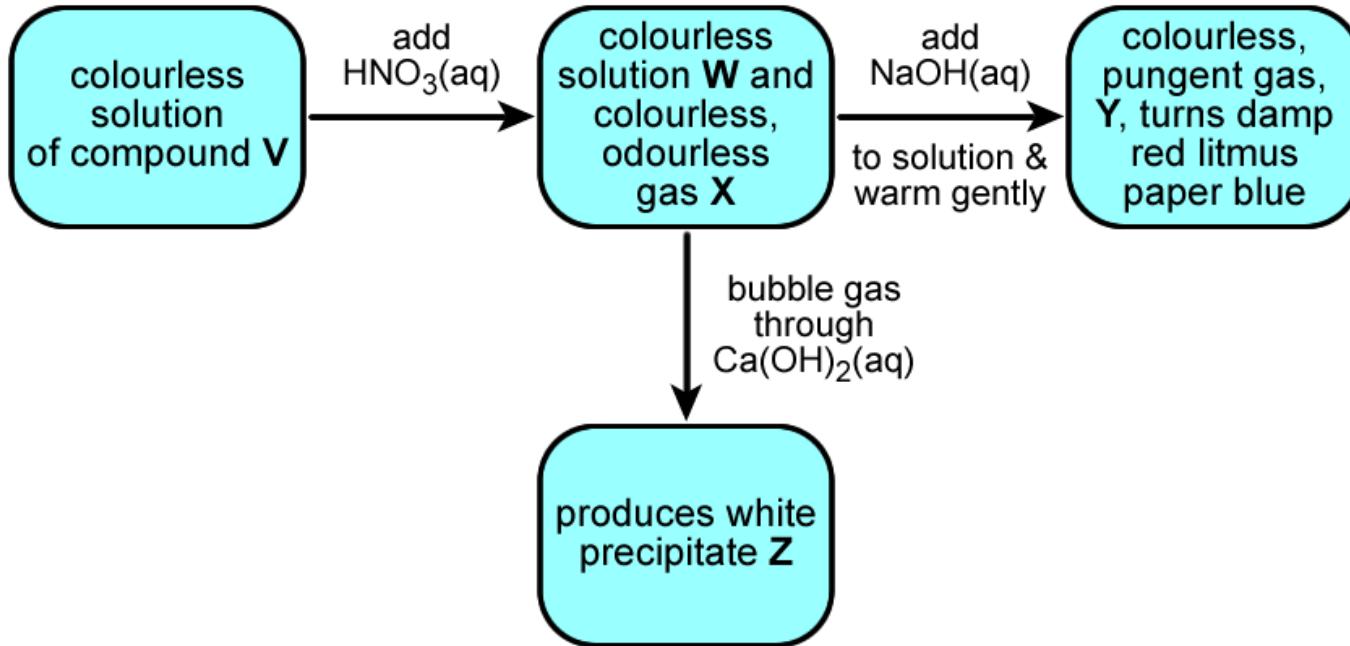
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Complete Qualitative Analysis 5.



Complete Qualitative Analysis 5.



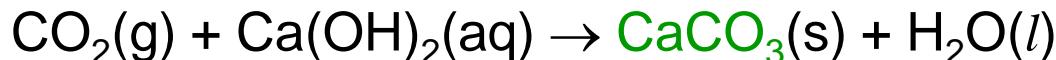
- Formation of W and X



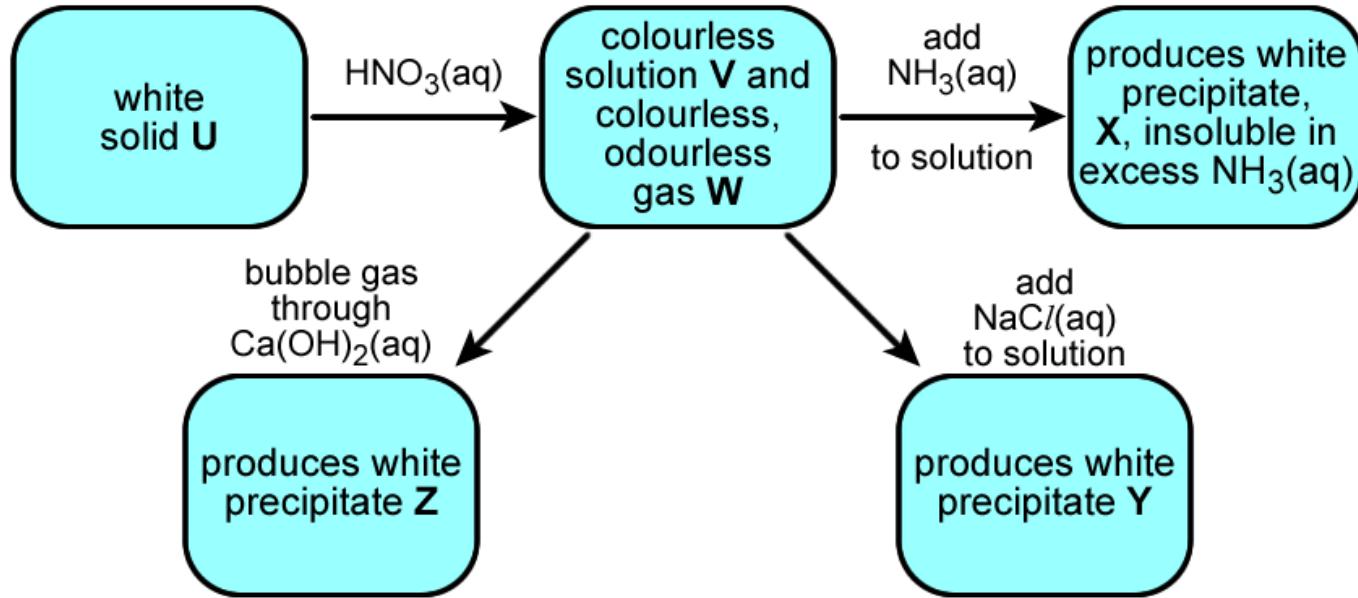
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 6.

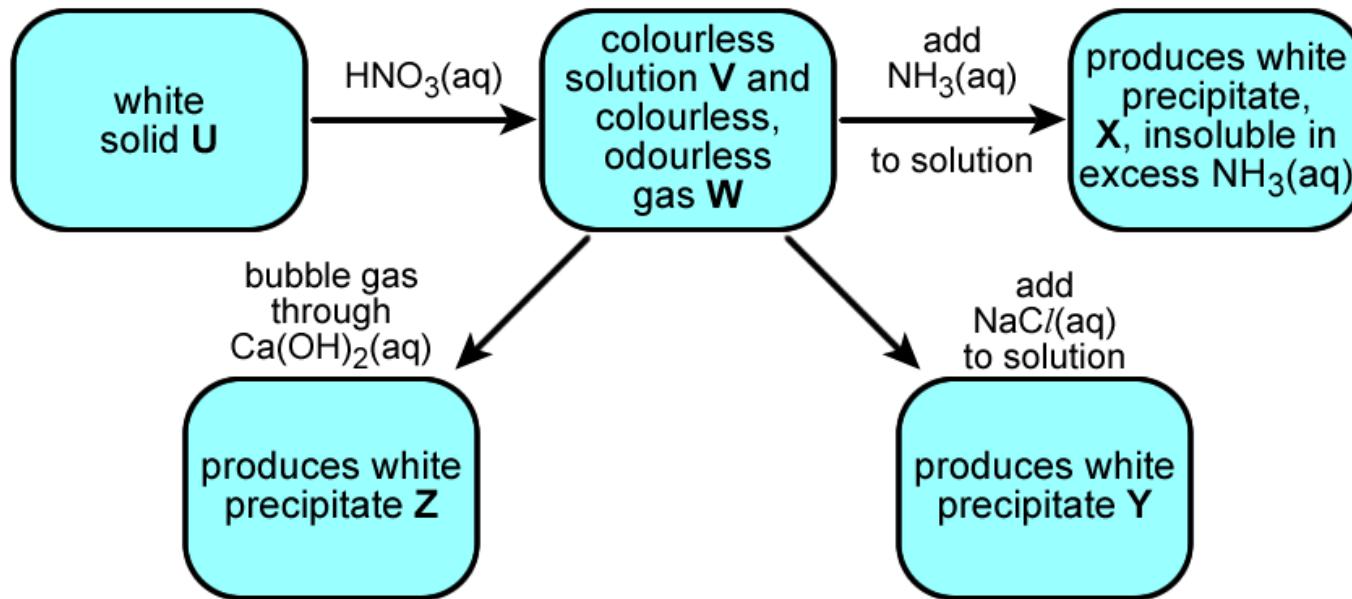


- Identify **U**, **V**, **W**, **X**, **Y** and **Z**.

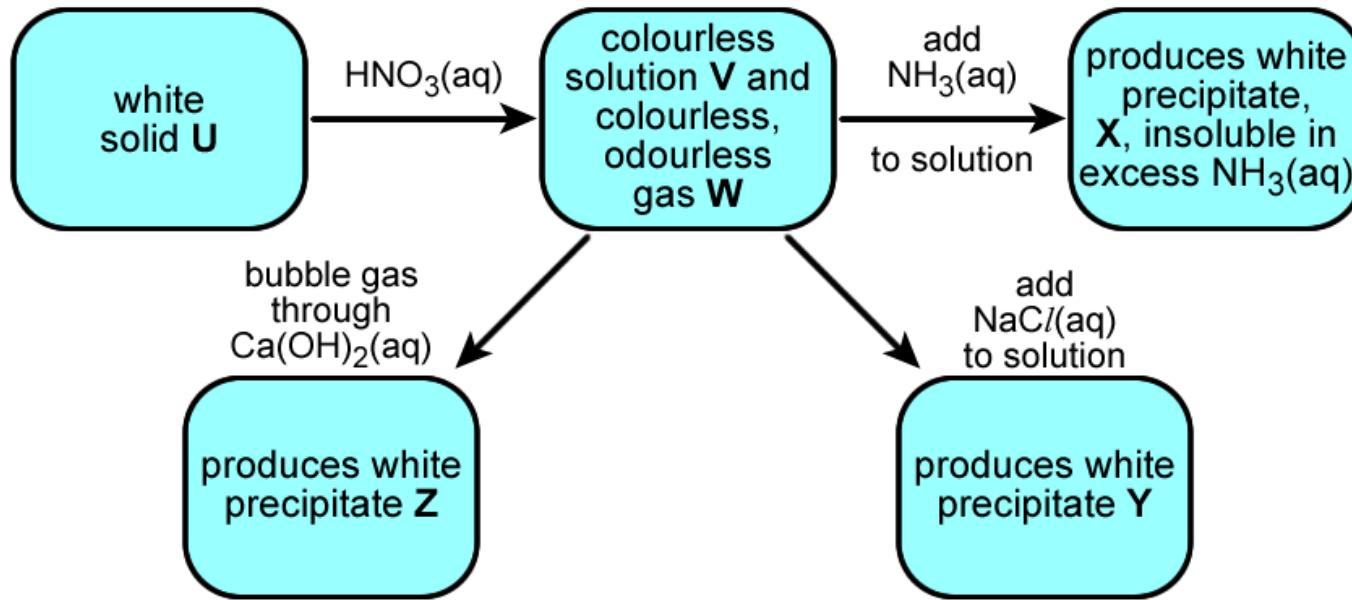


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Complete Qualitative Analysis 6.



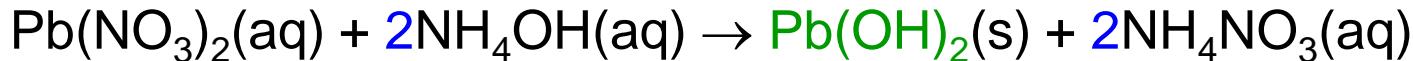
Complete Qualitative Analysis 6.



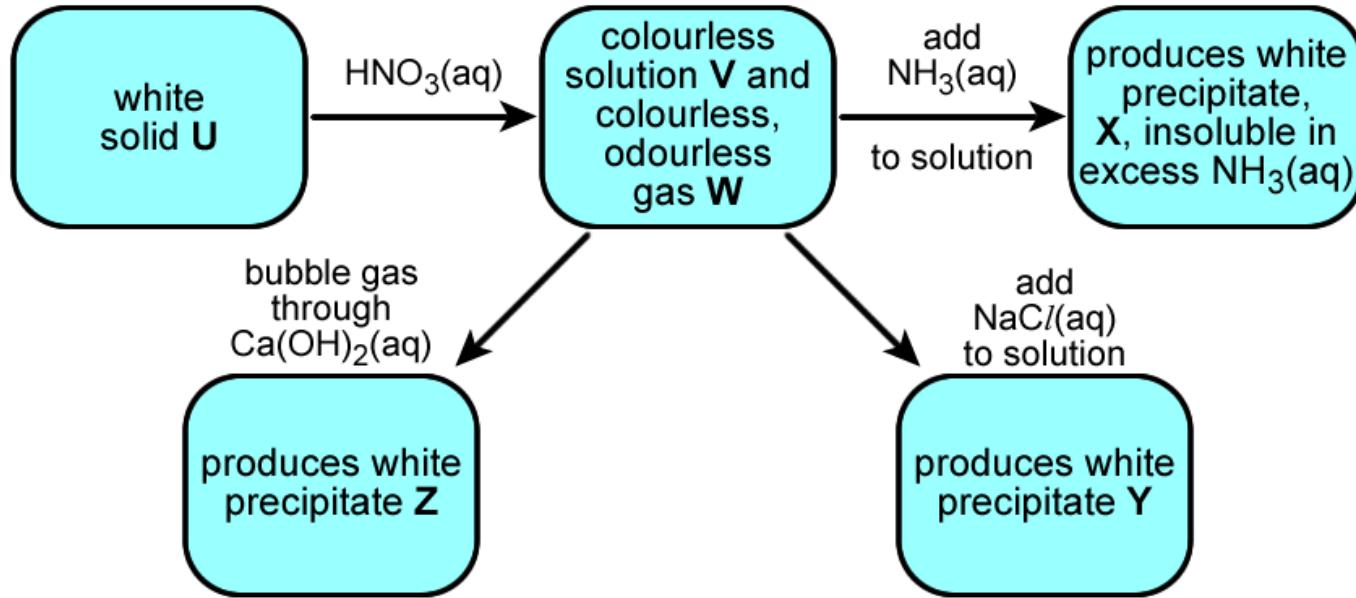
- Formation of **V** and **W**



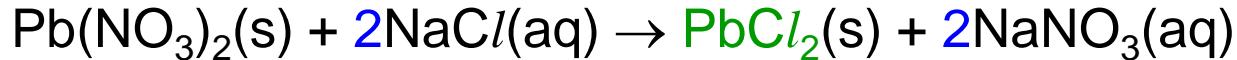
- Formation of **X**



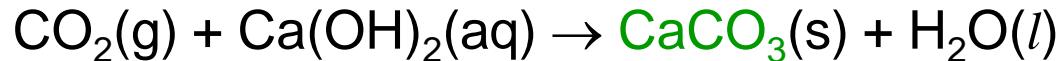
Complete Qualitative Analysis 6.



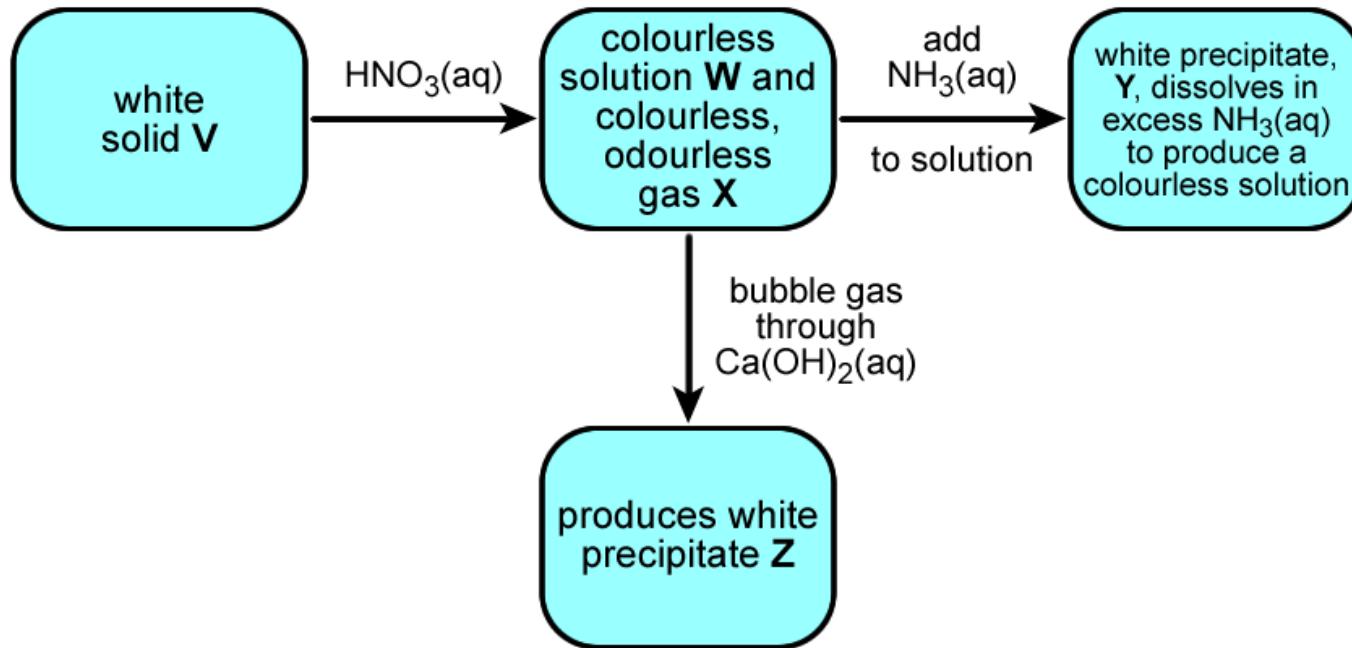
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 7.

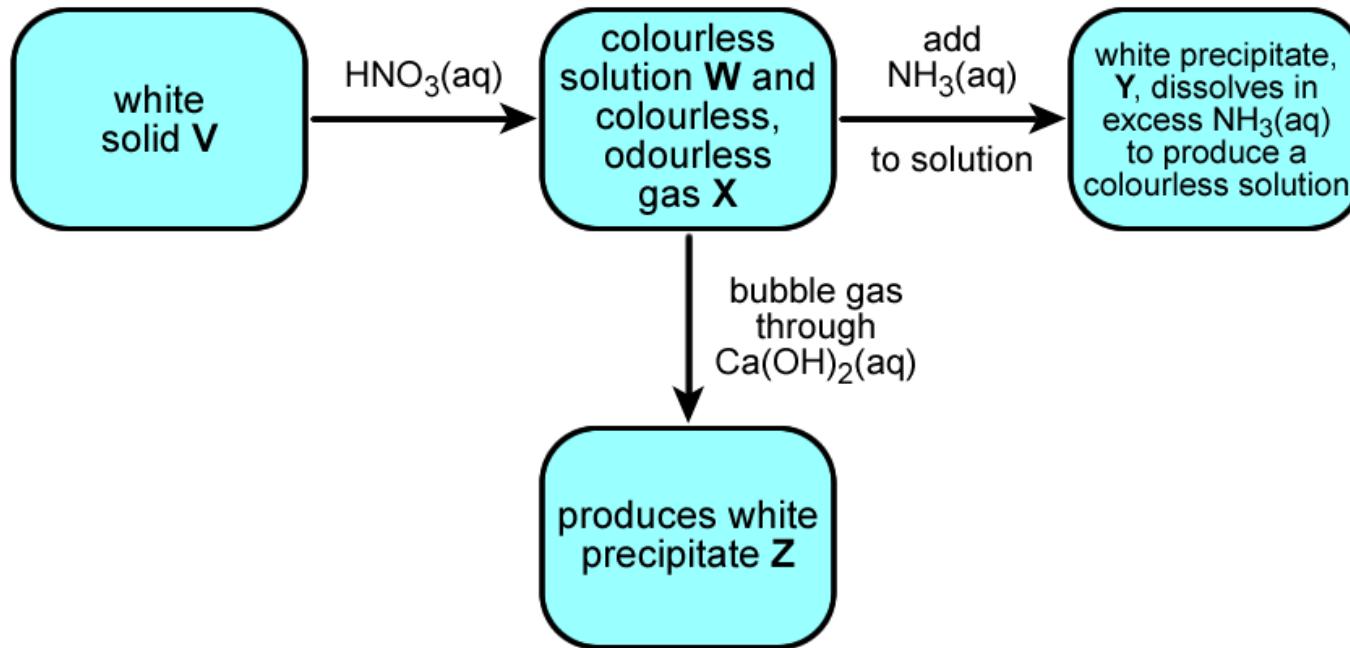


- Identify **V**, **W**, **X**, **Y** and **Z**.

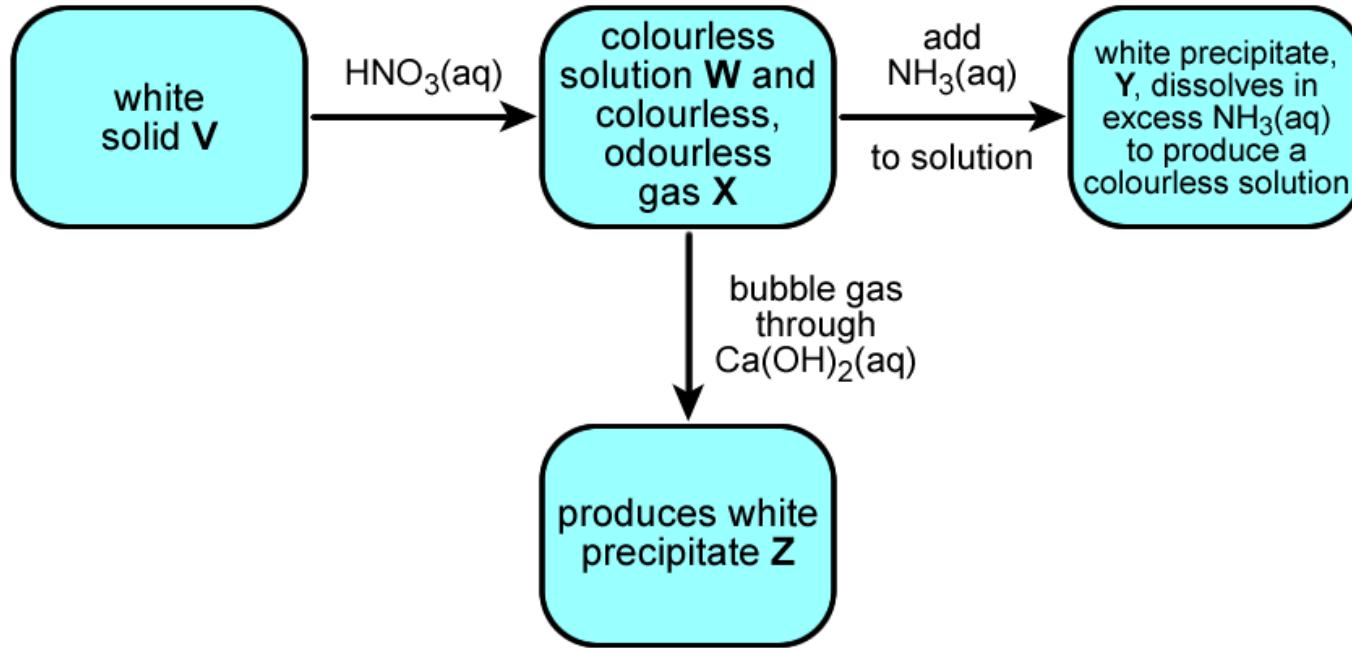
- Return to Index of Salts



Complete Qualitative Analysis 7.



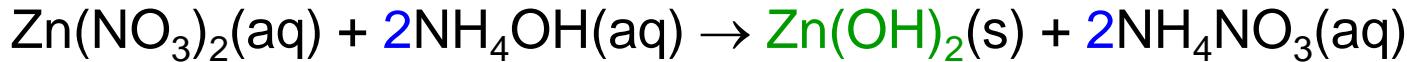
Complete Qualitative Analysis 7.



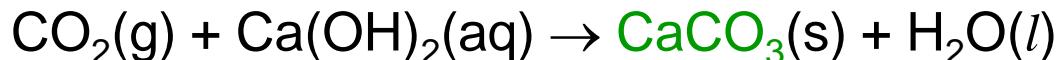
- Formation of **W** and **X**



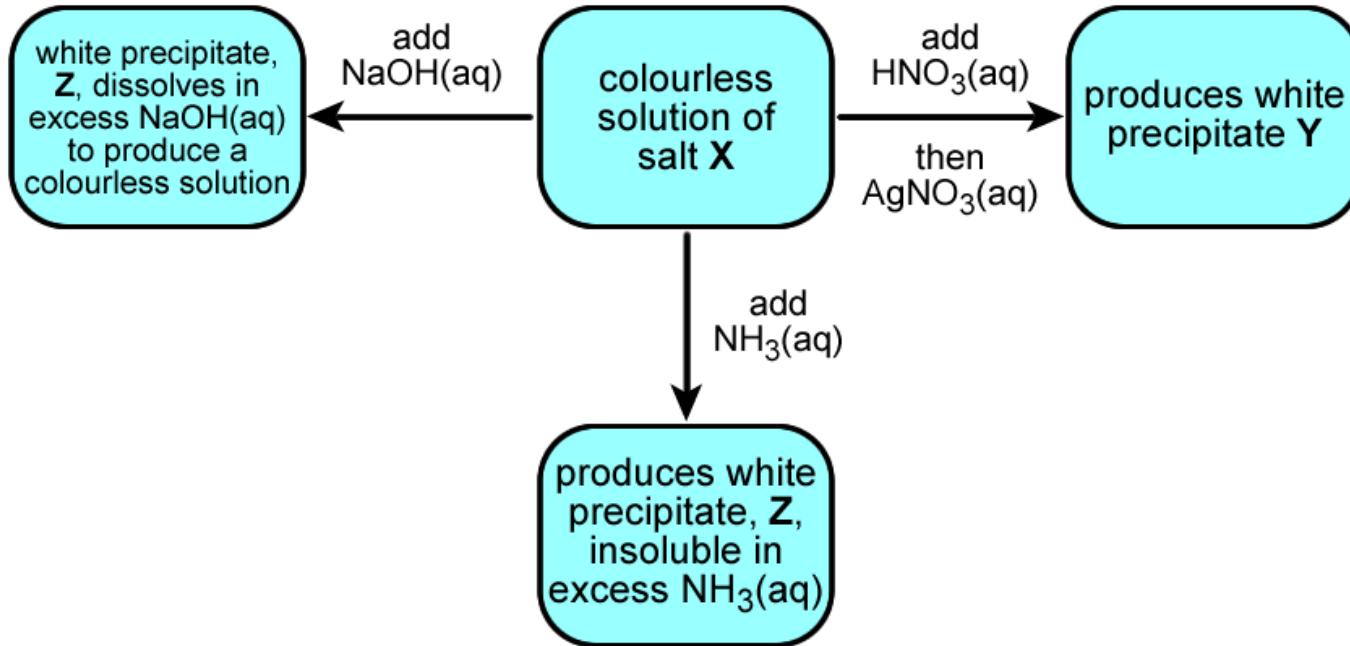
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 8.

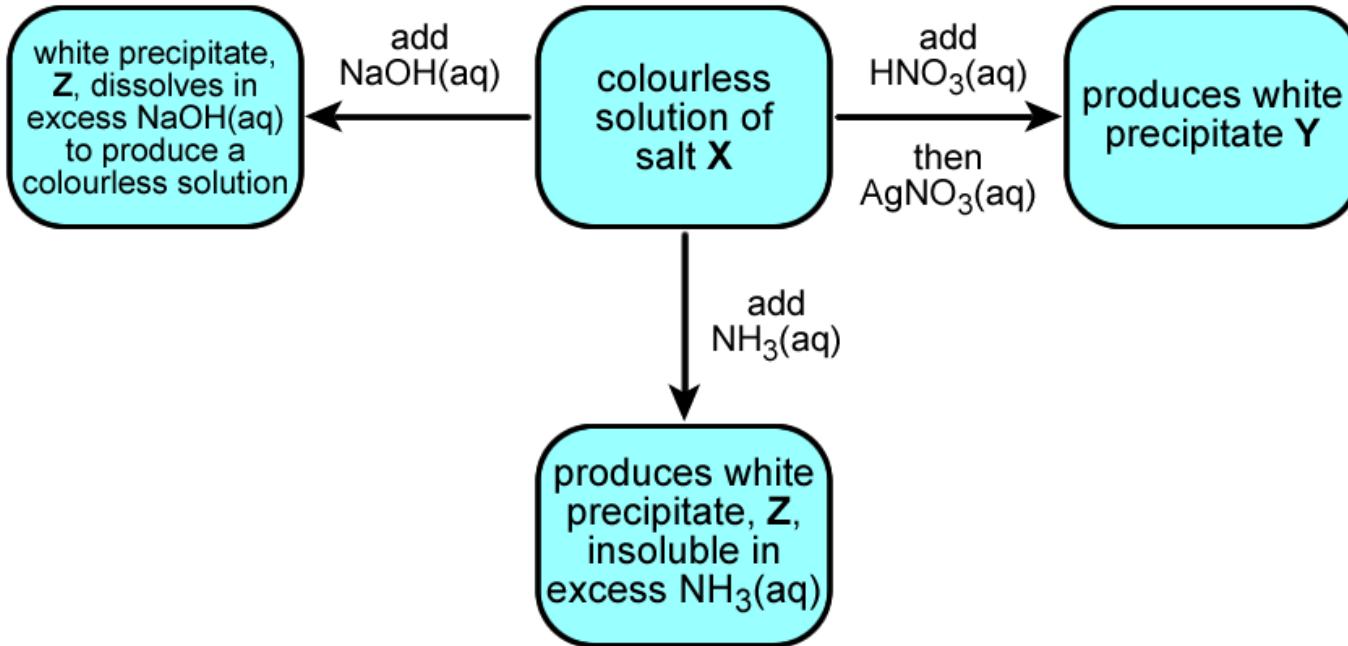


- Identify **X**, **Y** and **Z**.

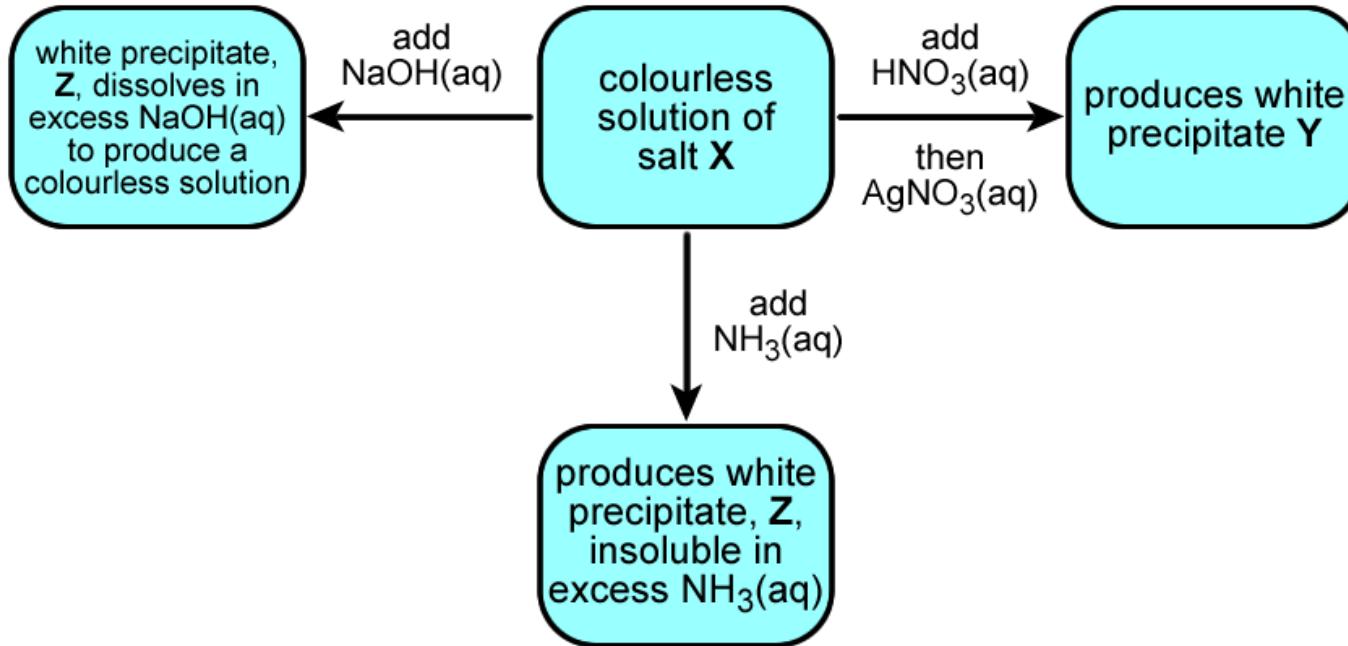


- Return to Index of Salts

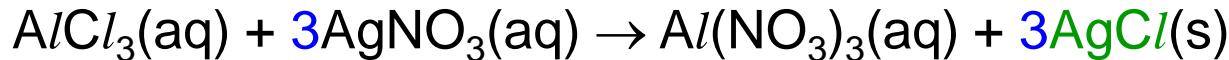
Complete Qualitative Analysis 8.



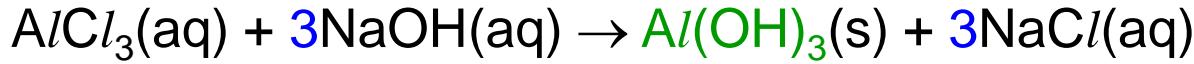
Complete Qualitative Analysis 8.



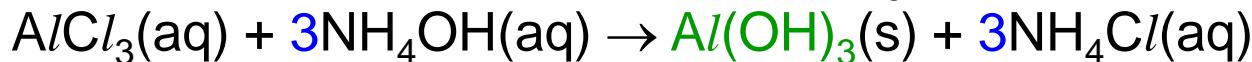
- Formation of Y



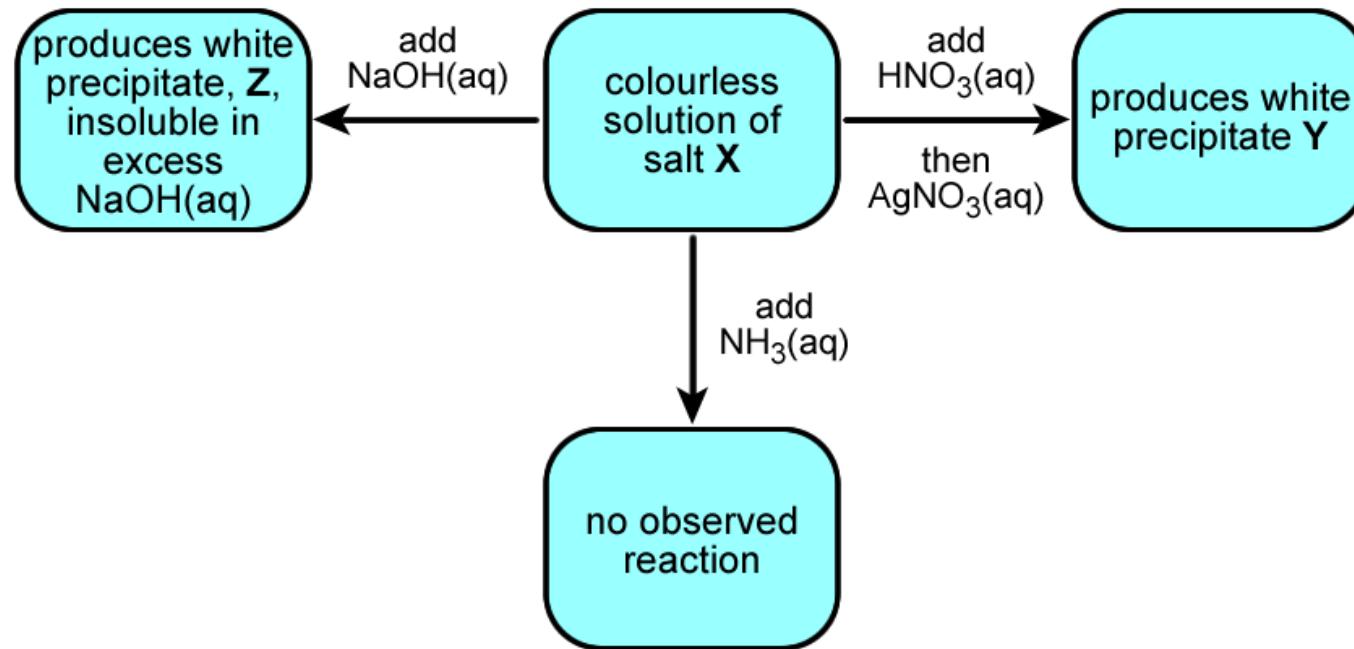
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 9.

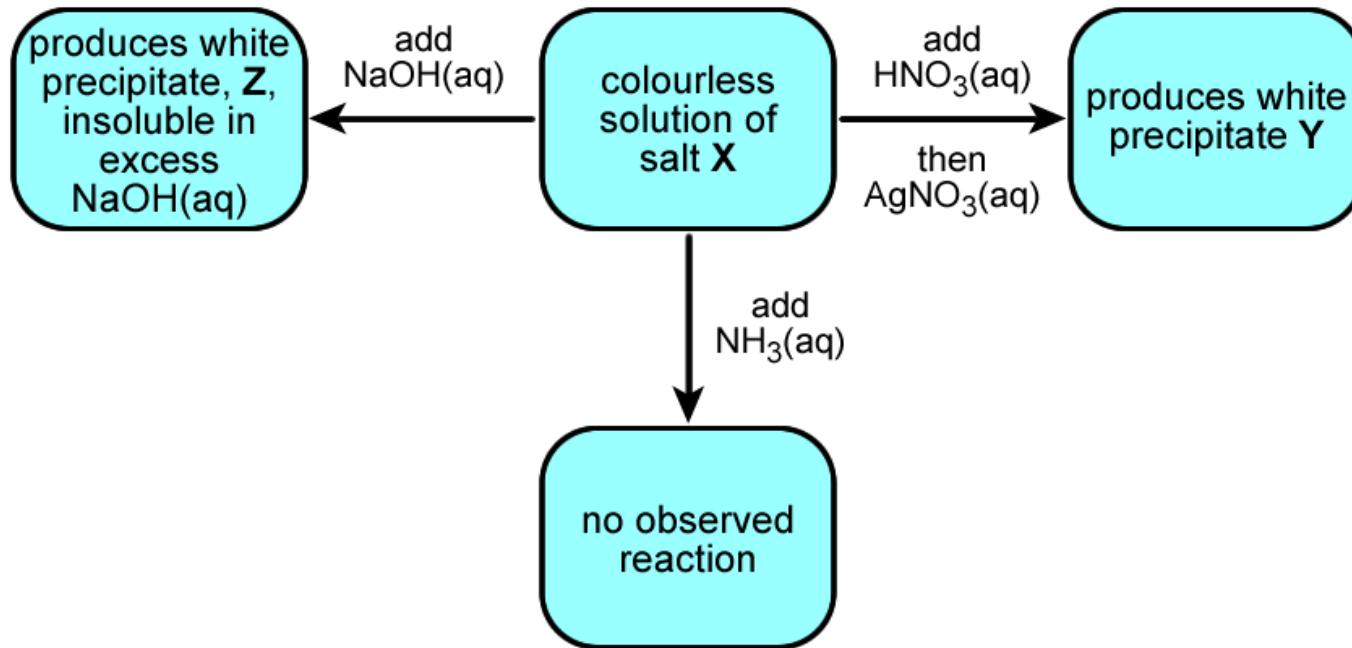


- Identify **X**, **Y** and **Z**.

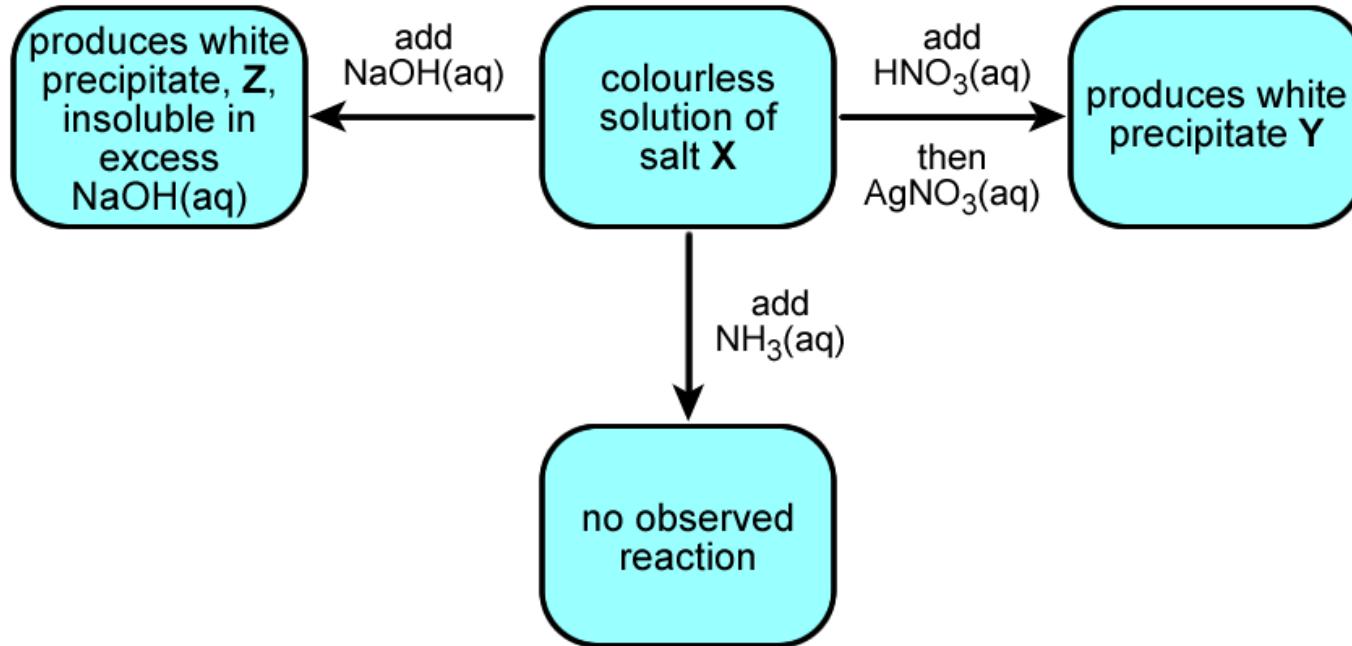


- Return to Index of Salts

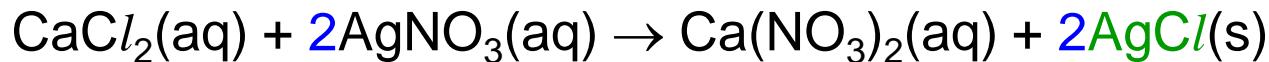
Complete Qualitative Analysis 9.



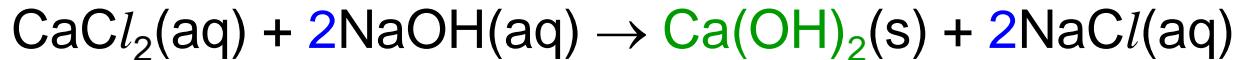
Complete Qualitative Analysis 9.



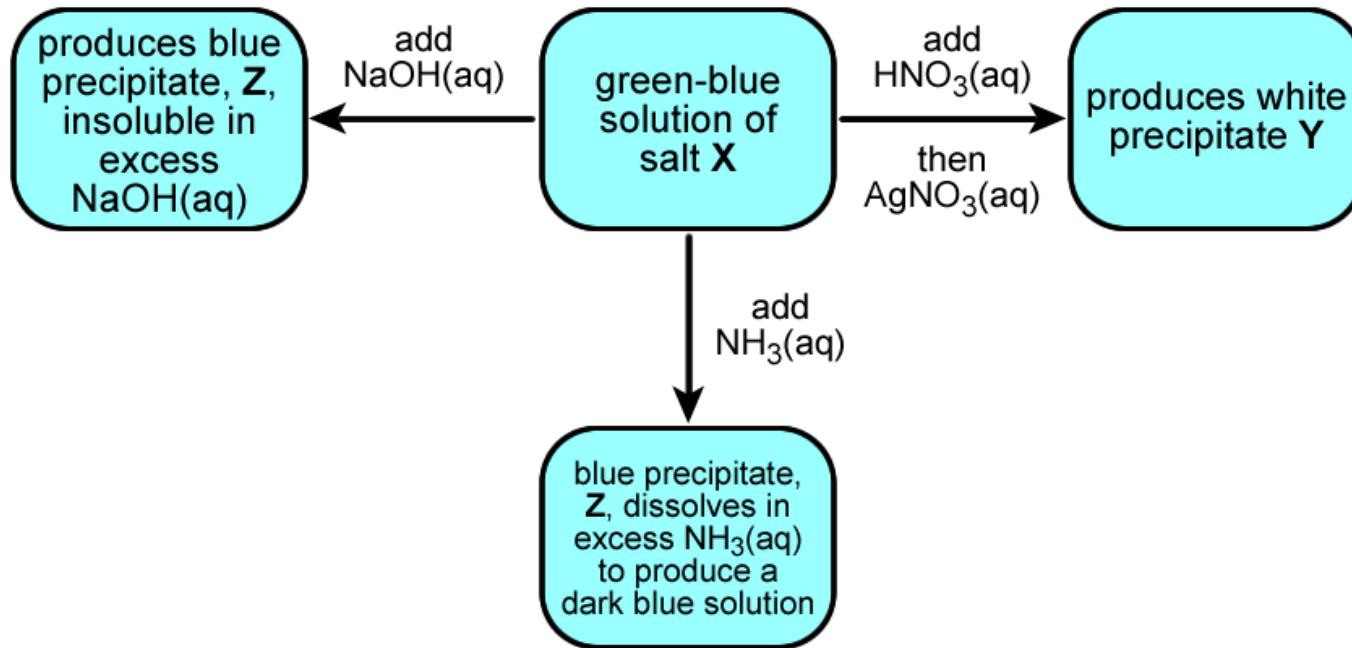
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 10.

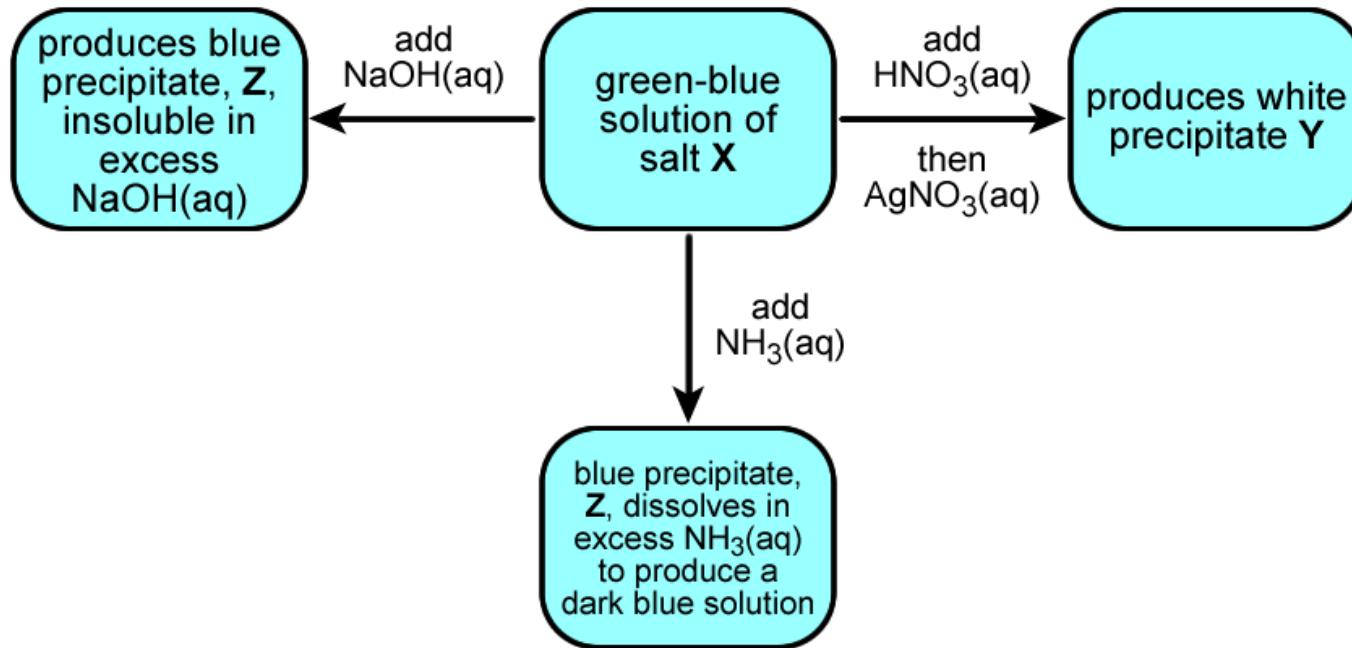


- Identify **X**, **Y** and **Z**.

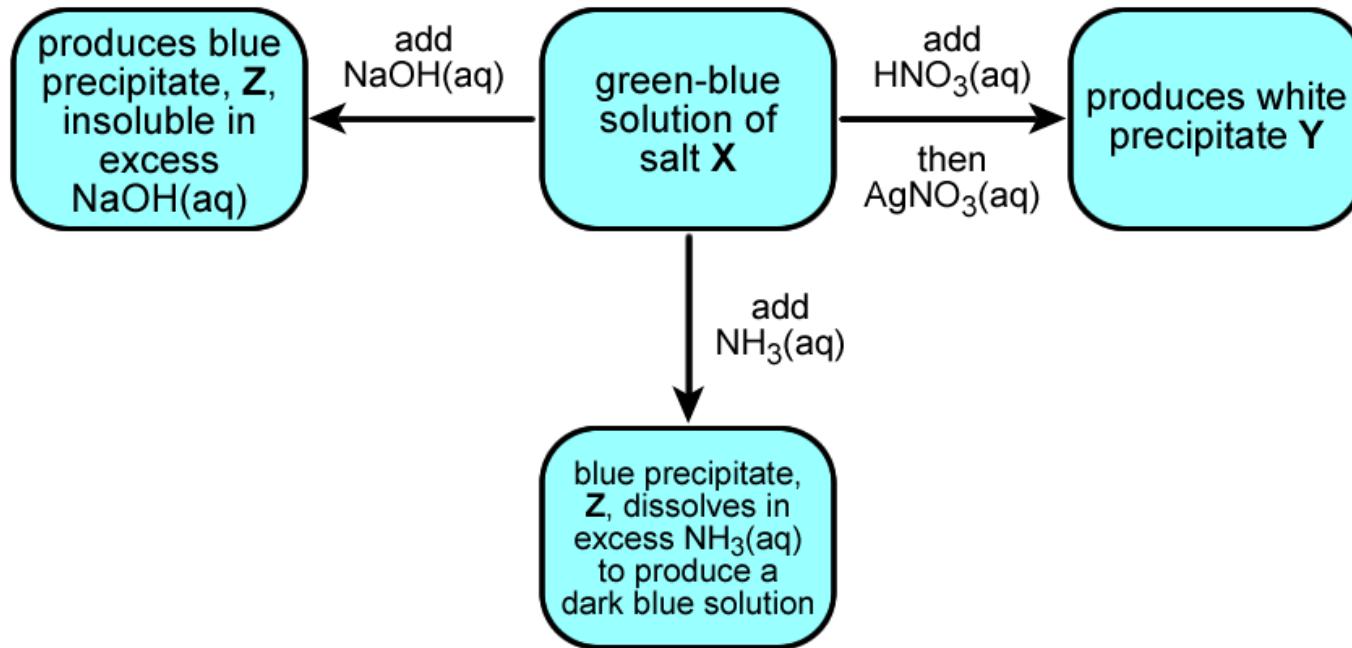


- Return to Index of Salts

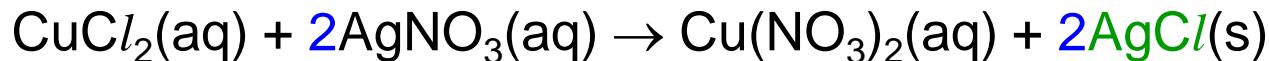
Complete Qualitative Analysis 10.



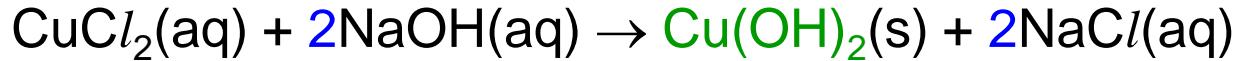
Complete Qualitative Analysis 10.



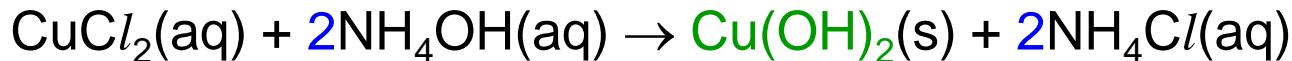
- Formation of **Y**



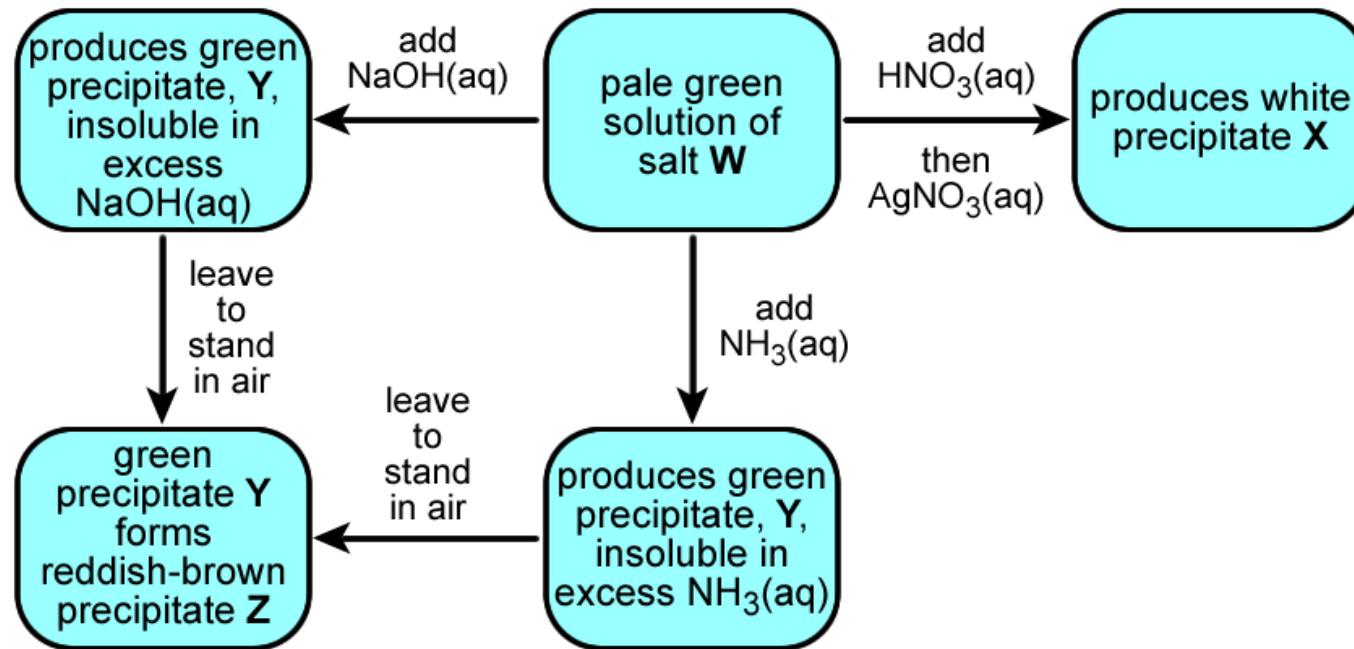
- Formation of **Z** using $\text{NaOH}(\text{aq})$



- Formation of **Z** using $\text{NH}_3(\text{aq})$



Complete Qualitative Analysis 11.

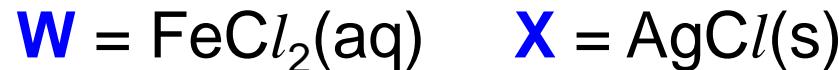
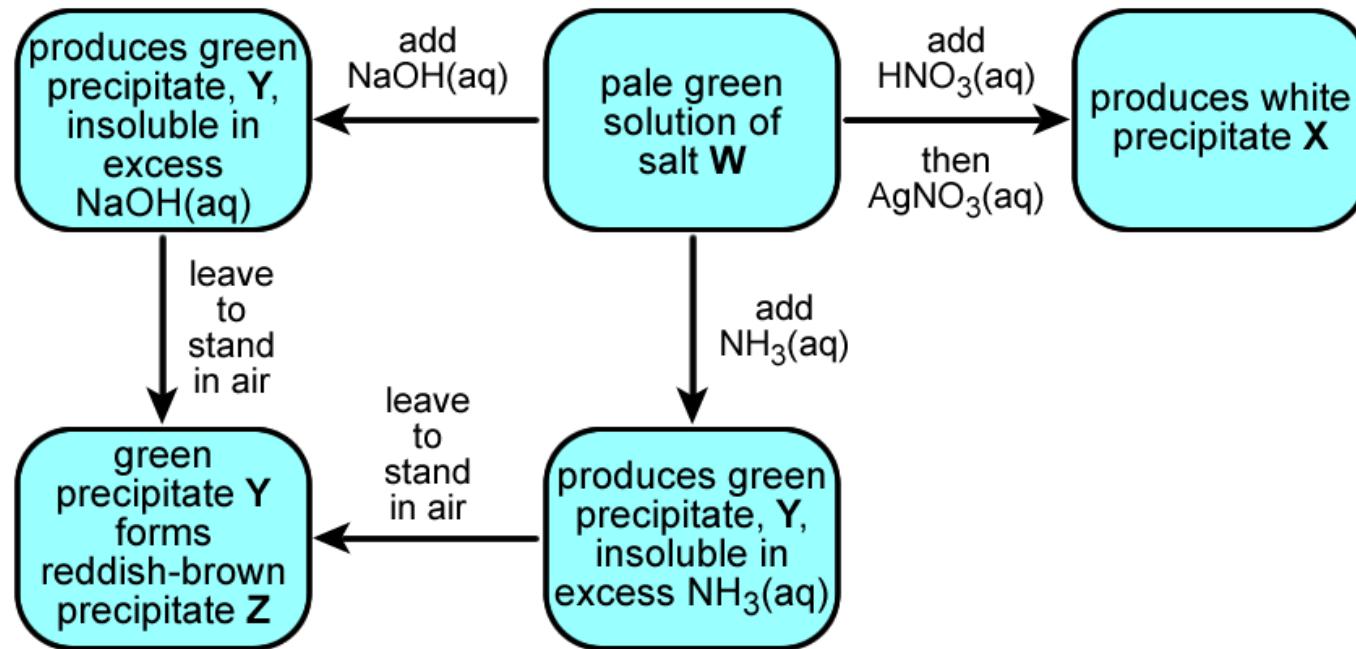


- Identify **W, X, Y** and **Z**.

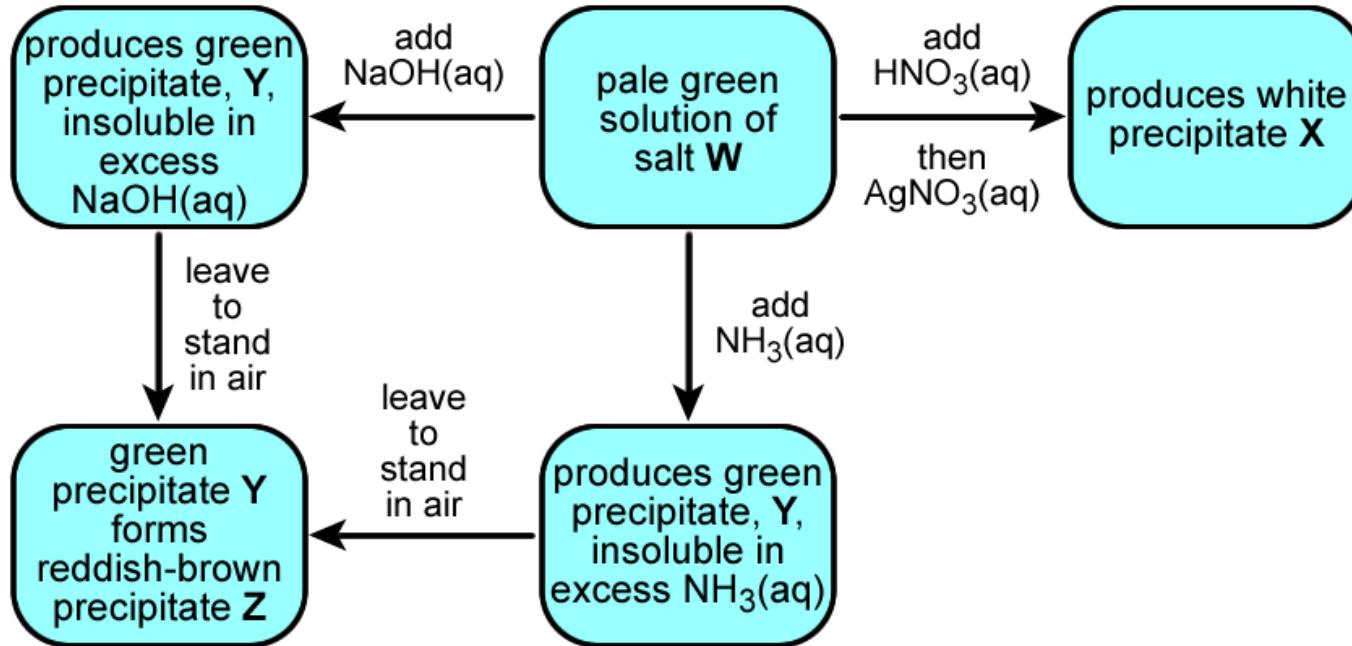


- Return to Index of Salts

Complete Qualitative Analysis 11.



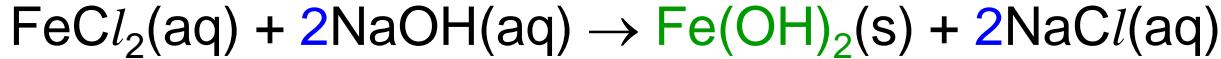
Complete Qualitative Analysis 11.



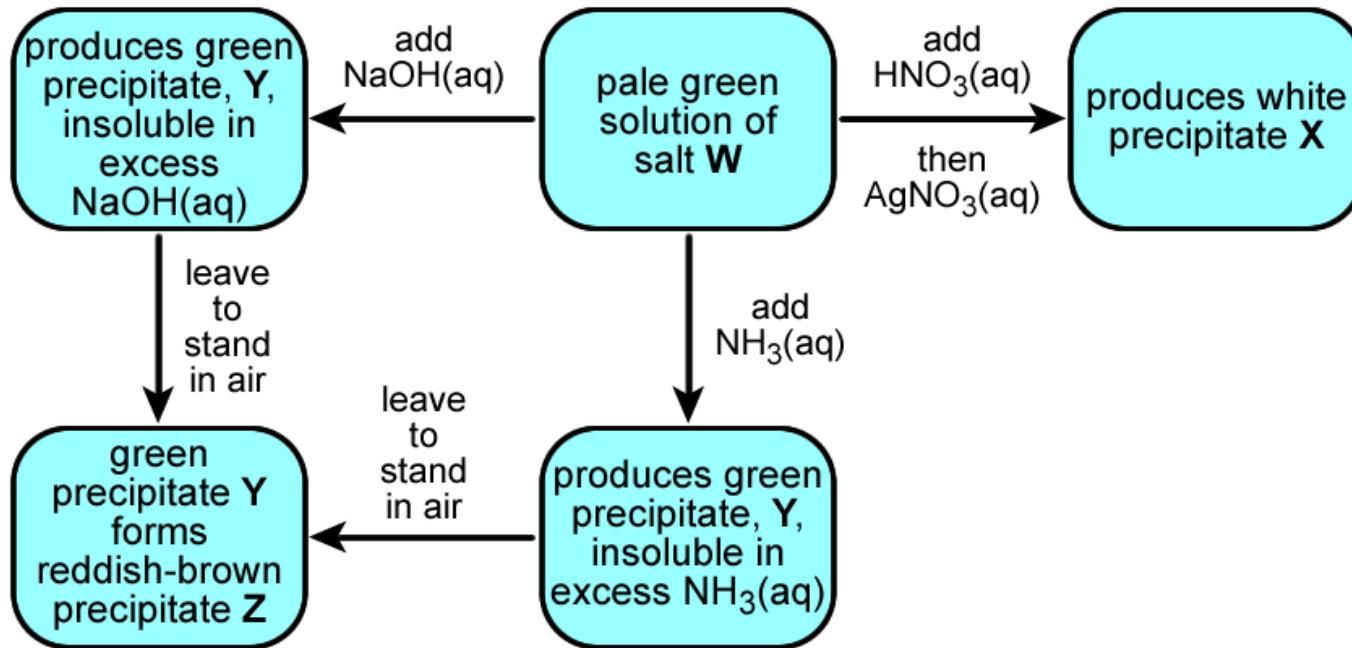
- Formation of X



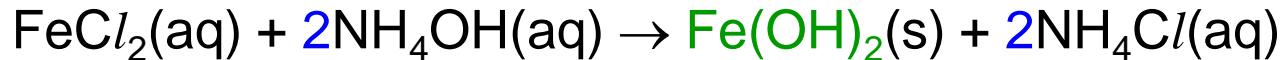
- Formation of Y using NaOH(aq)



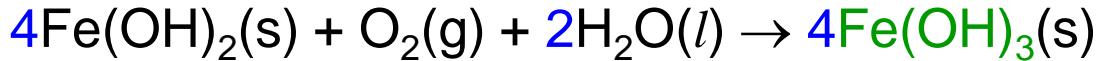
Complete Qualitative Analysis 11.



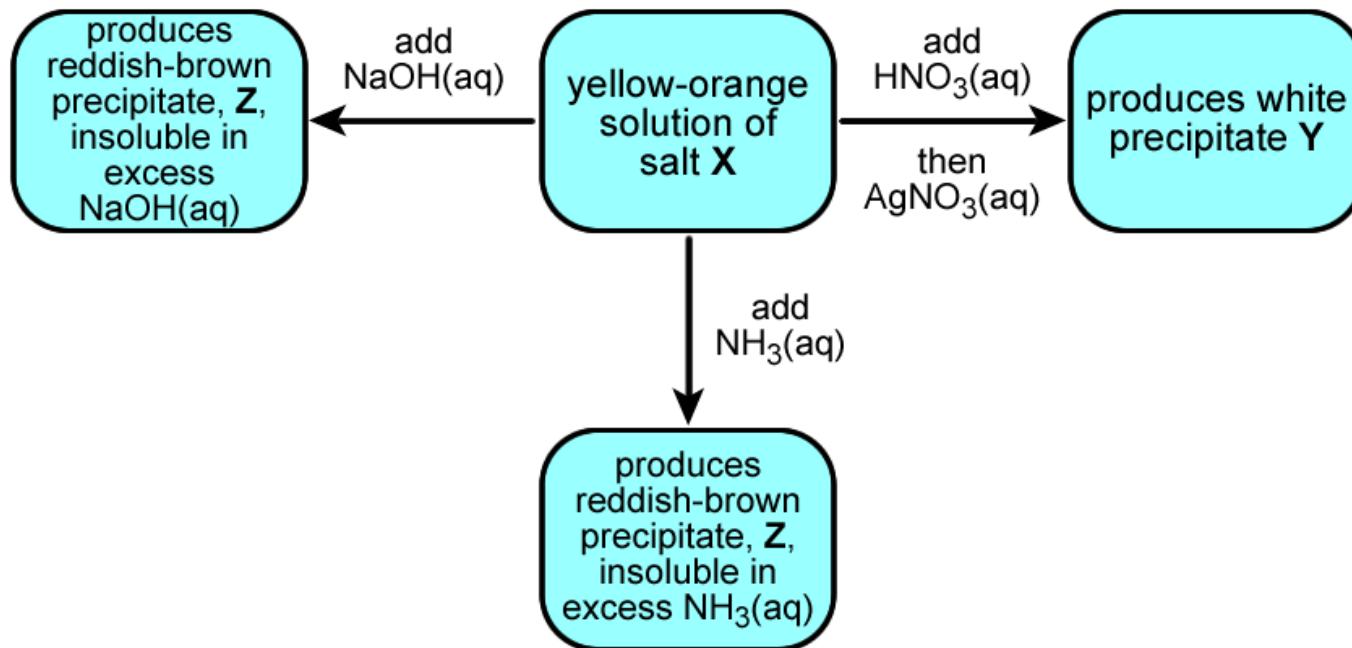
- Formation of **Y** using NH₃(aq)



- Formation of **Z** – the aerial oxidation of Fe²⁺(aq) to Fe³⁺(aq):



Complete Qualitative Analysis 12.

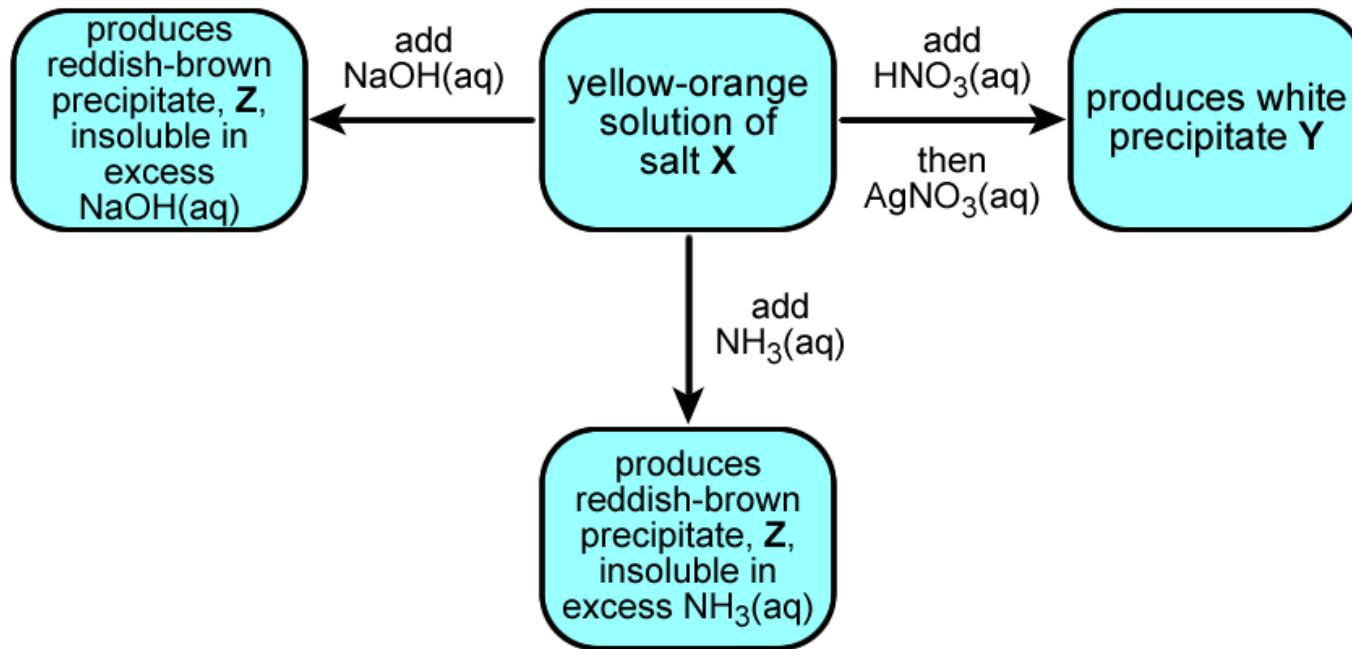


- Identify **X**, **Y** and **Z**.

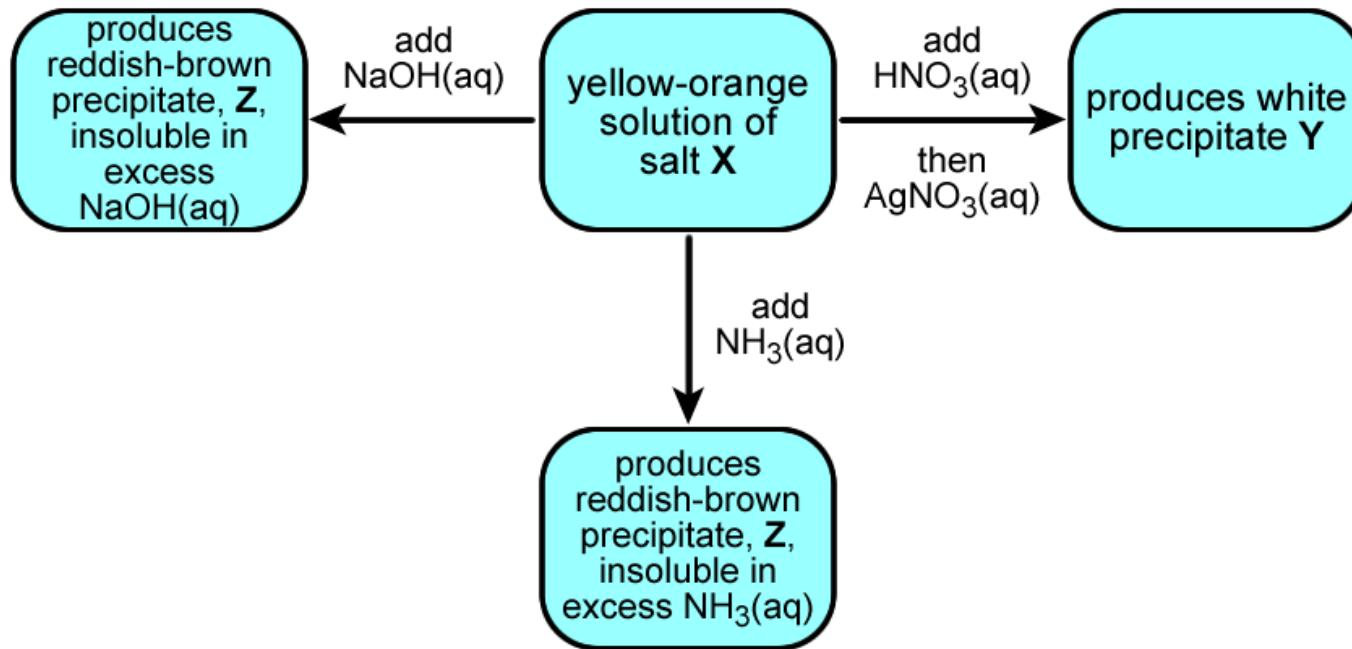
- Return to Index of Salts



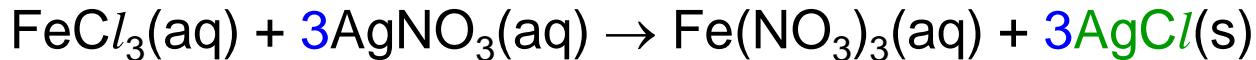
Complete Qualitative Analysis 12.



Complete Qualitative Analysis 12.



- Formation of **Y**



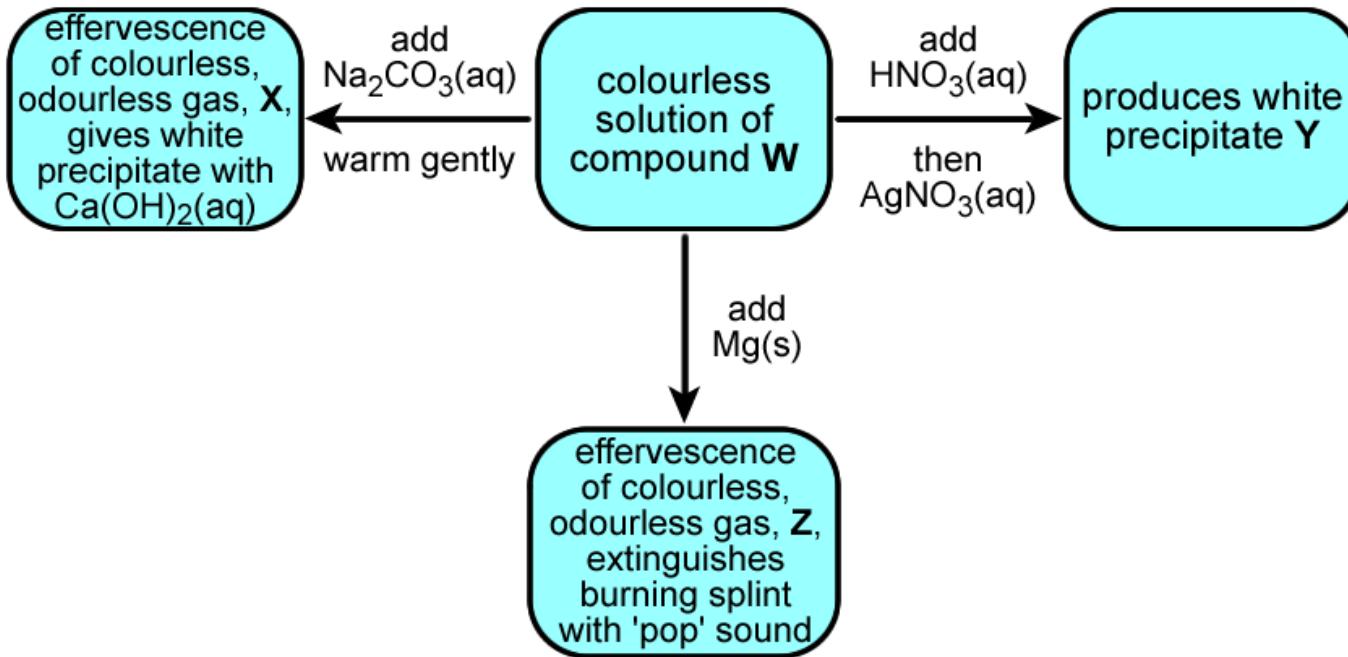
- Formation of **Z** using $\text{NaOH}(\text{aq})$



- Formation of **Z** using $\text{NH}_3(\text{aq})$



Complete Qualitative Analysis 13.

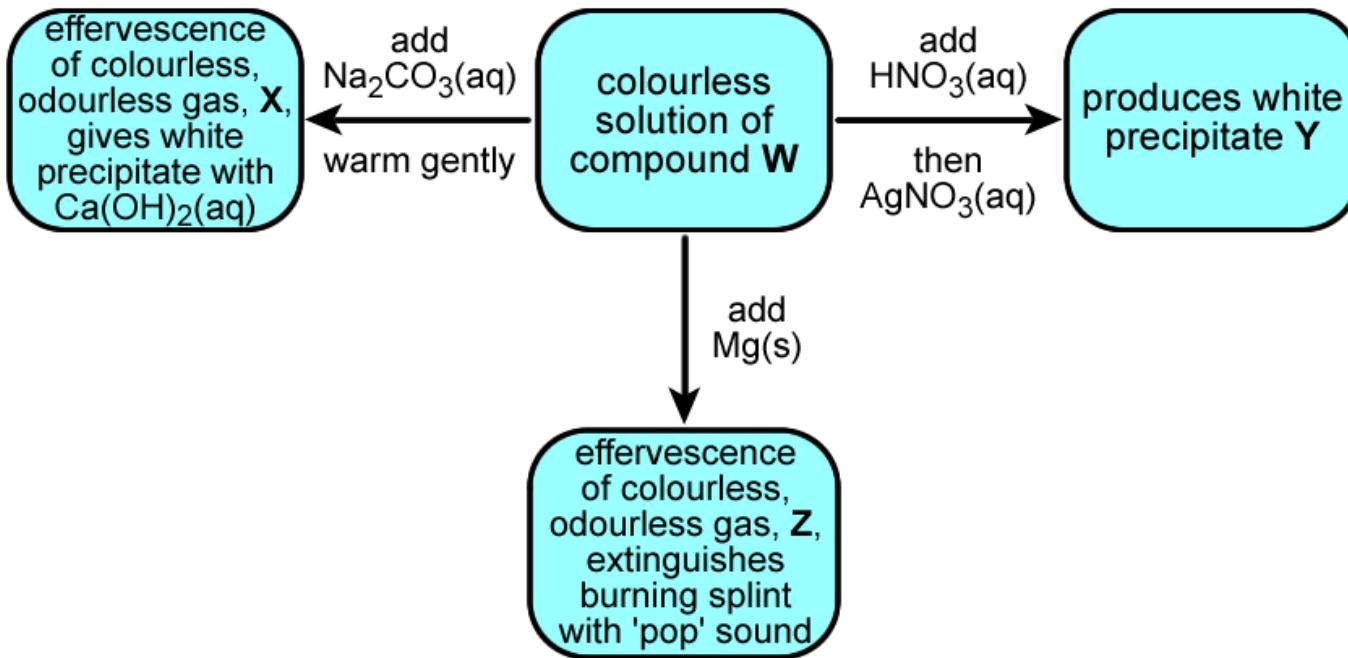


- Identify **W**, **X**, **Y** and **Z**.

- Return to Index of Salts



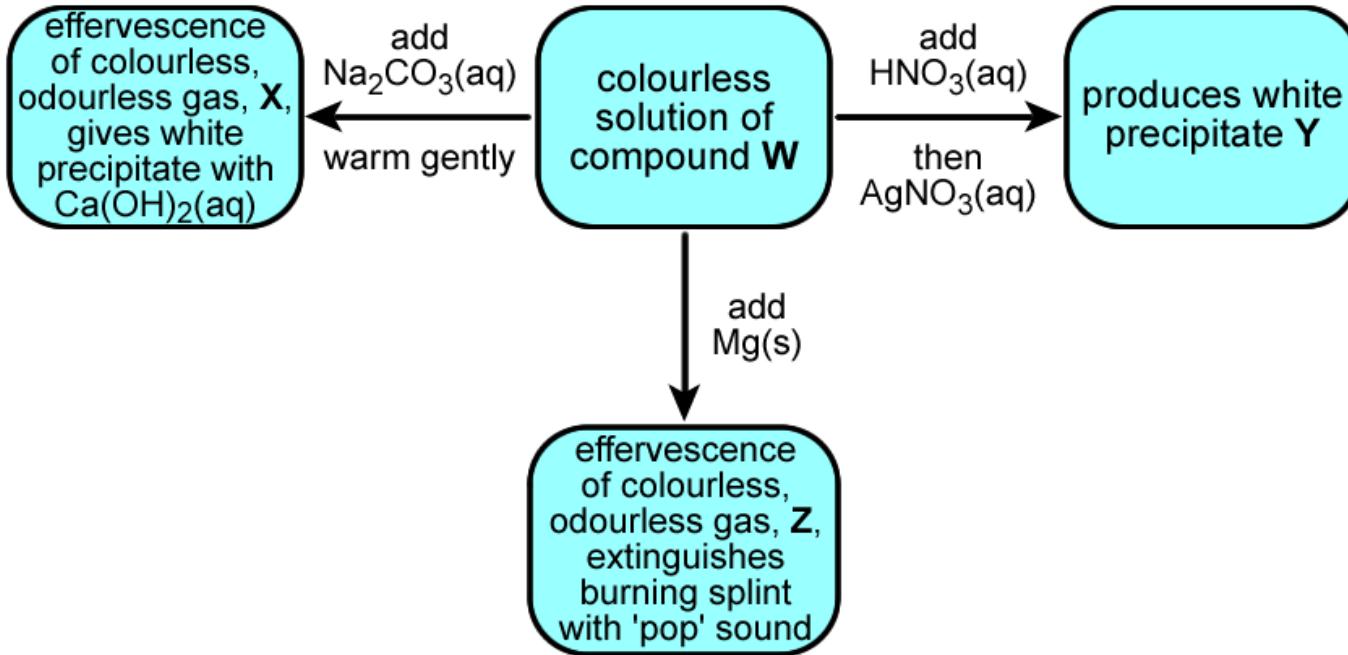
Complete Qualitative Analysis 13.



$$\mathbf{W} = \text{HCl}(\text{aq}) \quad \mathbf{X} = \text{CO}_2(\text{g}) \quad \mathbf{Y} = \text{AgCl}(\text{s}) \quad \mathbf{Z} = \text{H}_2(\text{g})$$



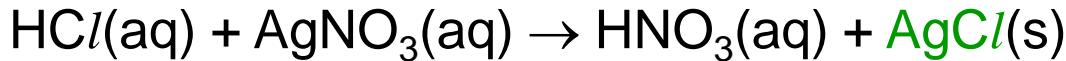
Complete Qualitative Analysis 13.



- Formation of X



- Formation of Y



- Formation of Z



Complete Qualitative Analysis 14.

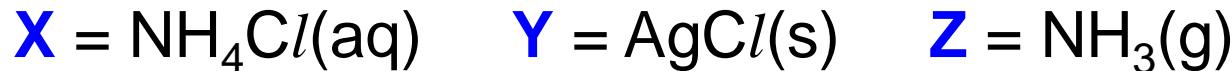
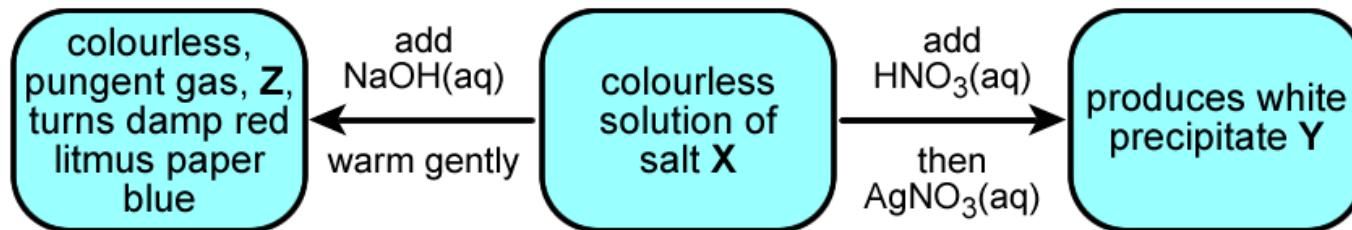


- Identify **X**, **Y** and **Z**.

- Return to Index of Salts



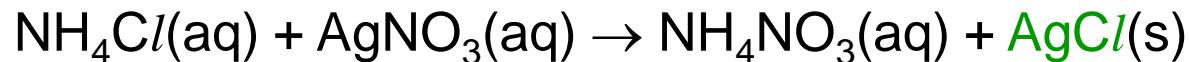
Complete Qualitative Analysis 14.



Complete Qualitative Analysis 14.



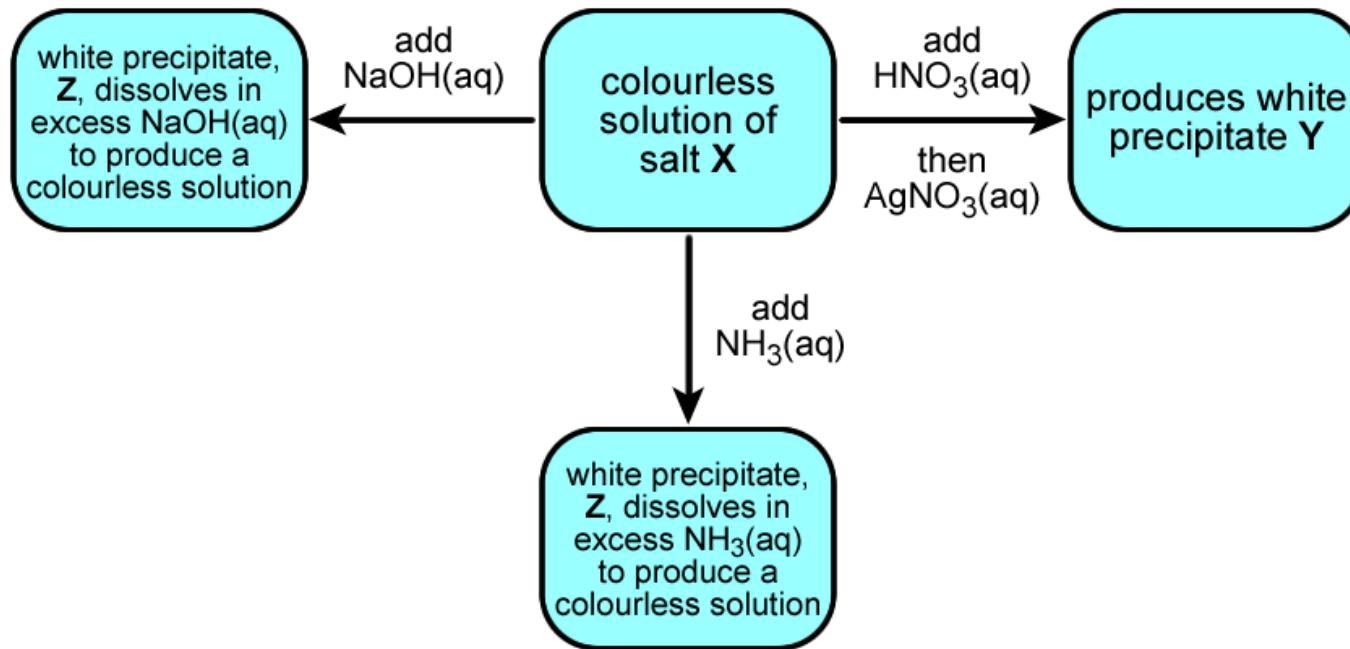
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 15.

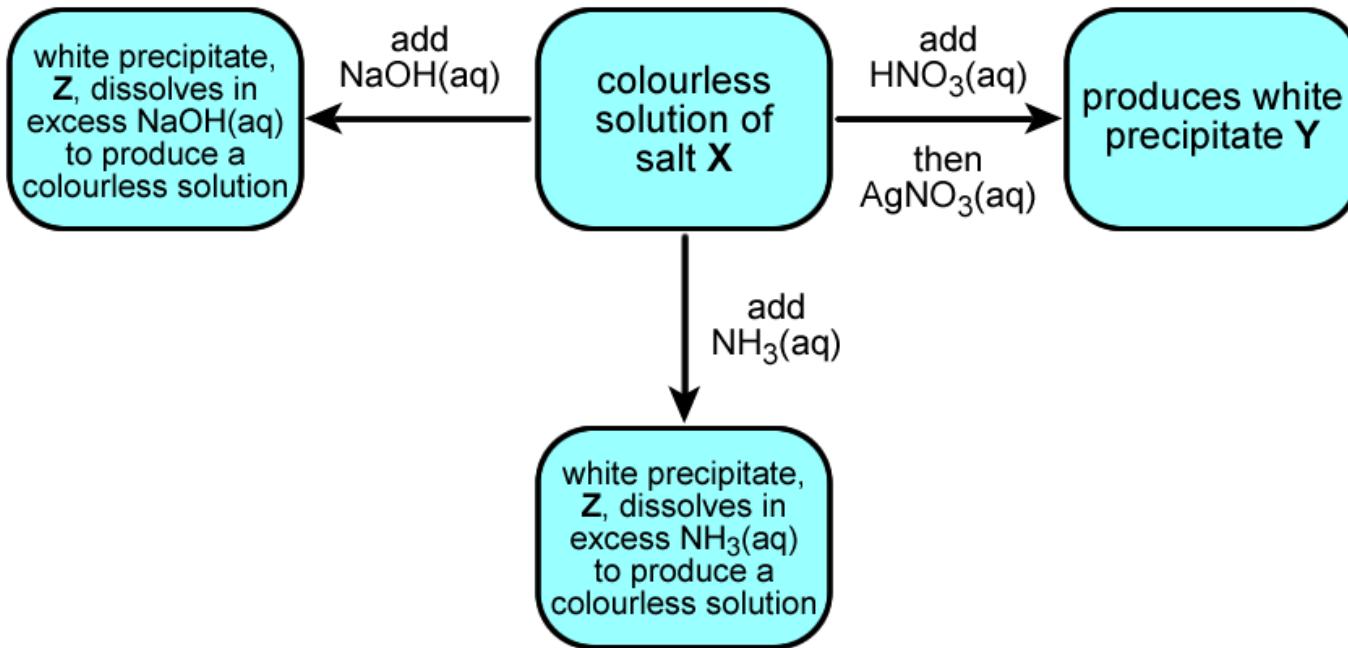


- Identify **X**, **Y** and **Z**.

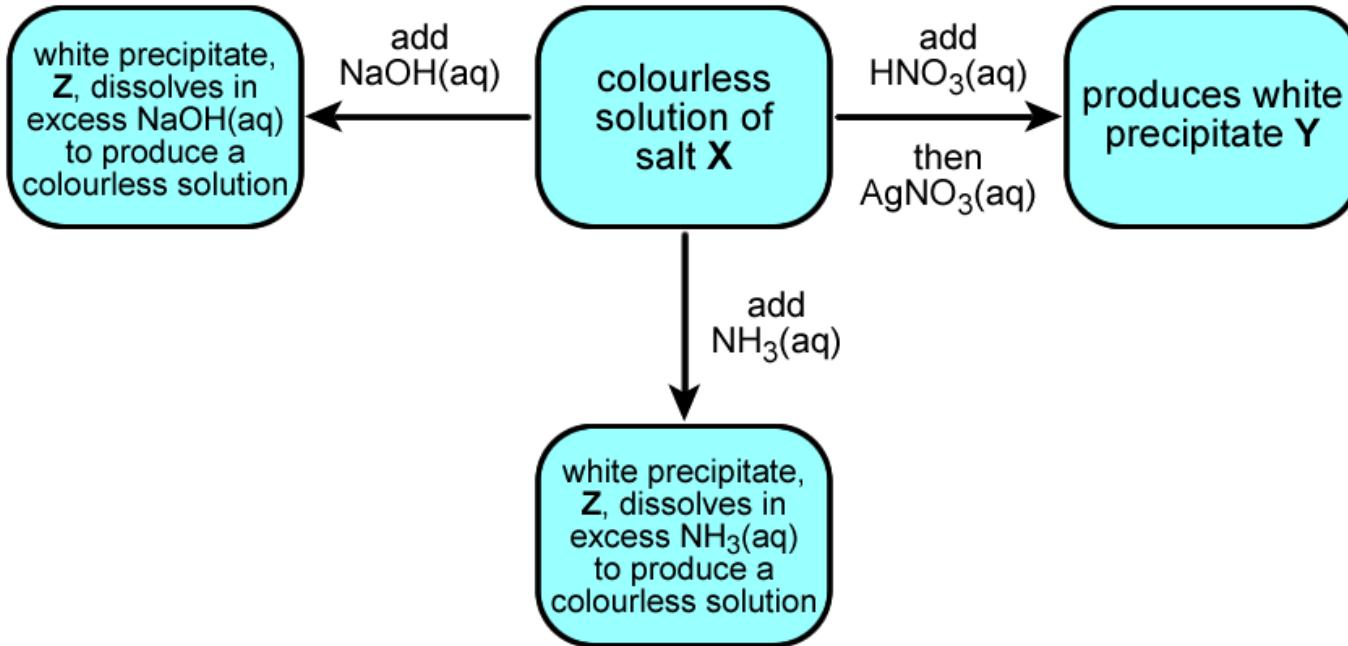


- Return to Index of Salts

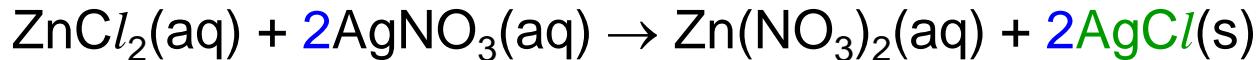
Complete Qualitative Analysis 15.



Complete Qualitative Analysis 15.



- Formation of Y



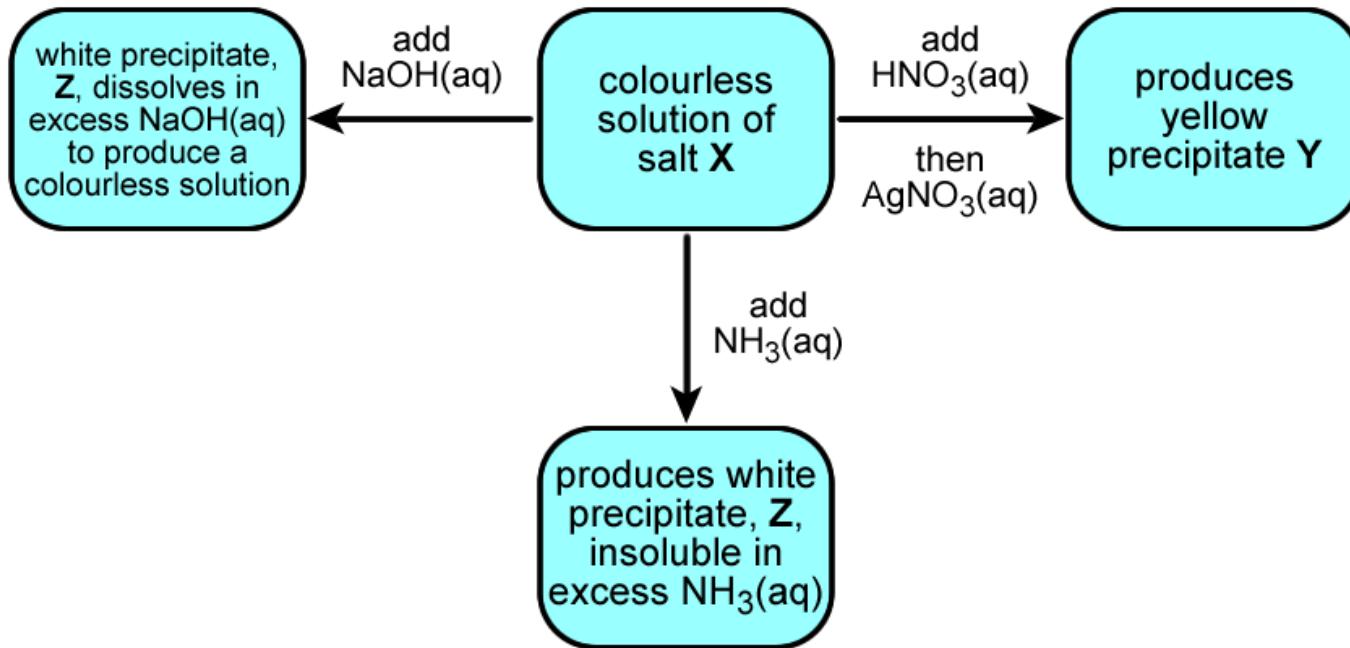
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 16.

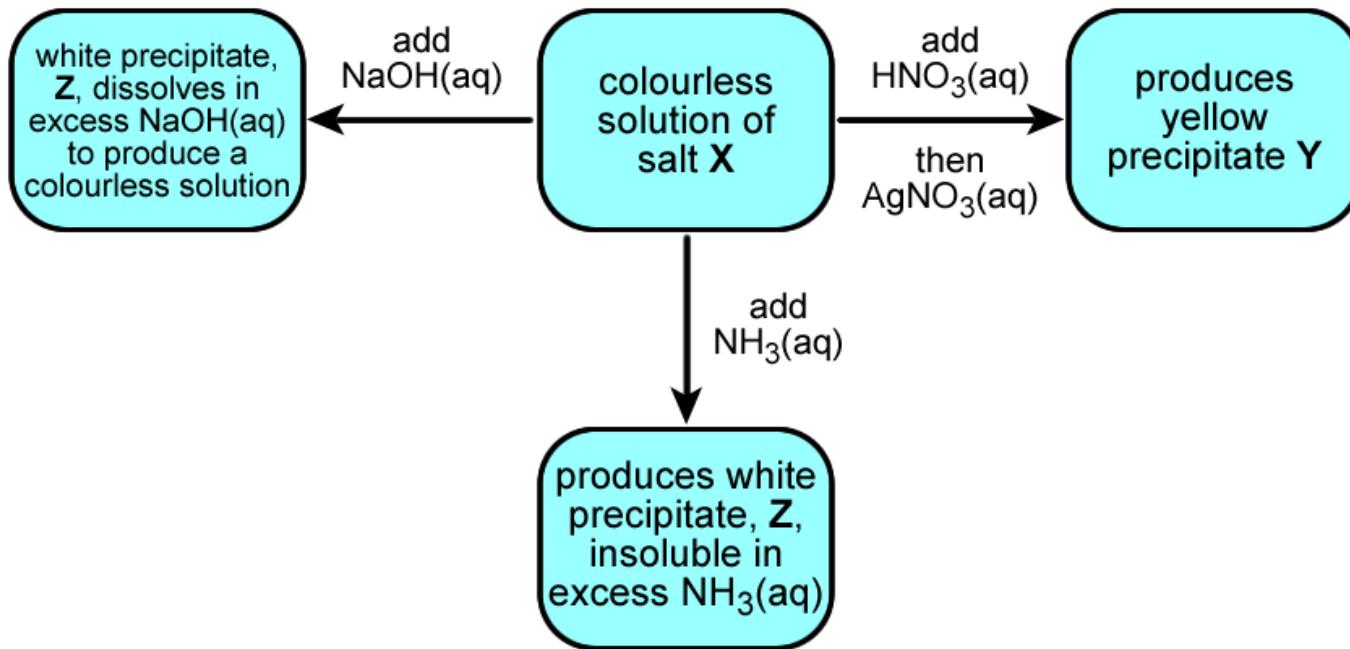


- Identify **X**, **Y** and **Z**.

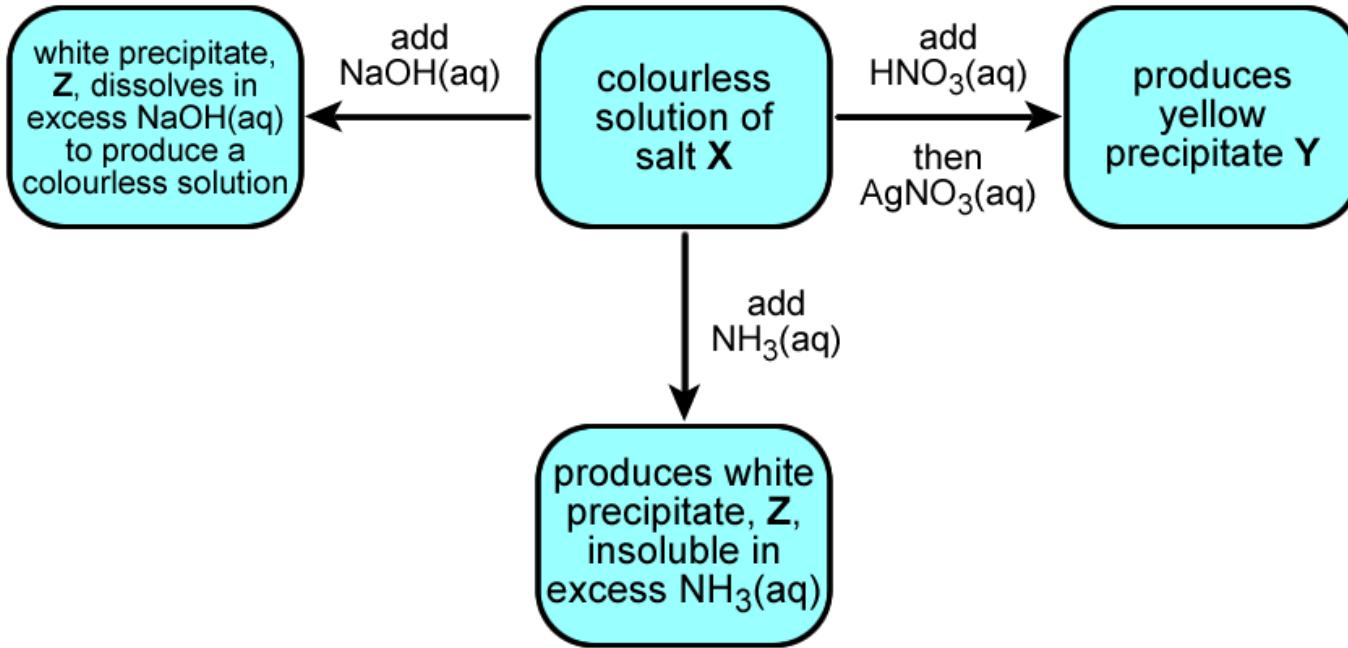


- Return to Index of Salts

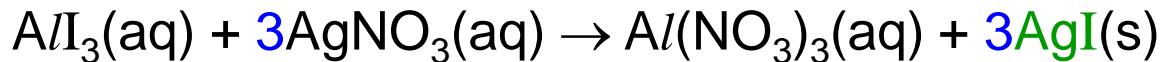
Complete Qualitative Analysis 16.



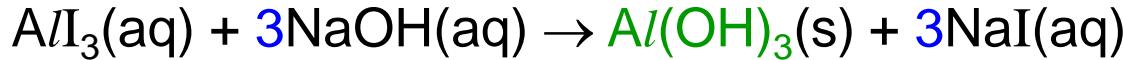
Complete Qualitative Analysis 16.



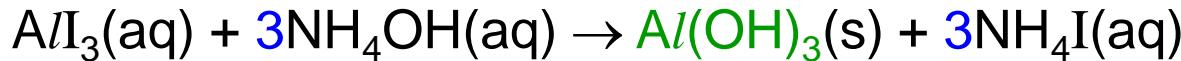
- Formation of Y



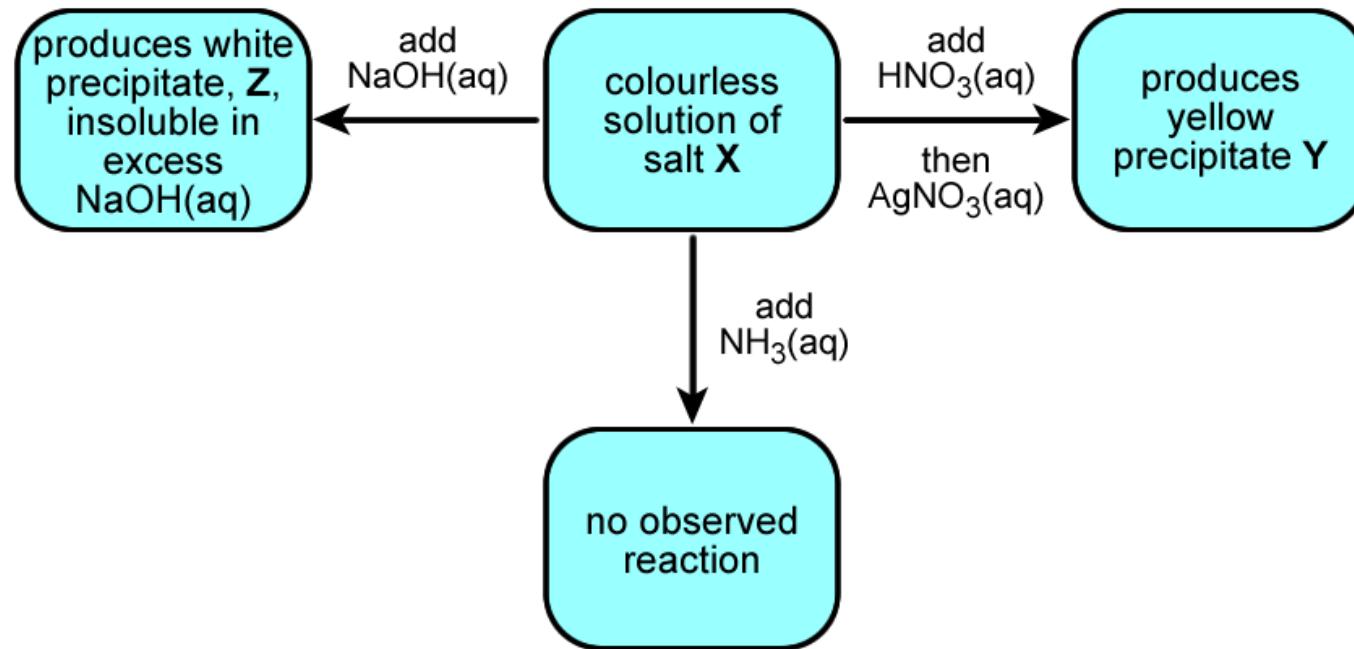
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 17.

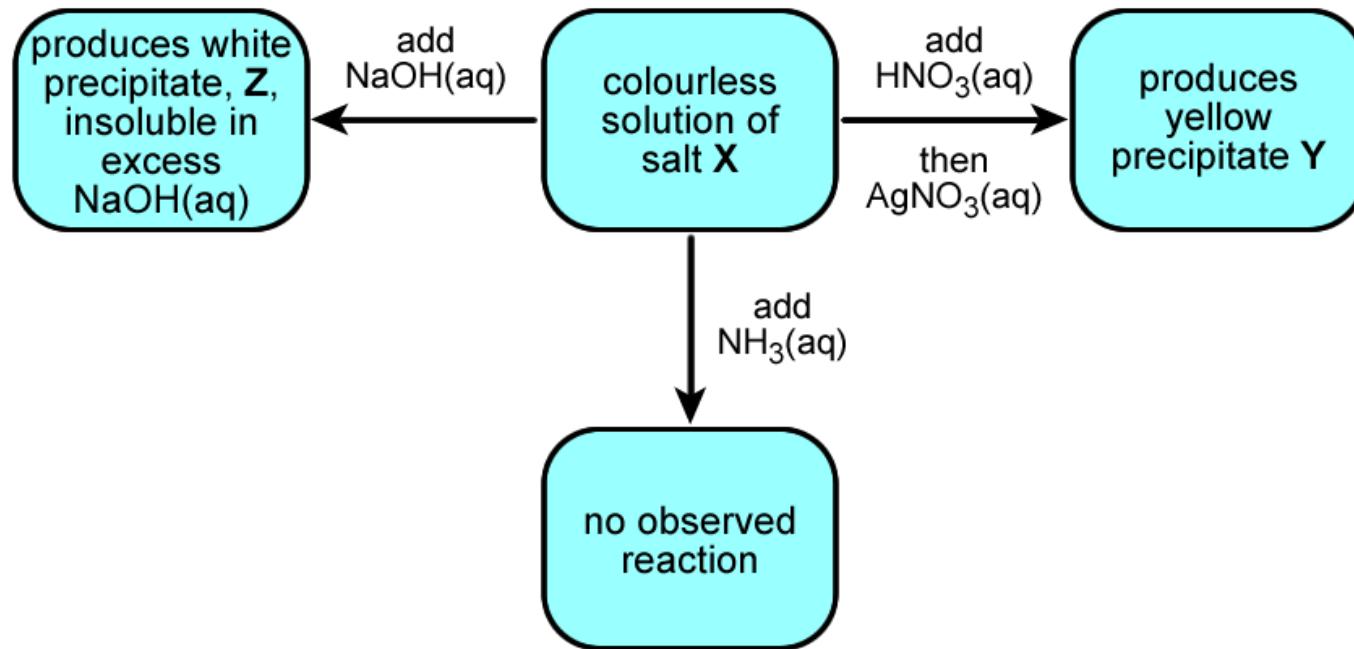


- Identify **X**, **Y** and **Z**.

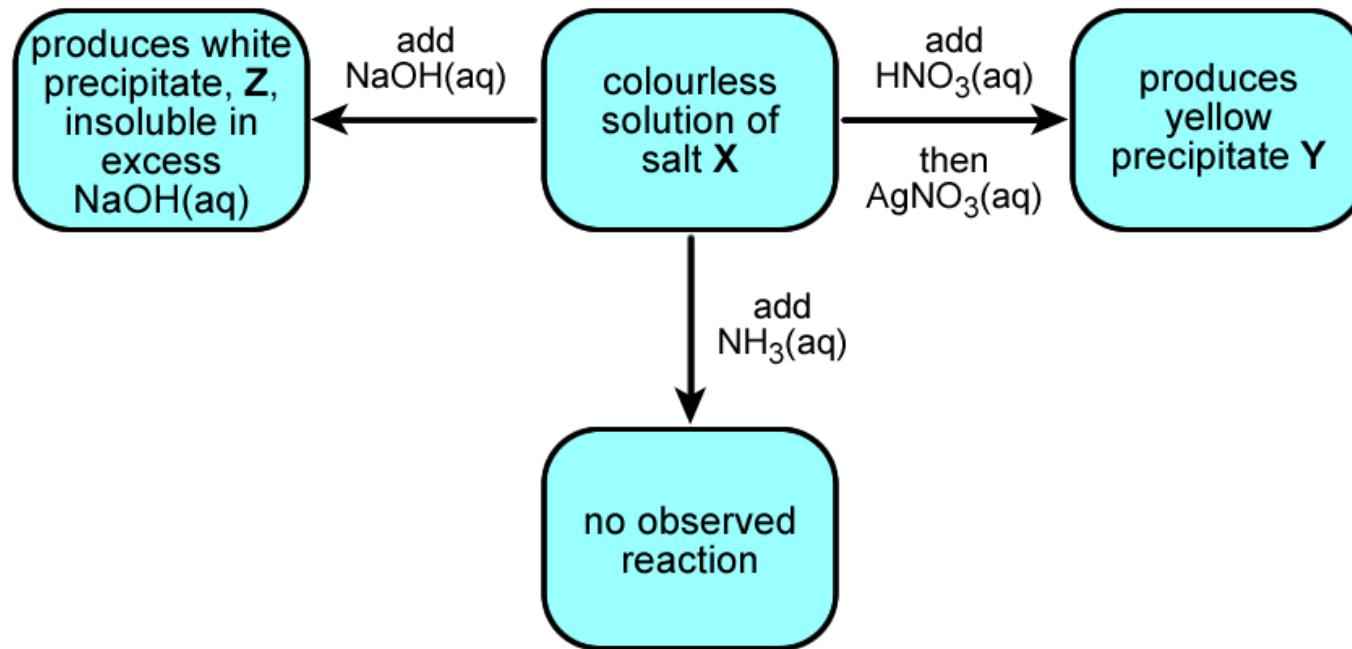
- Return to Index of Salts



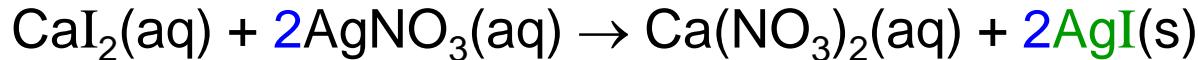
Complete Qualitative Analysis 17.



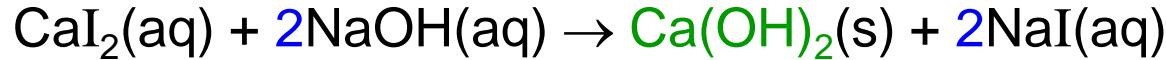
Complete Qualitative Analysis 17.



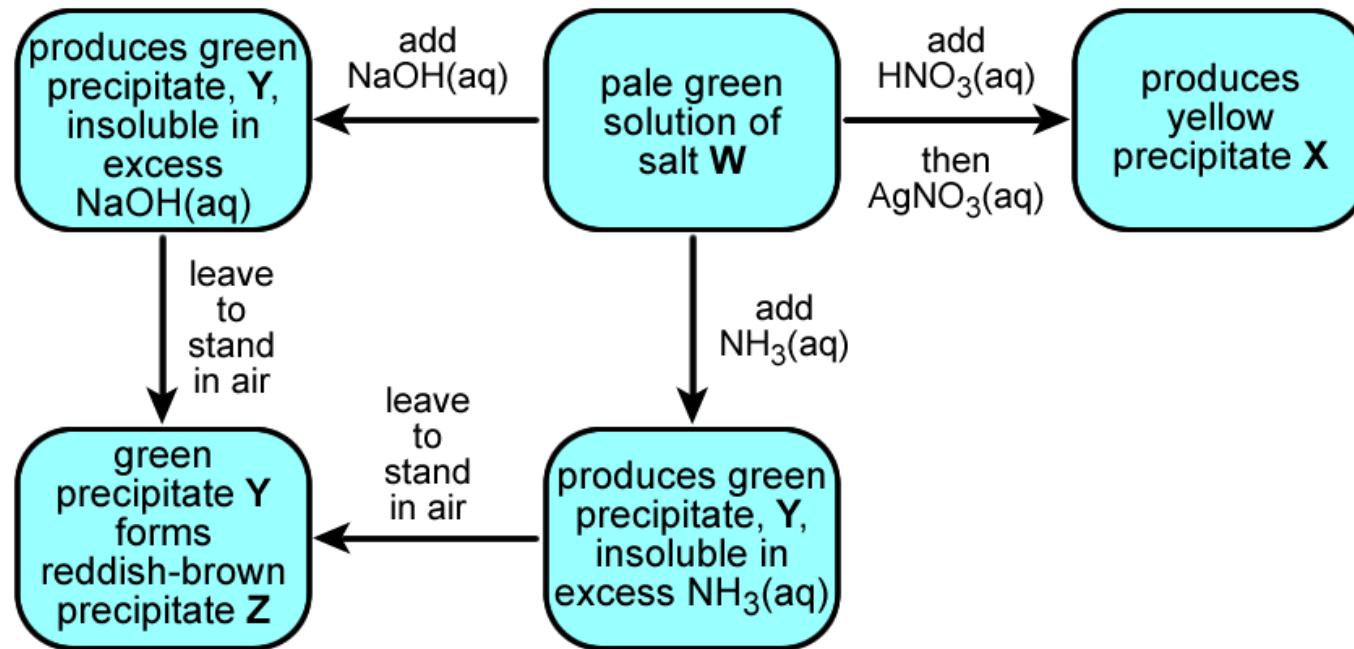
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 18.

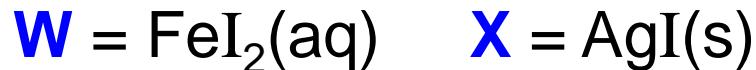
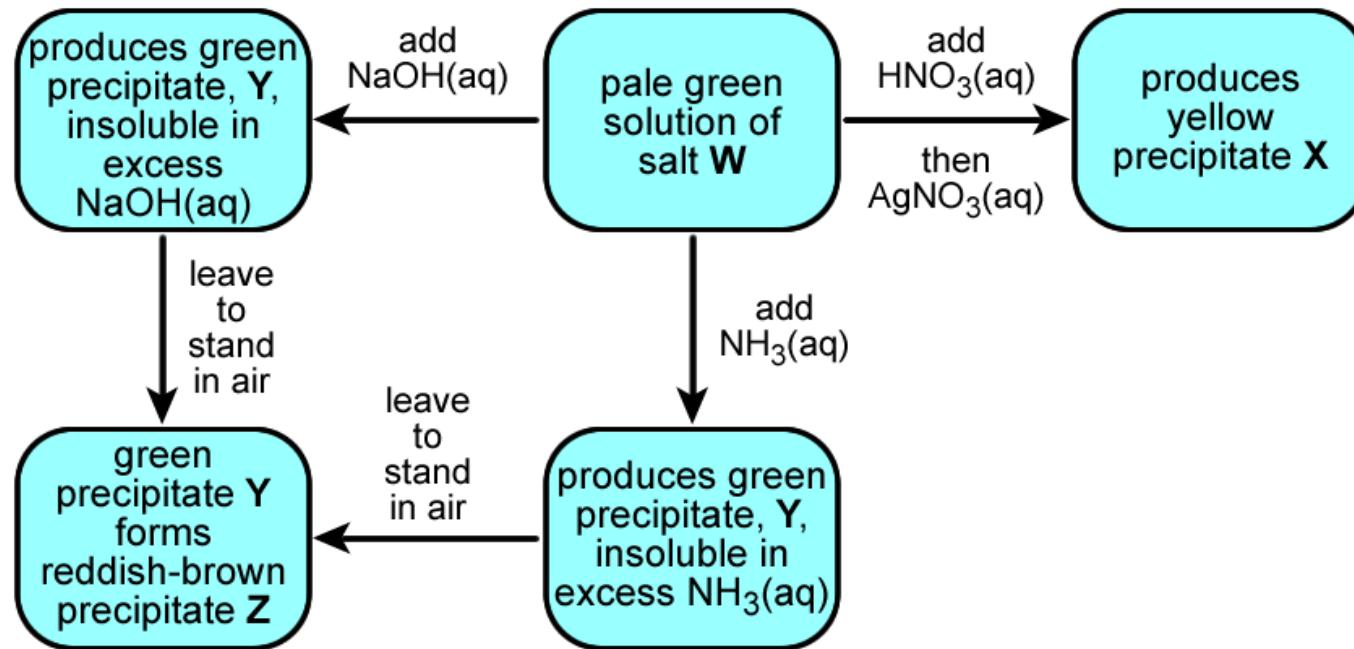


- Identify **W, X, Y** and **Z**.

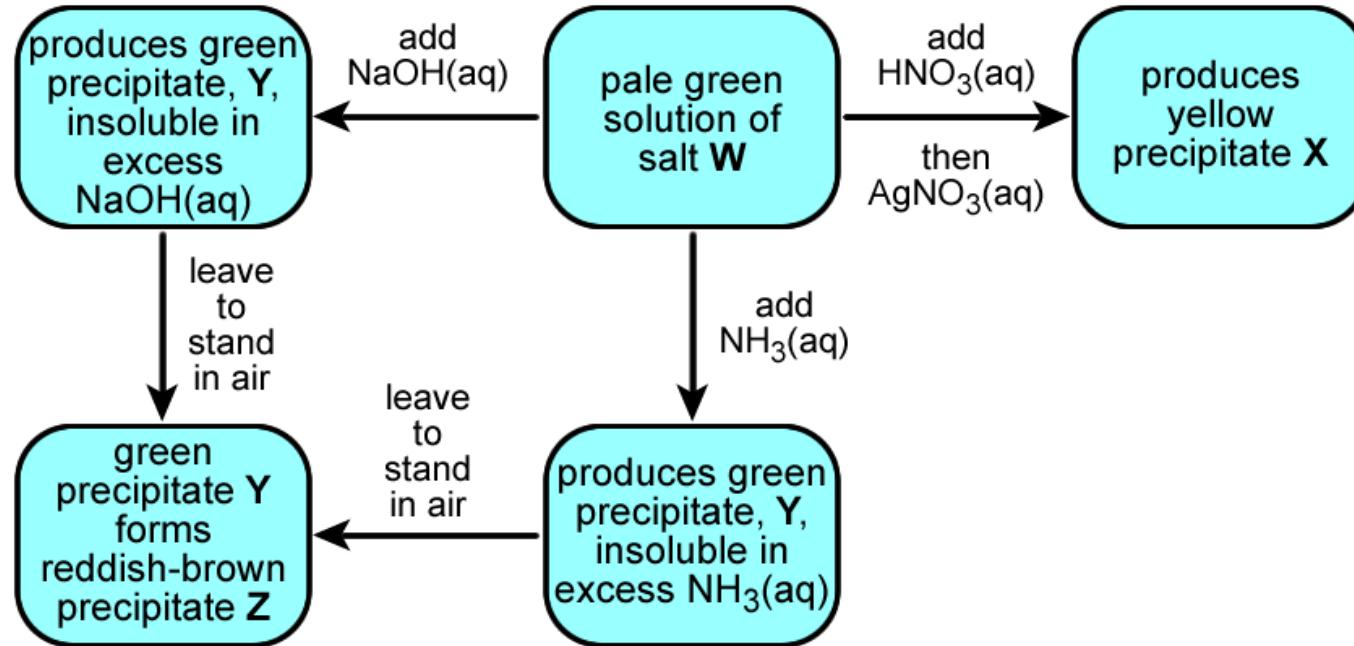


- Return to Index of Salts

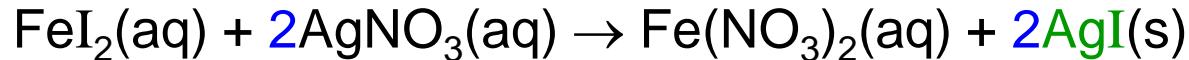
Complete Qualitative Analysis 18.



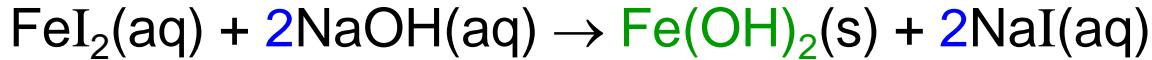
Complete Qualitative Analysis 18.



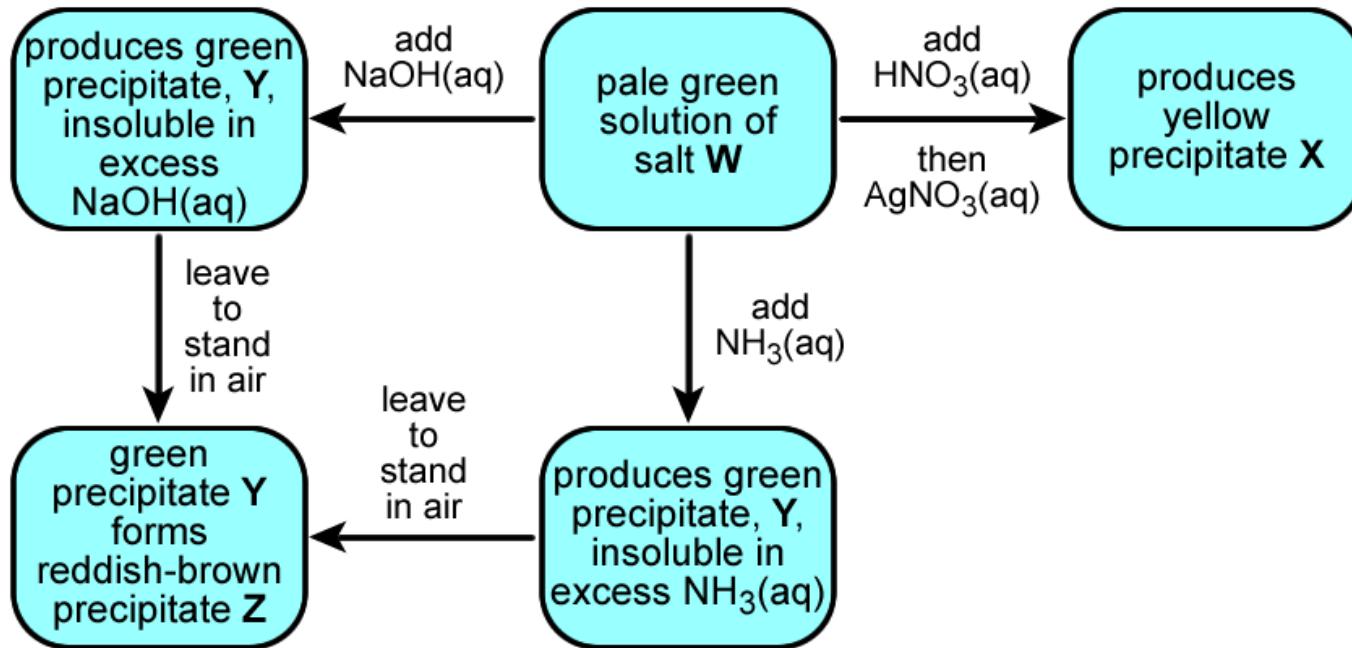
- Formation of X



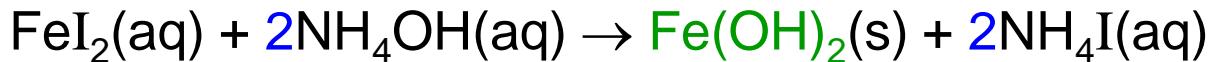
- Formation of Y using NaOH(aq)



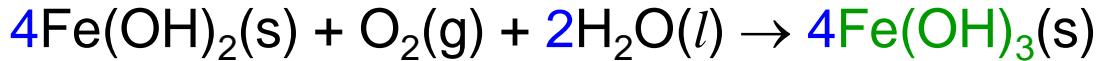
Complete Qualitative Analysis 18.



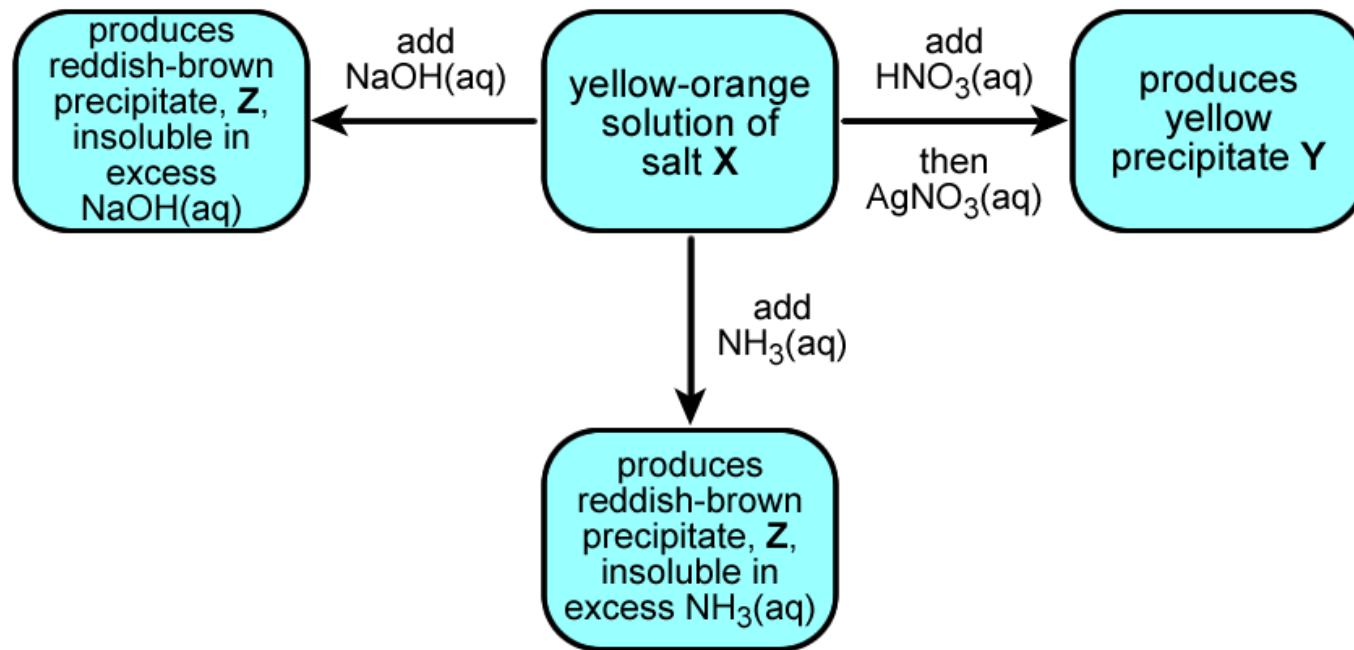
- Formation of **Y** using NH₃(aq)



- Formation of **Z** – the aerial oxidation of Fe²⁺(aq) to Fe³⁺(aq):



Complete Qualitative Analysis 19.

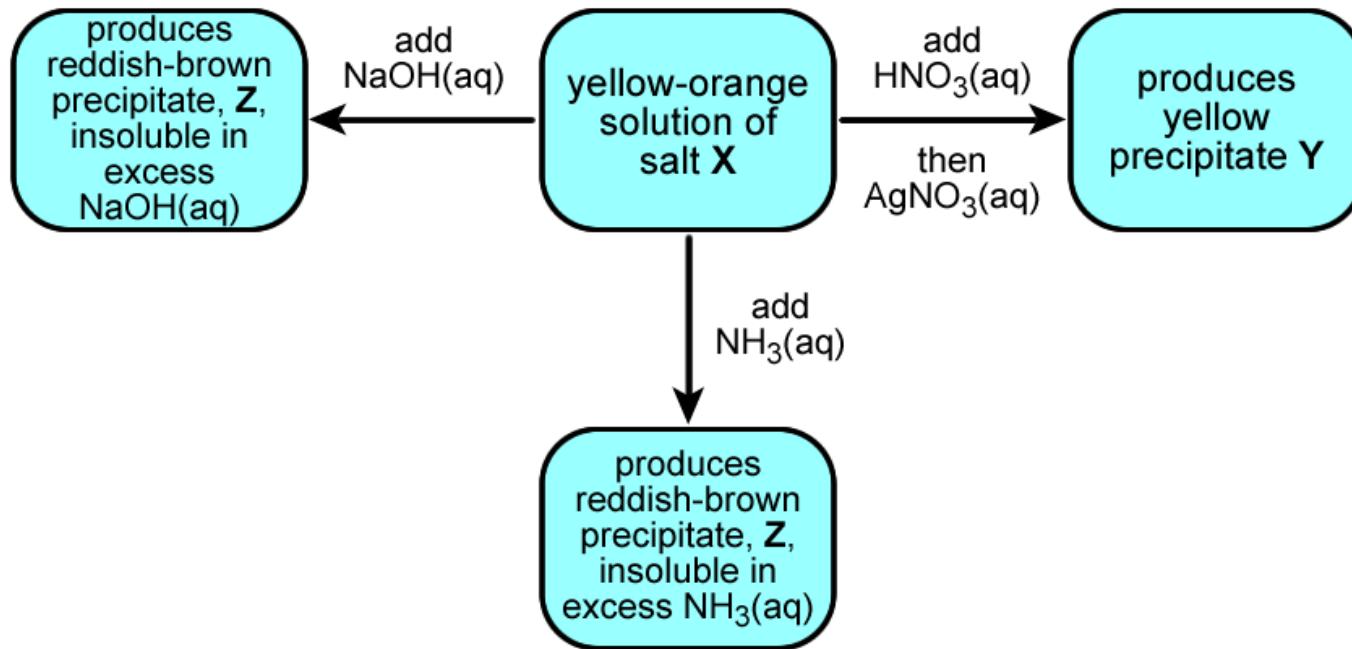


- Identify **X**, **Y** and **Z**.

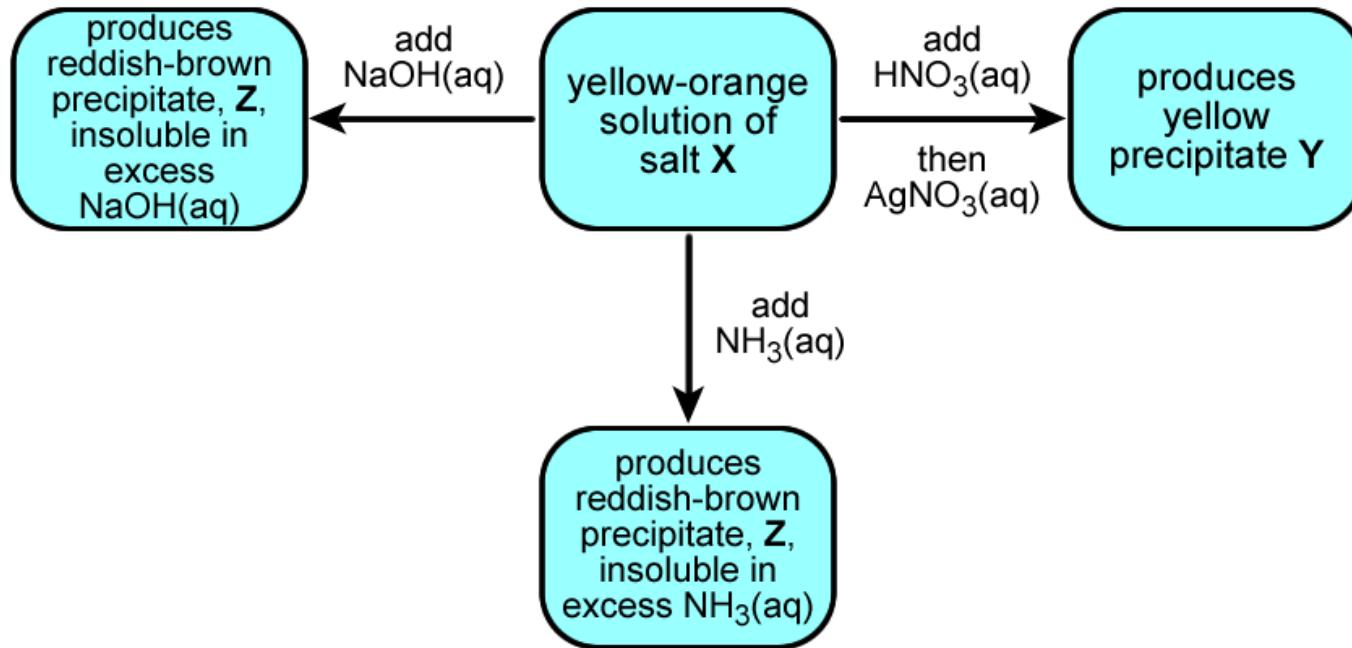


- Return to Index of Salts

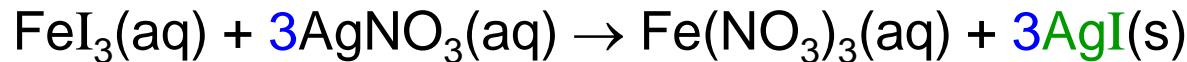
Complete Qualitative Analysis 19.



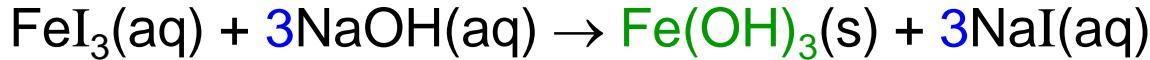
Complete Qualitative Analysis 19.



- Formation of Y



- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 20.

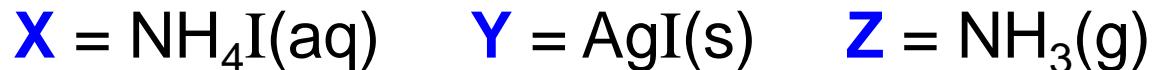


- Identify **X**, **Y** and **Z**.

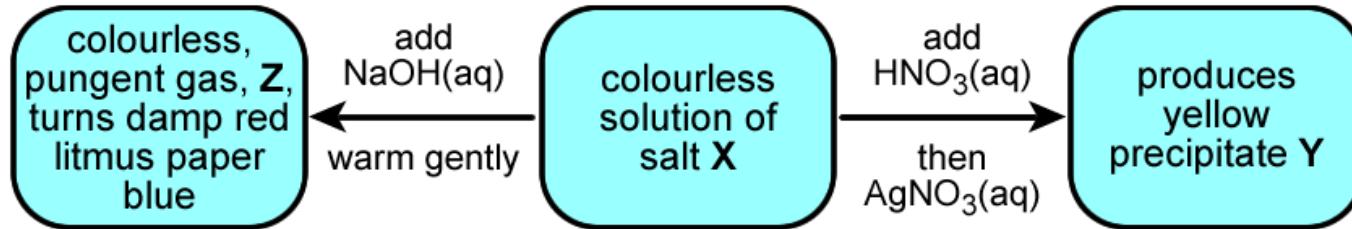
- Return to Index of Salts



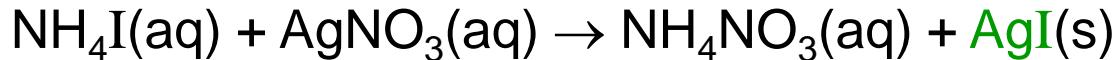
Complete Qualitative Analysis 20.



Complete Qualitative Analysis 20.



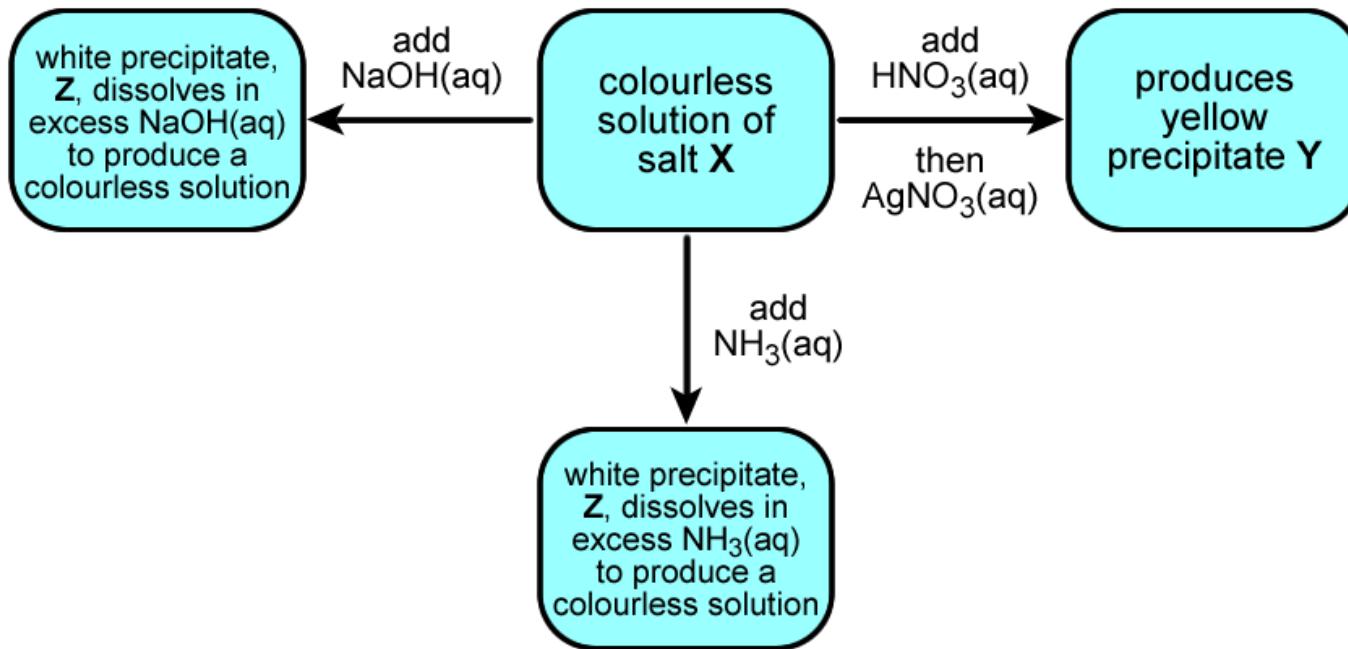
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 21.

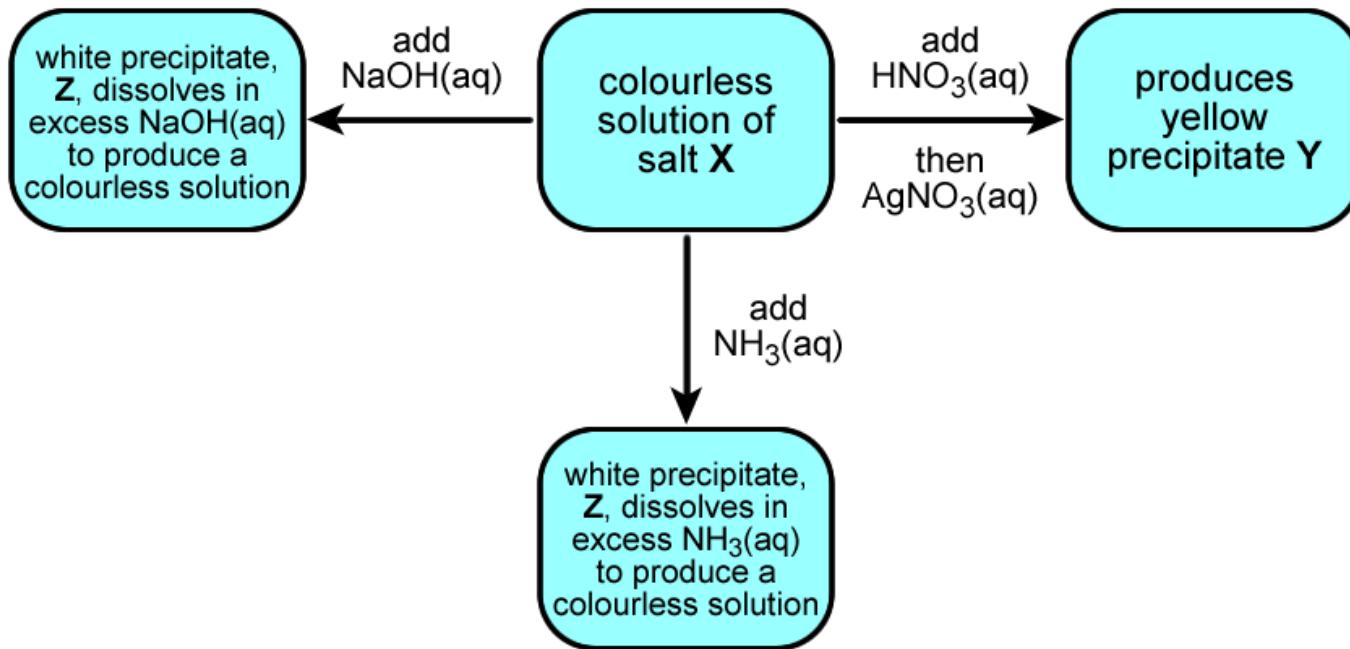


- Identify **X**, **Y** and **Z**.

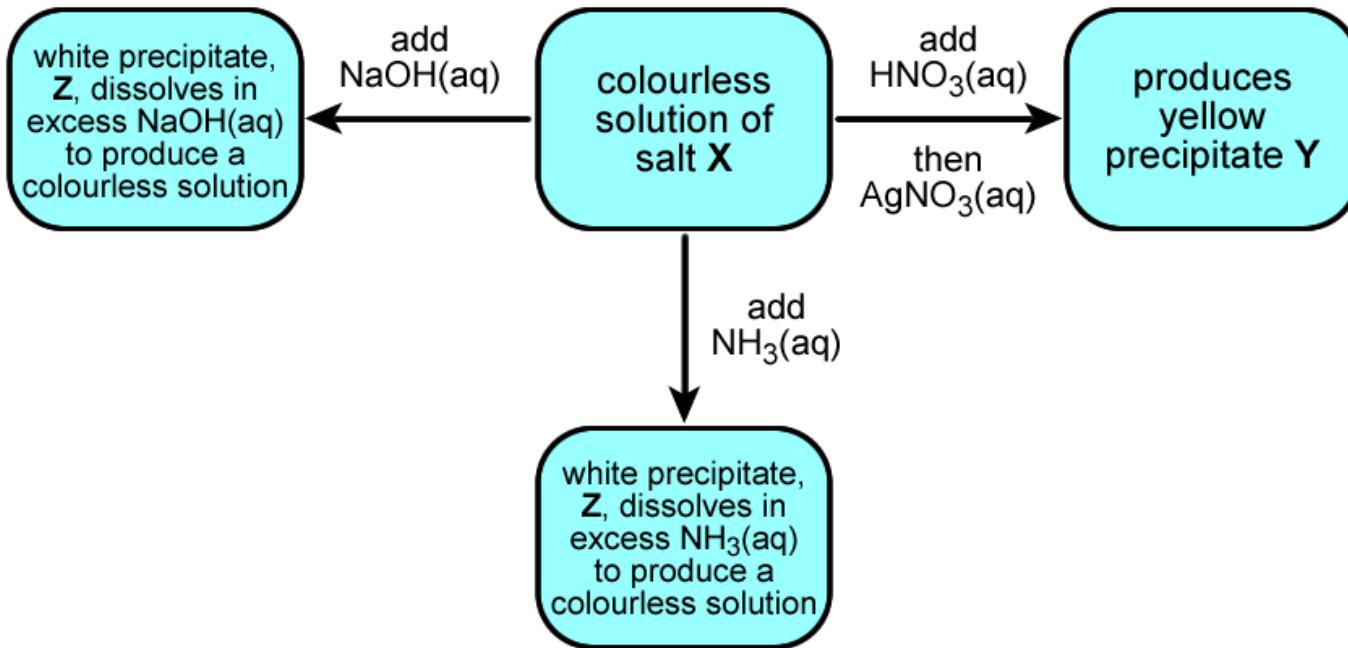
- Return to Index of Salts



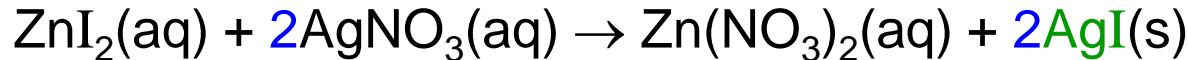
Complete Qualitative Analysis 21.



Complete Qualitative Analysis 21.



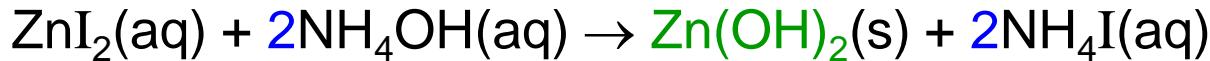
- Formation of Y



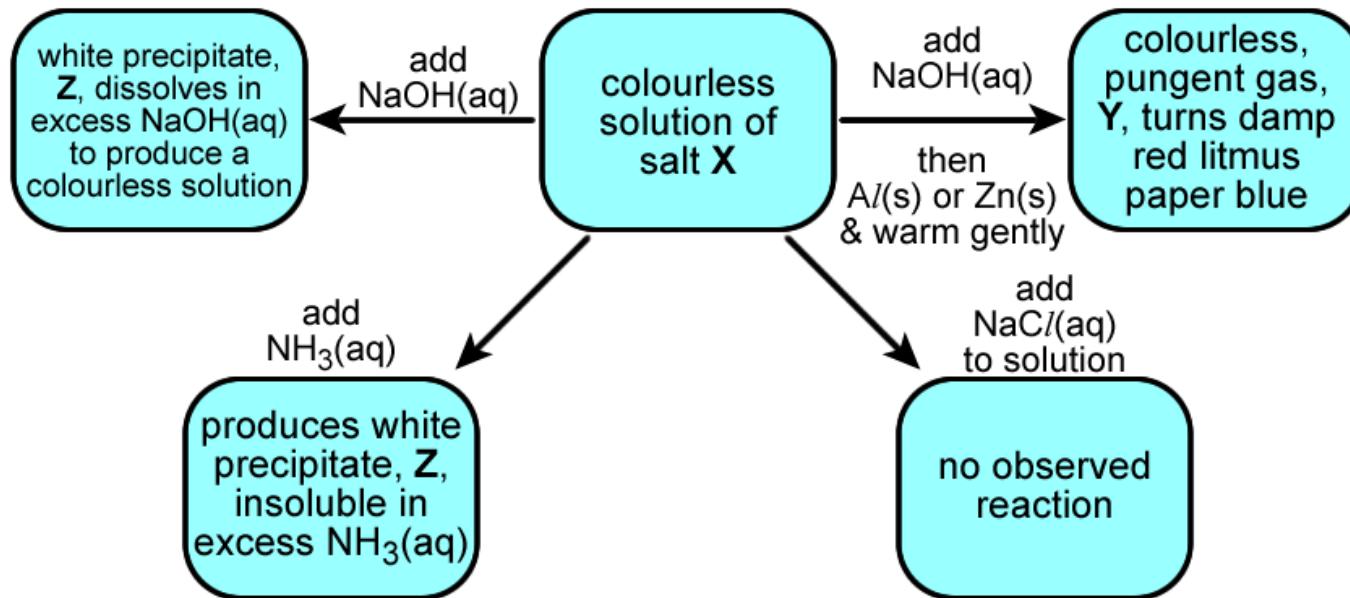
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 22.

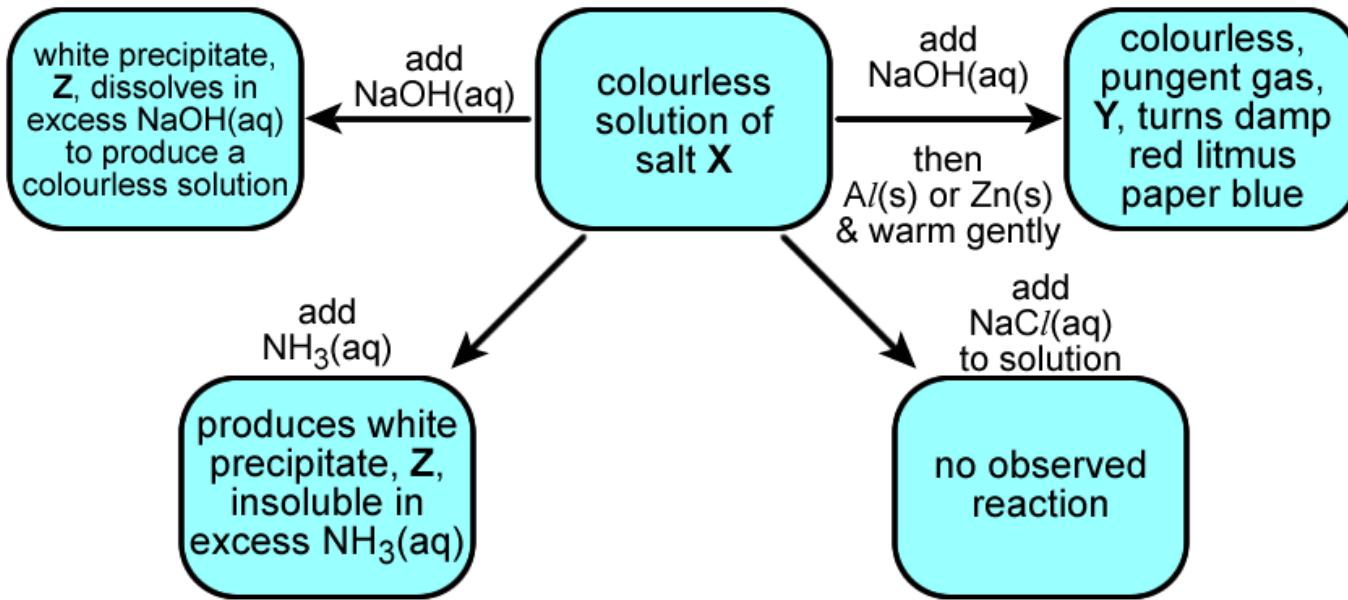


- Identify **X**, **Y** and **Z**.

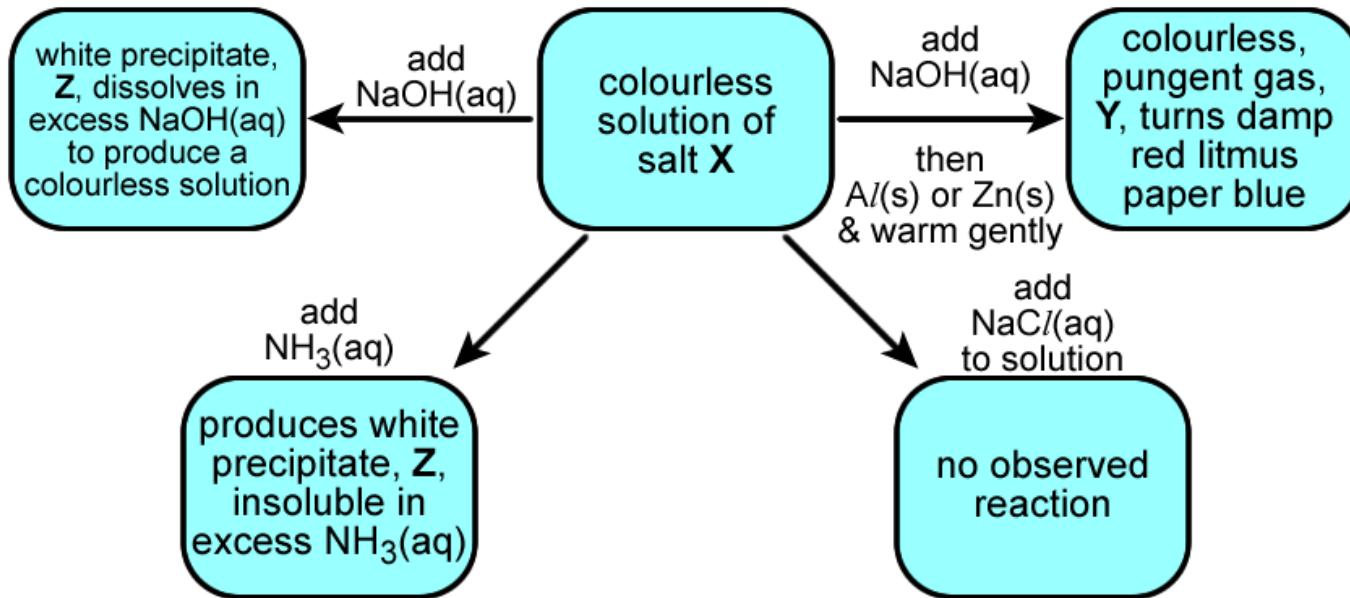
- Return to Index of Salts



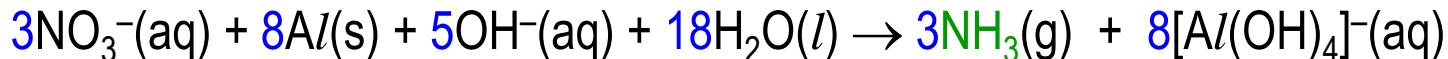
Complete Qualitative Analysis 22.



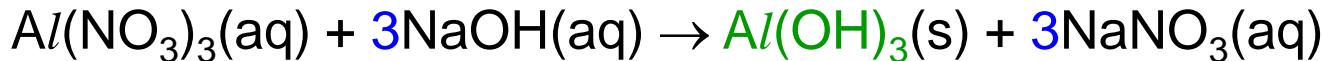
Complete Qualitative Analysis 22.



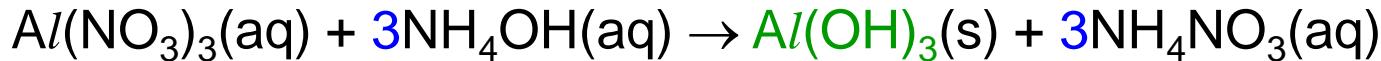
- Formation of Y



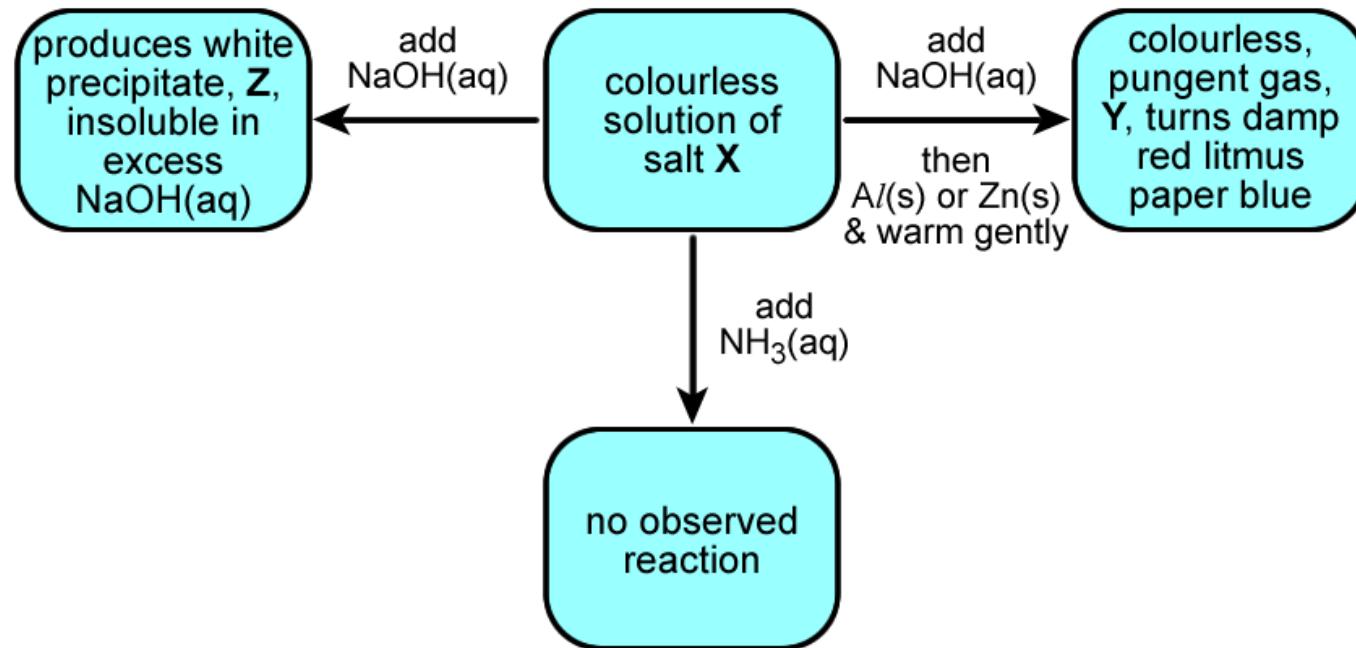
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 23.

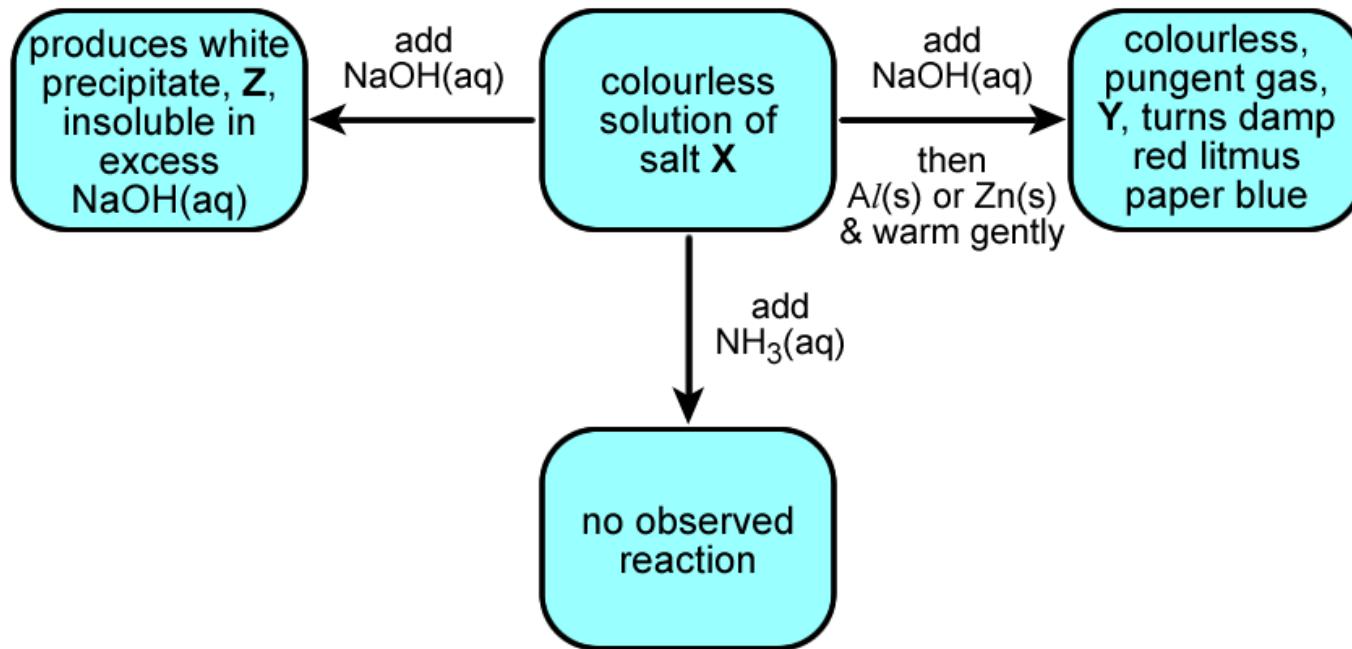


- Identify **X**, **Y** and **Z**.

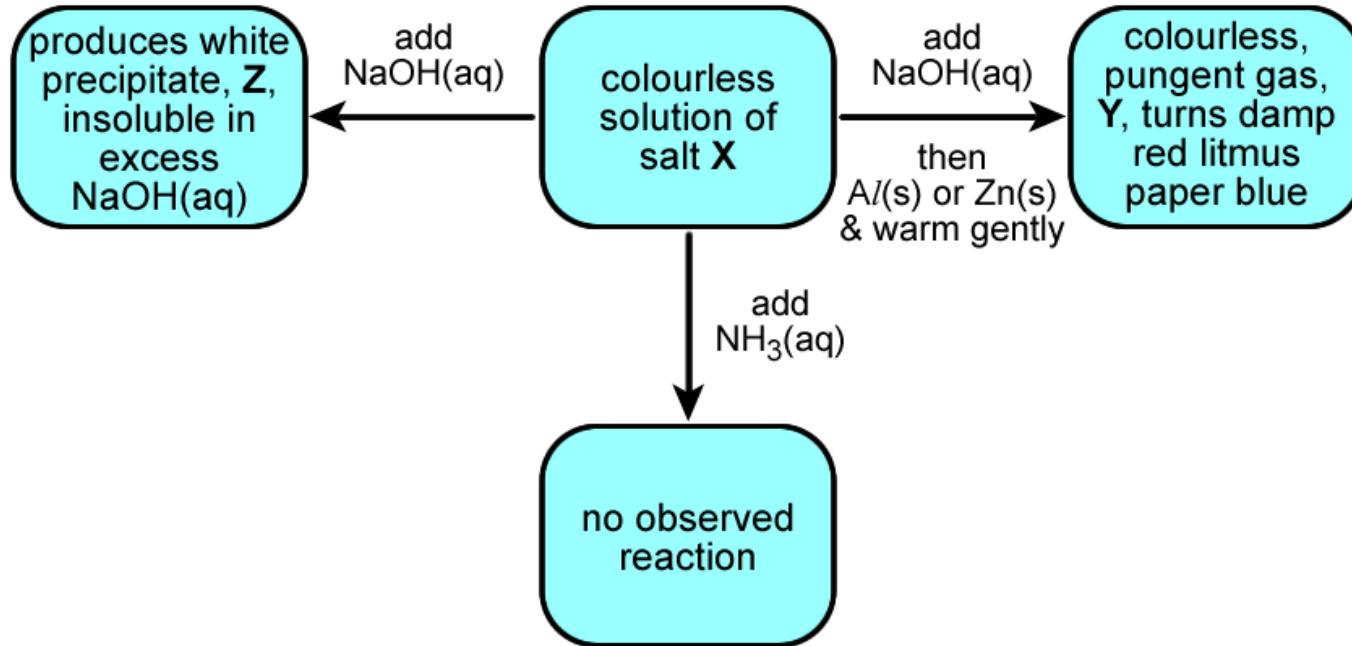
- Return to Index of Salts



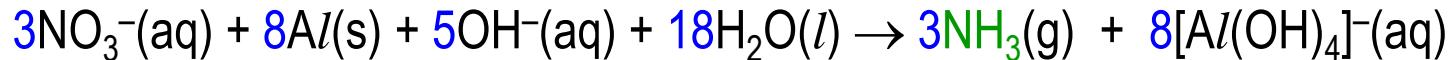
Complete Qualitative Analysis 23.



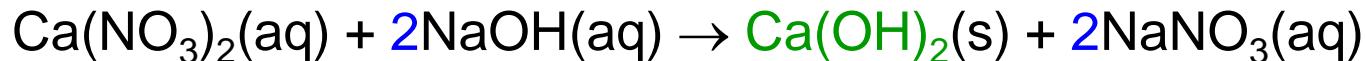
Complete Qualitative Analysis 23.



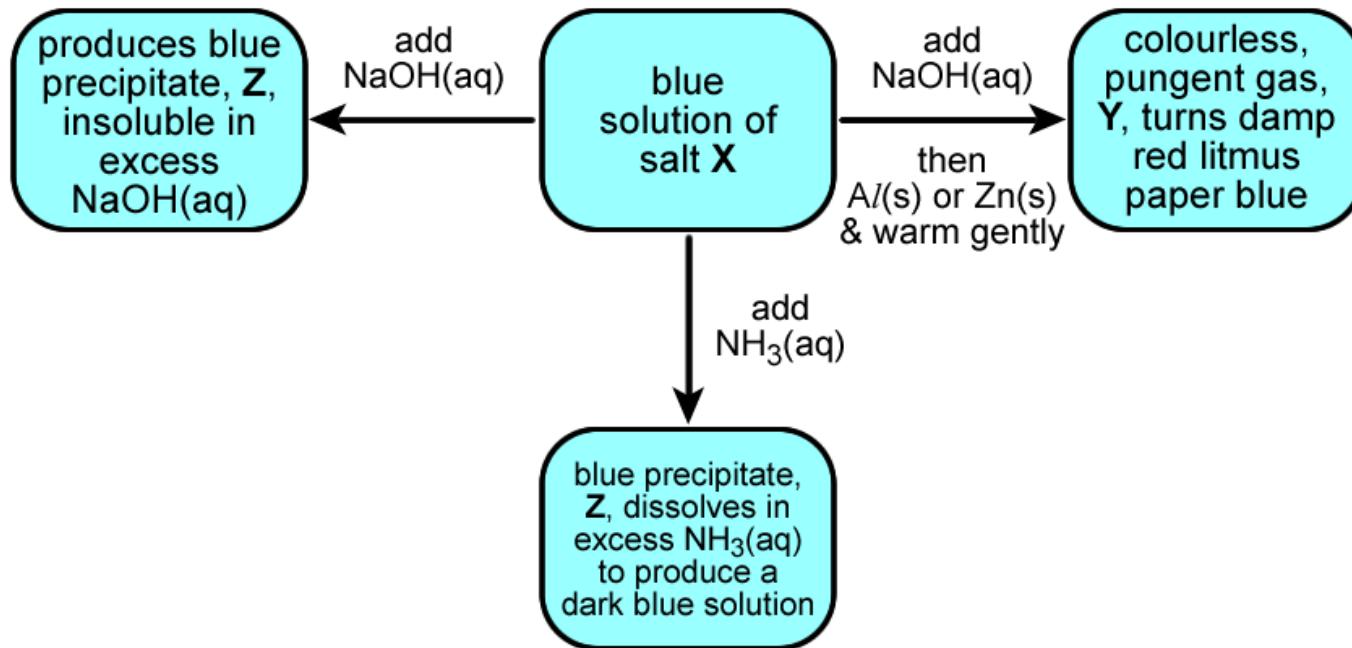
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 24.

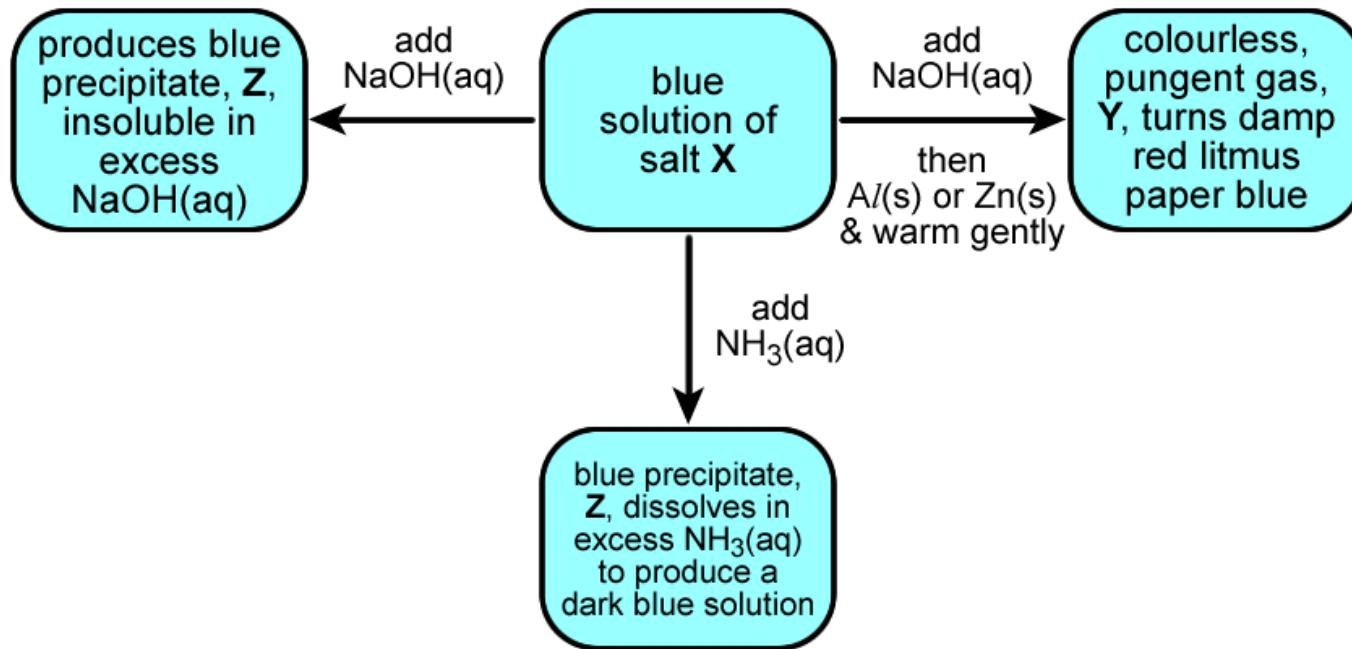


- Identify **X**, **Y** and **Z**.

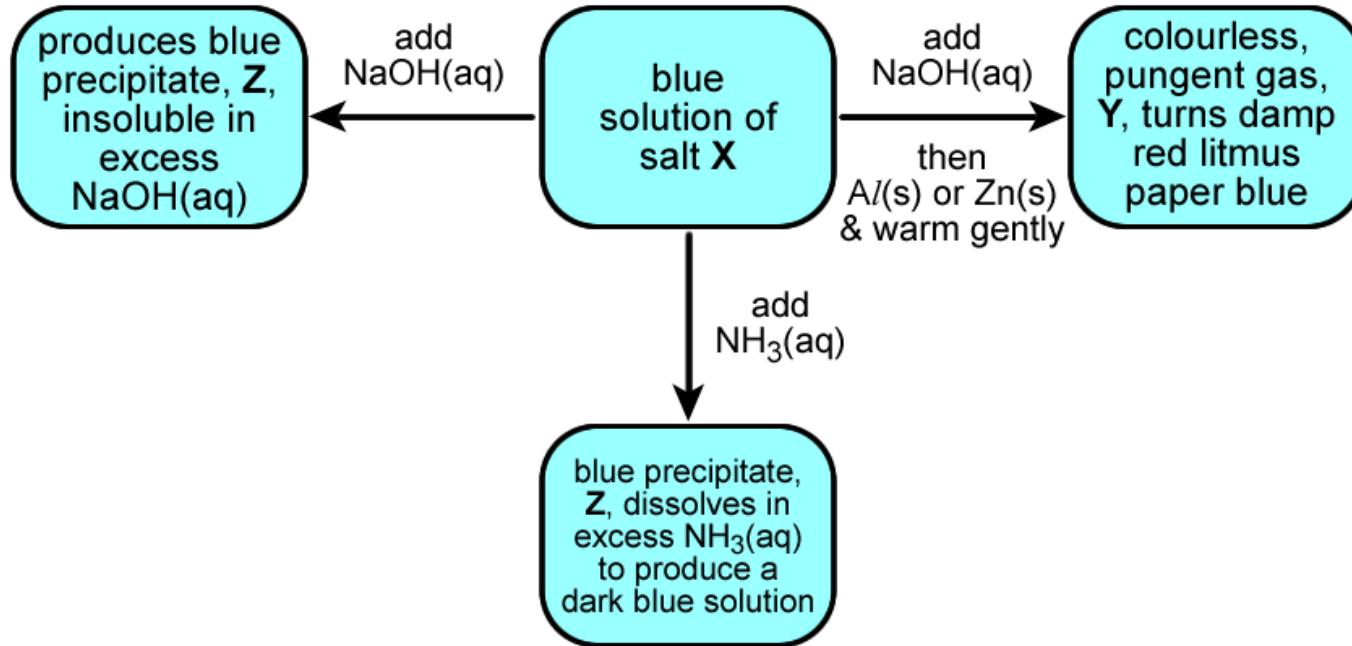


- Return to Index of Salts

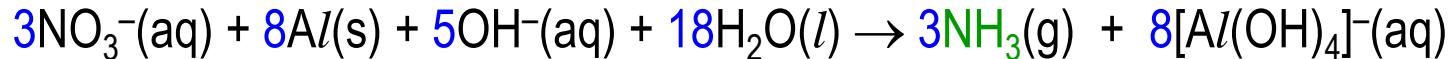
Complete Qualitative Analysis 24.



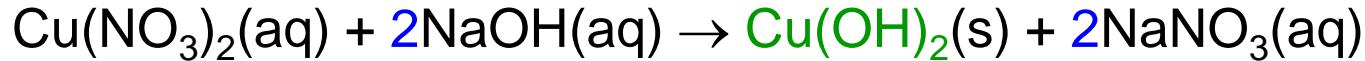
Complete Qualitative Analysis 24.



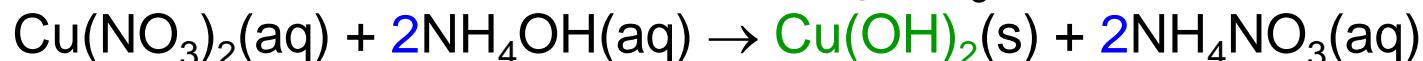
- Formation of **Y**



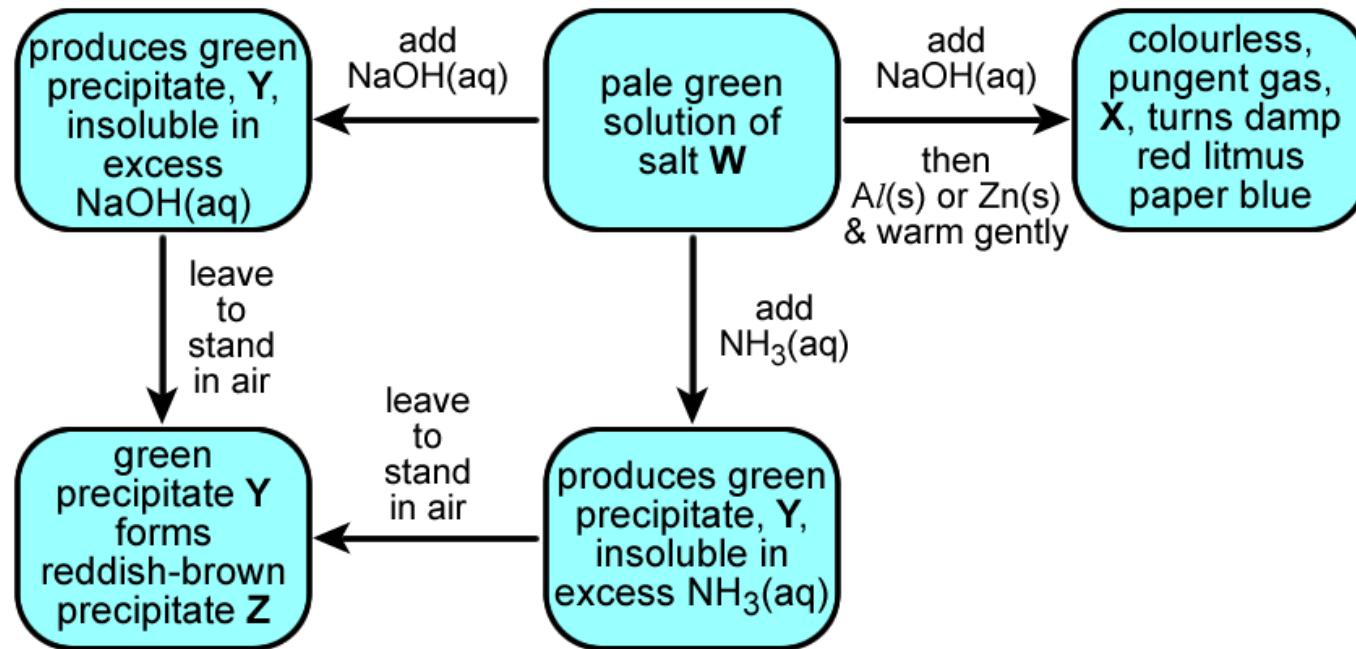
- Formation of **Z** using $\text{NaOH}(\text{aq})$



- Formation of **Z** using $\text{NH}_3(\text{aq})$



Complete Qualitative Analysis 25.

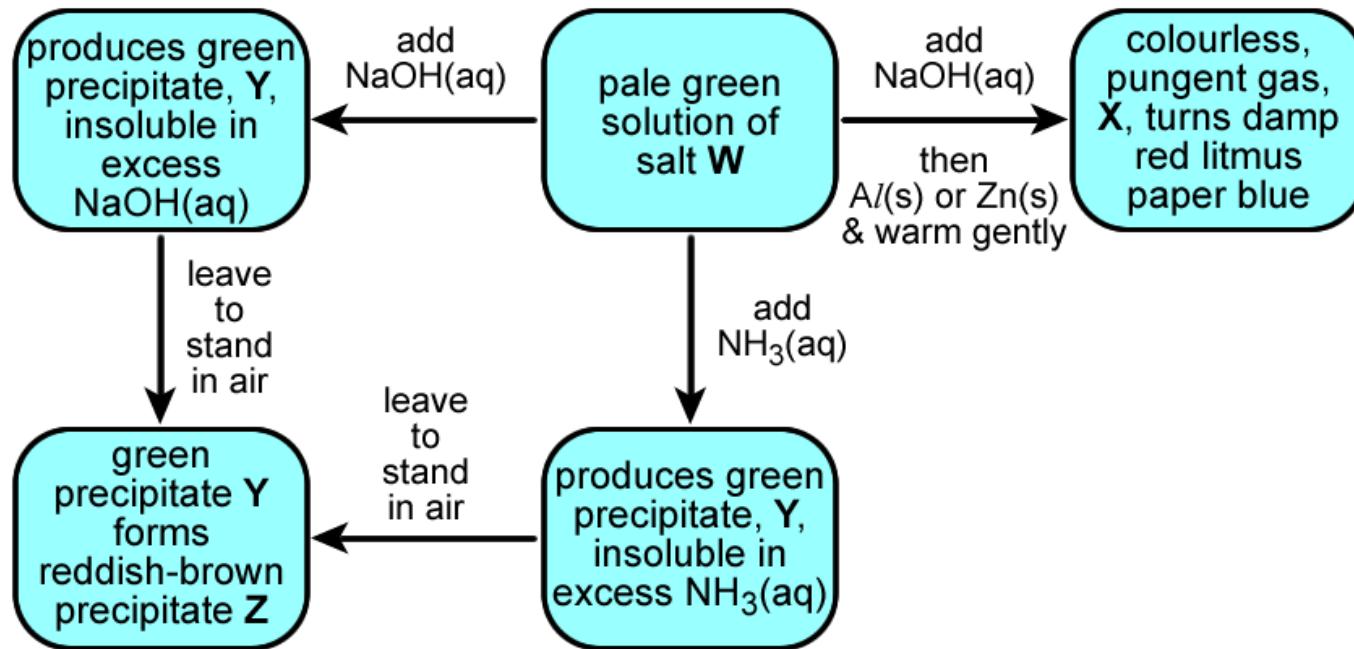


- Identify **W**, **X**, **Y** and **Z**.

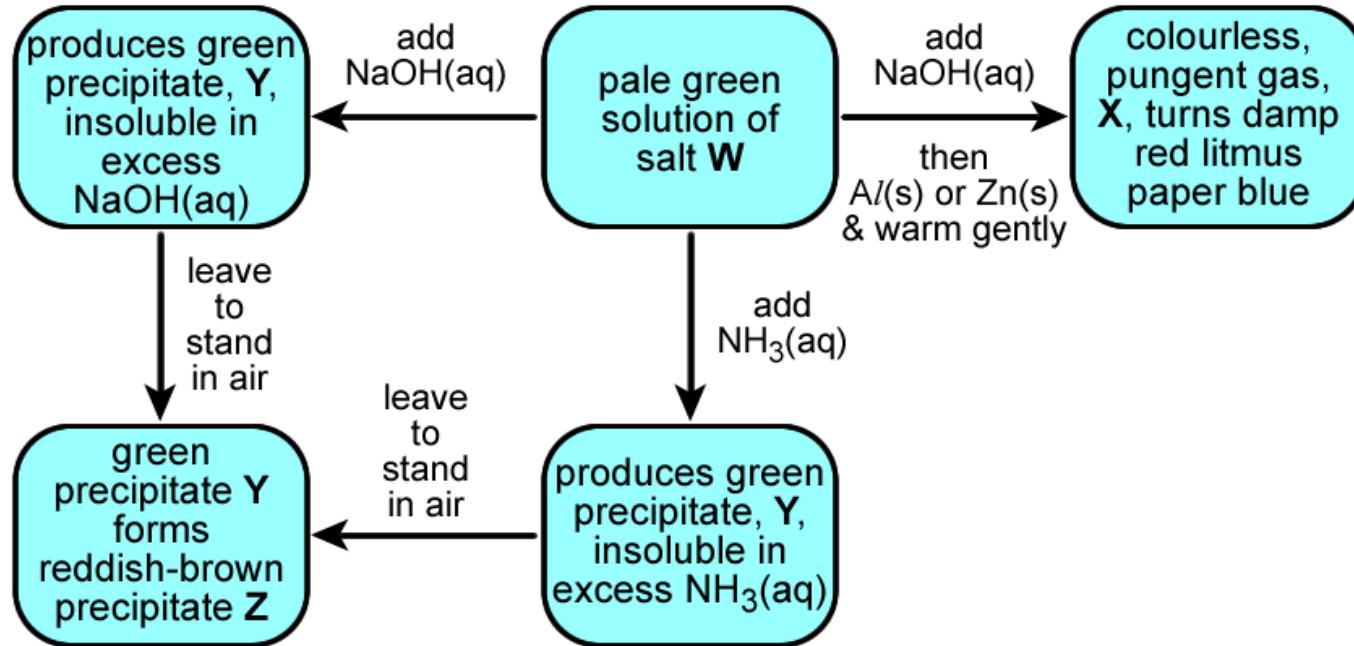


- Return to Index of Salts

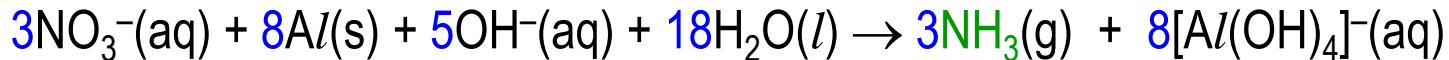
Complete Qualitative Analysis 25.



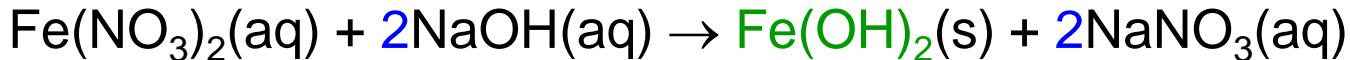
Complete Qualitative Analysis 25.



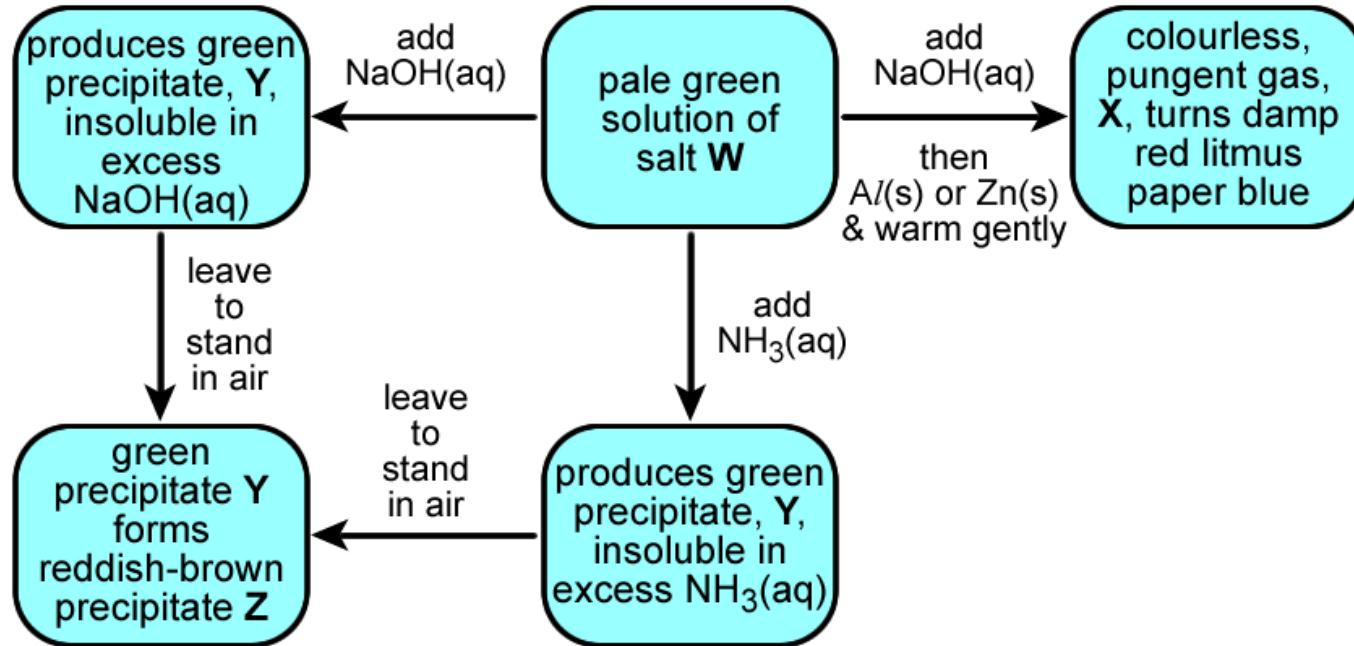
- Formation of X



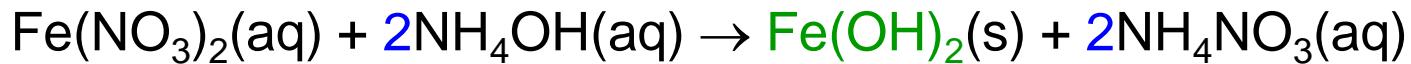
- Formation of Y using NaOH(aq)



Complete Qualitative Analysis 25.



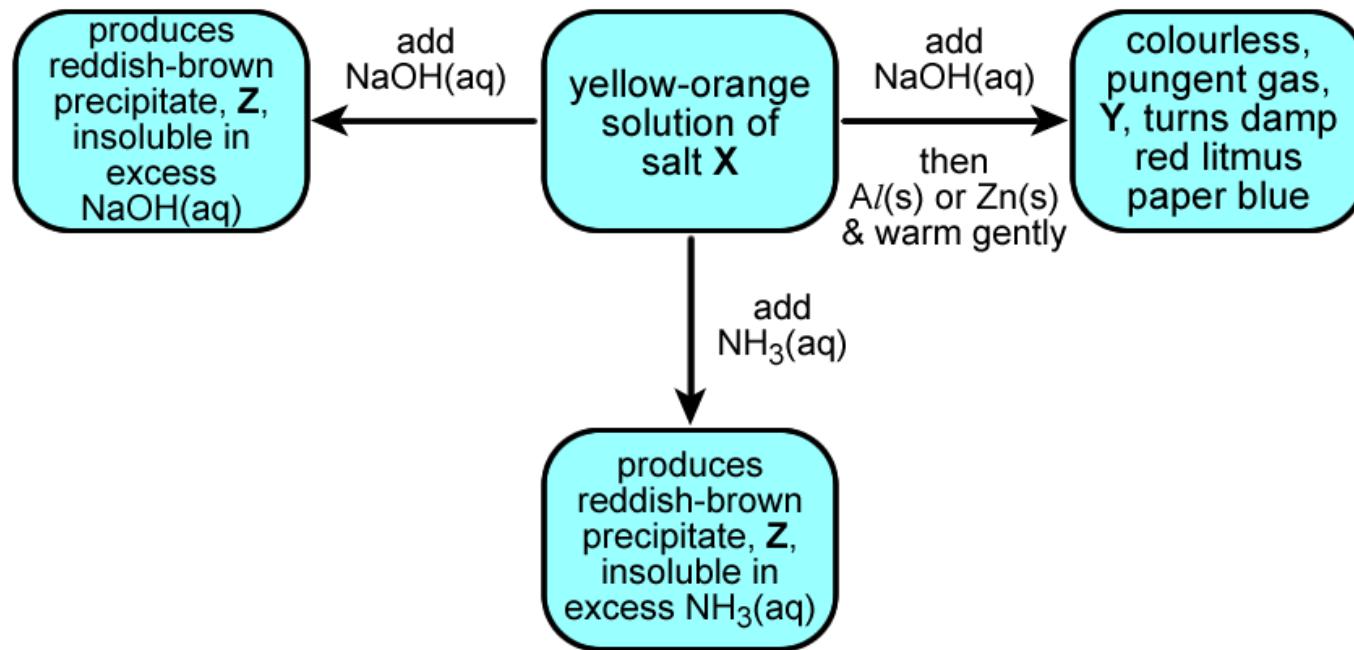
- Formation of **Y** using NH₃(aq)



- Formation of **Z** – the aerial oxidation of Fe²⁺(aq) to Fe³⁺(aq):
$$4\text{Fe(OH)}_2(\text{s}) + \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 4\text{Fe(OH)}_3(\text{s})$$



Complete Qualitative Analysis 26.

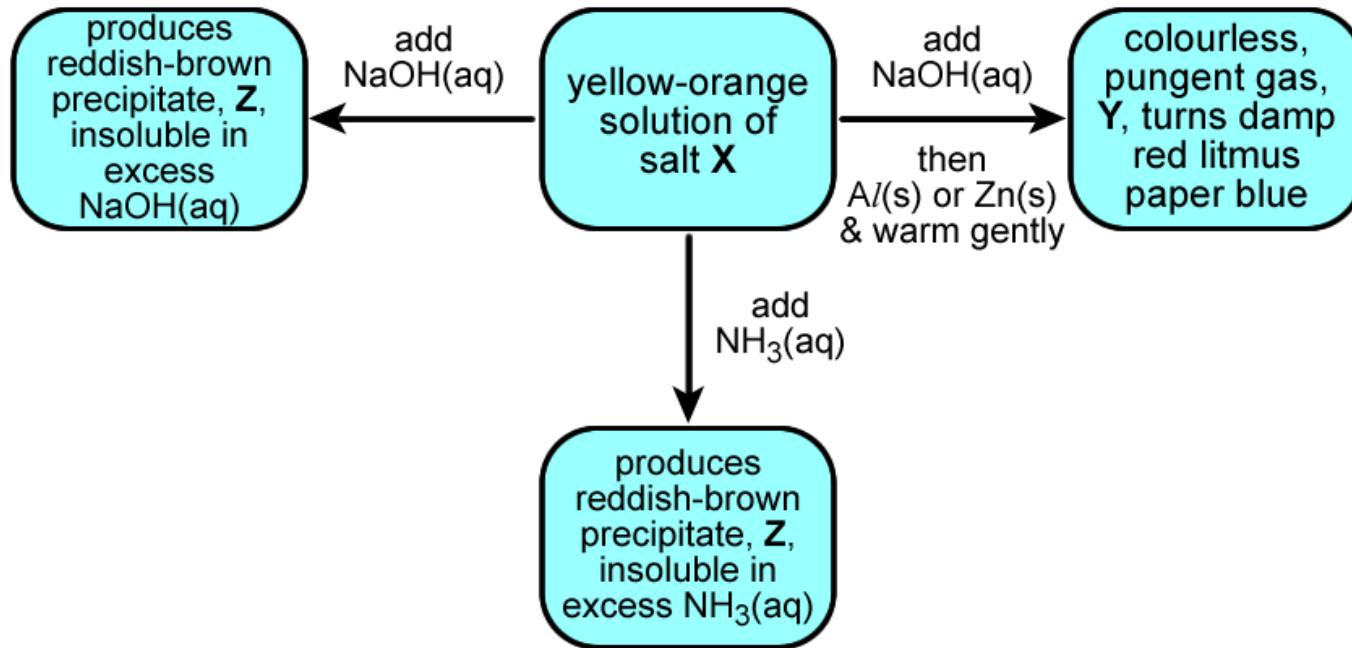


- Identify **X**, **Y** and **Z**.

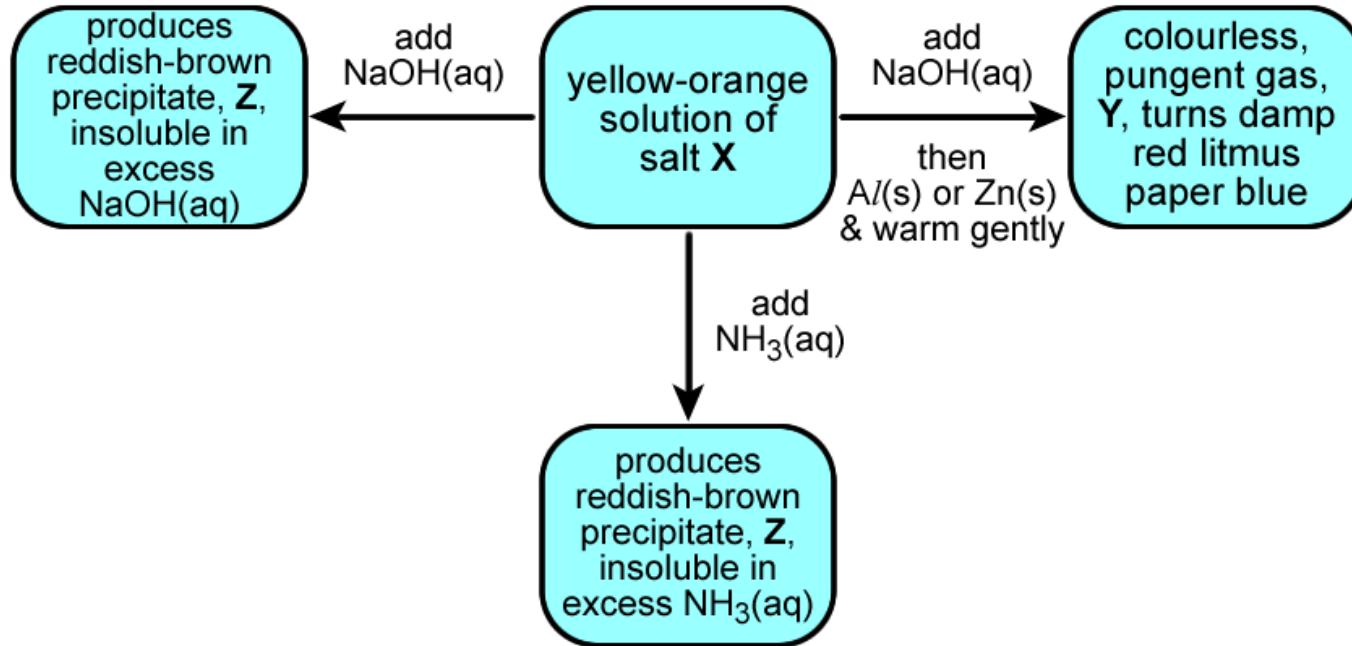
- Return to Index of Salts



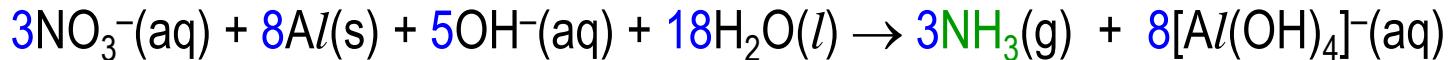
Complete Qualitative Analysis 26.



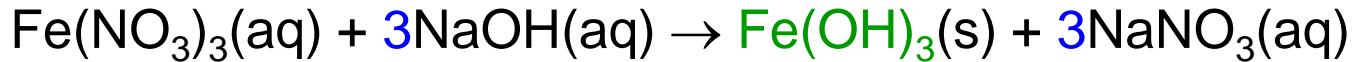
Complete Qualitative Analysis 26.



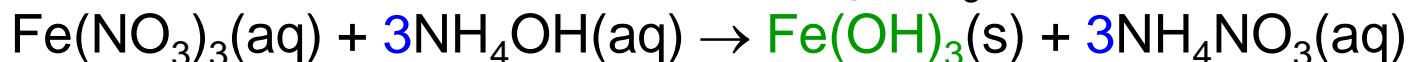
- Formation of Y



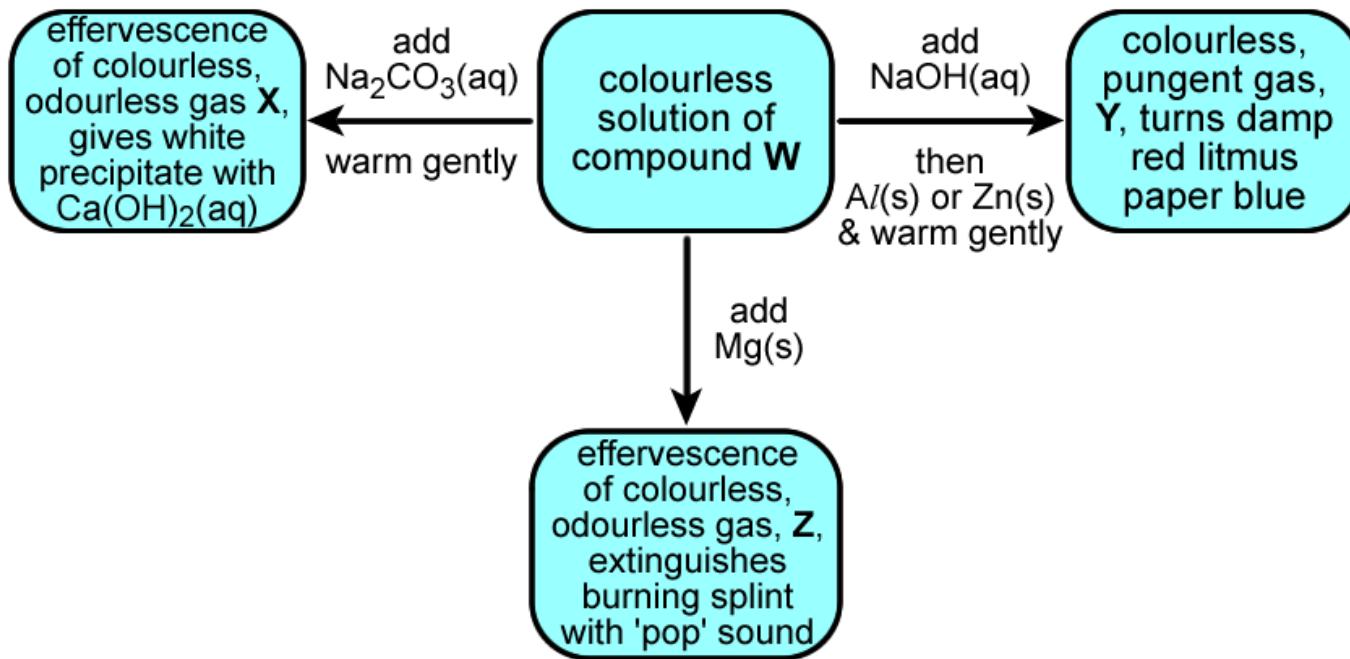
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 27.

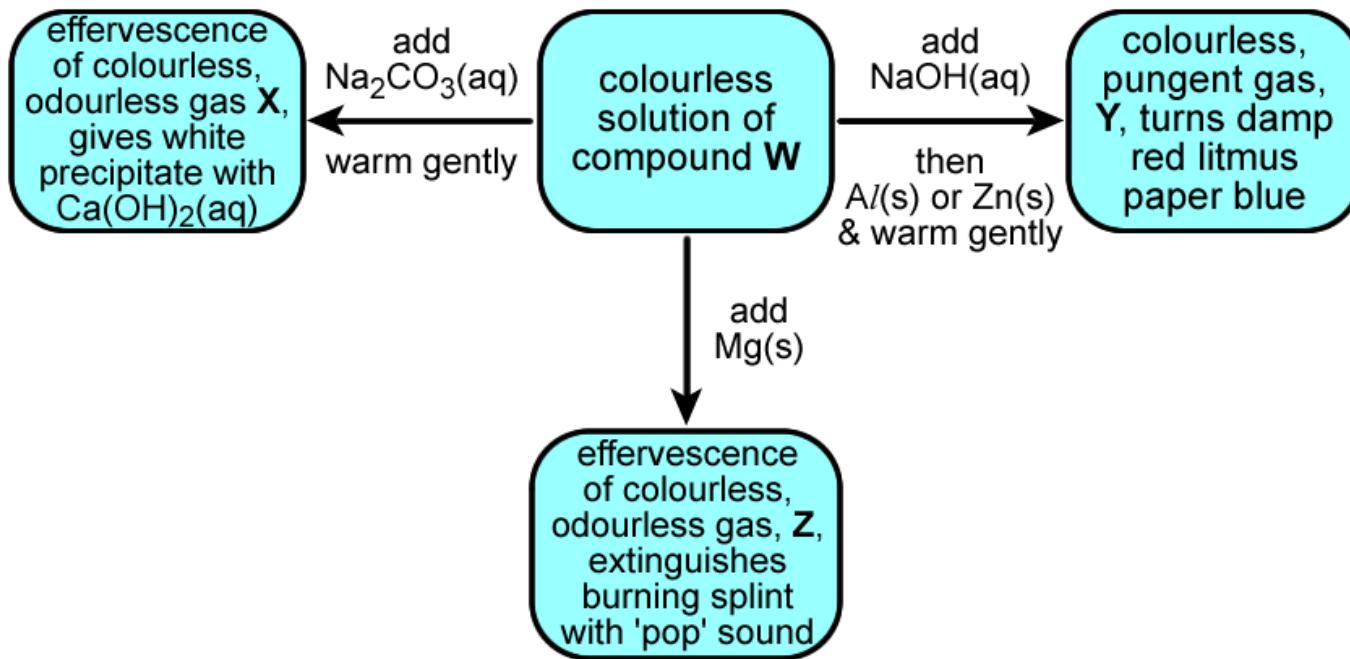


- Identify **W**, **X**, **Y** and **Z**.

- Return to Index of Salts



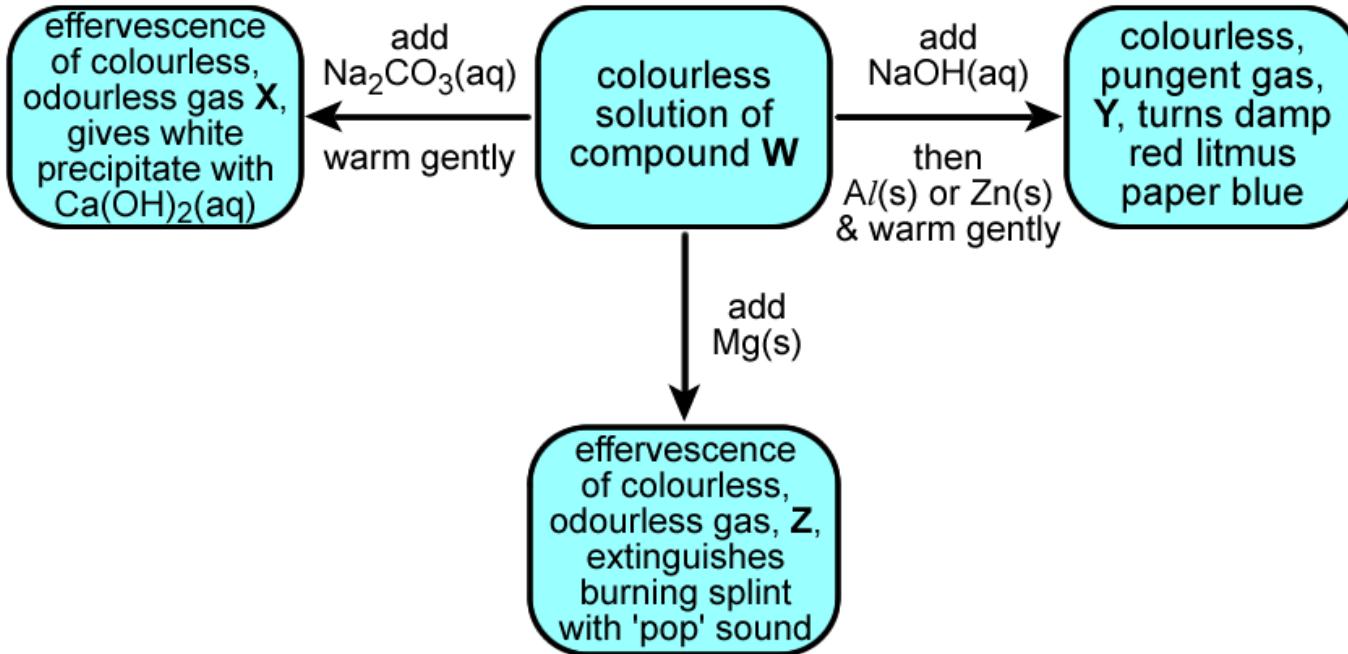
Complete Qualitative Analysis 27.



$$W = \text{HNO}_3(\text{aq}) \quad X = \text{CO}_2(\text{g}) \quad Y = \text{NH}_3(\text{g}) \quad Z = \text{H}_2(\text{g})$$



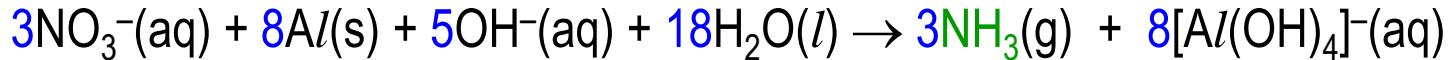
Complete Qualitative Analysis 27.



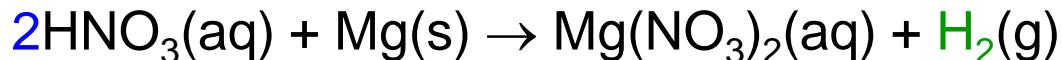
- Formation of **X**



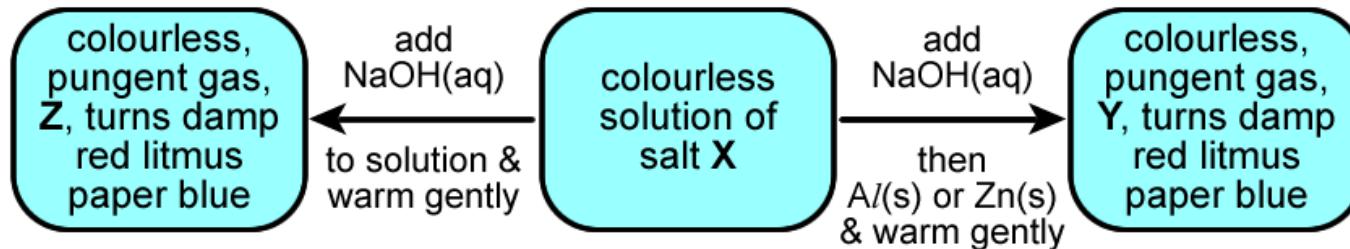
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 28.



- Identify **X**, **Y** and **Z**.

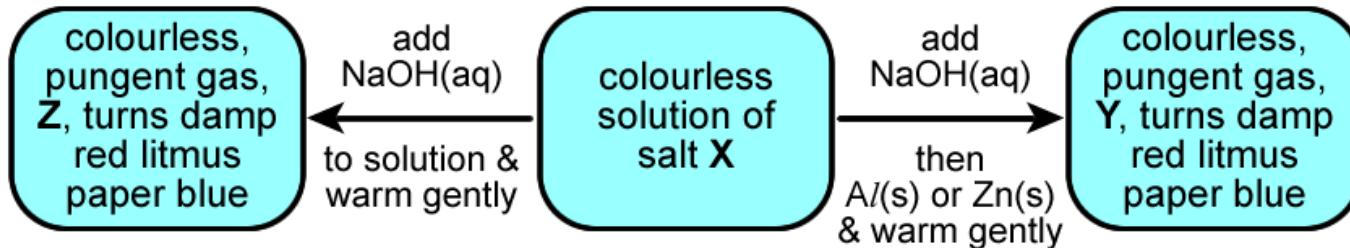
- Return to Index of Salts



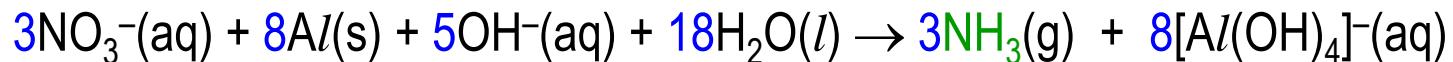
Complete Qualitative Analysis 28.



Complete Qualitative Analysis 28.



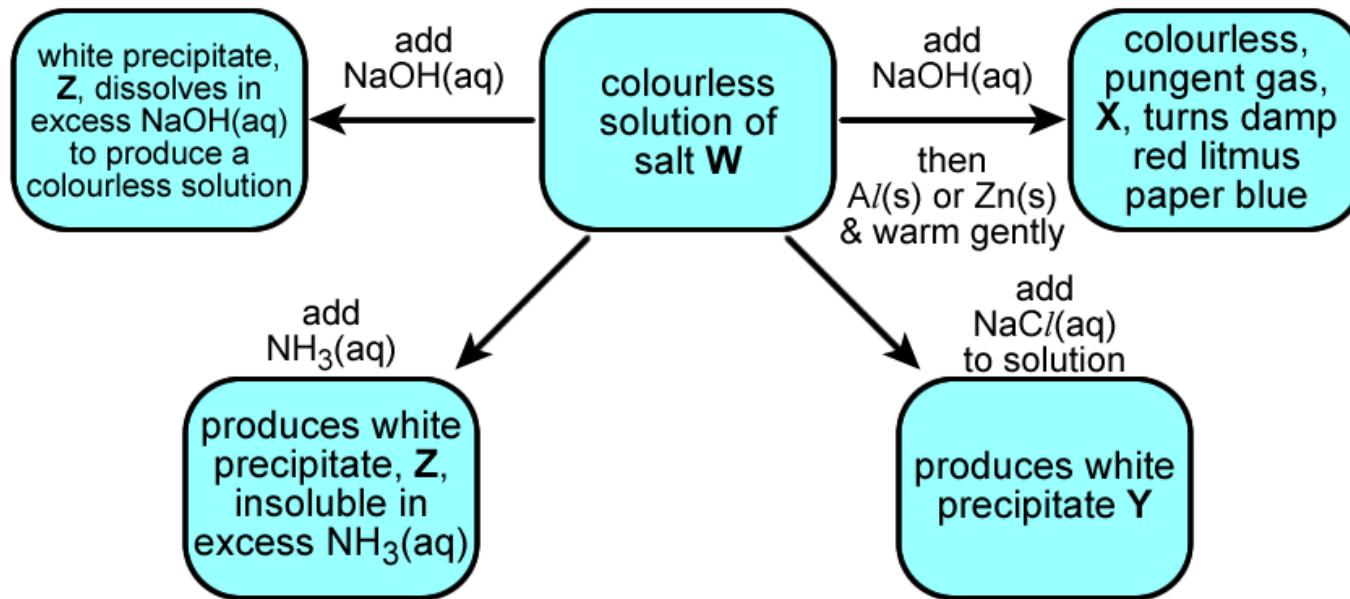
- Formation of Y



- Formation of Z



Complete Qualitative Analysis 29.

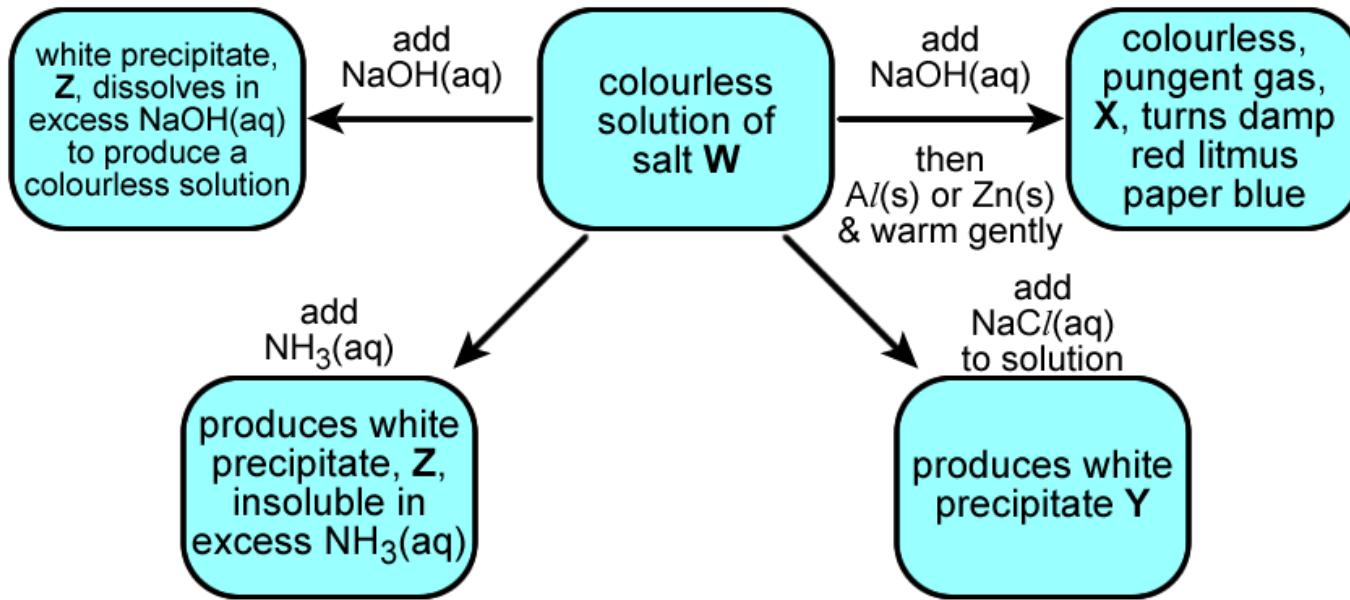


- Identify **W**, **X**, **Y** and **Z**.

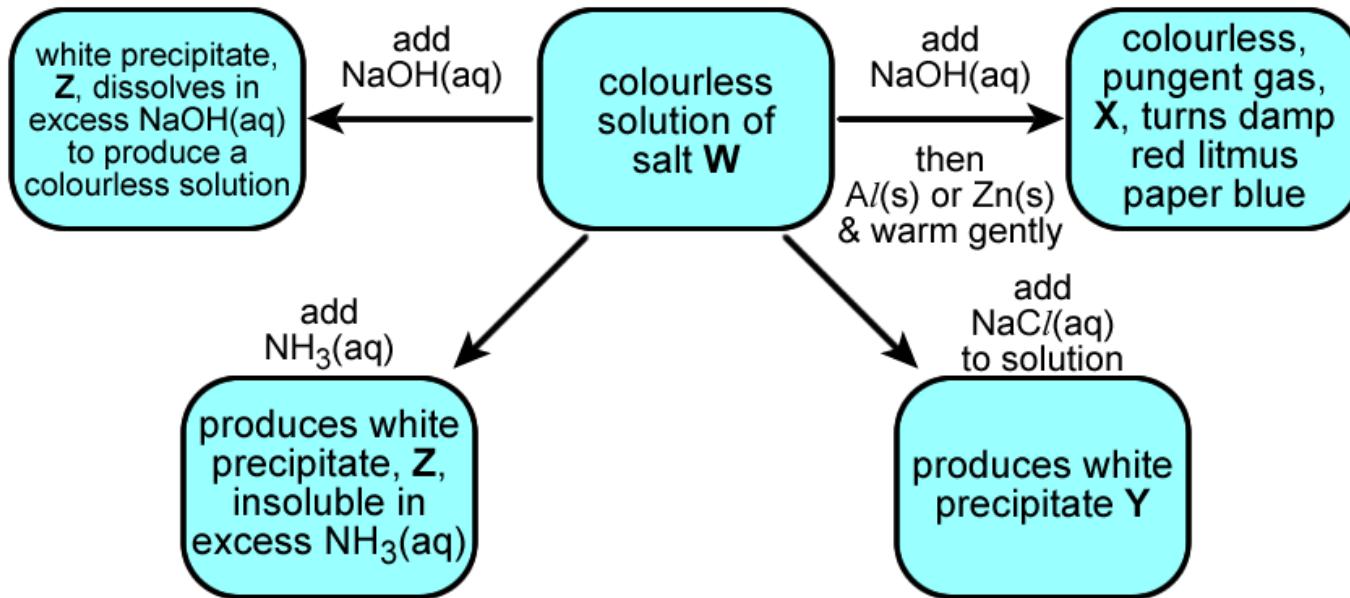


- Return to Index of Salts

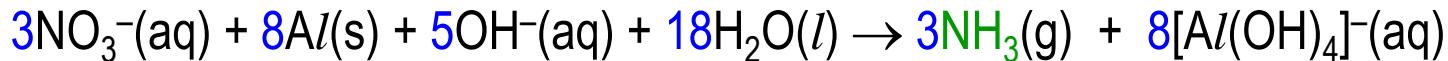
Complete Qualitative Analysis 29.



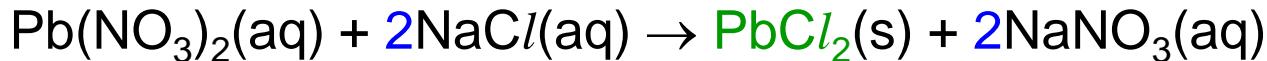
Complete Qualitative Analysis 29.



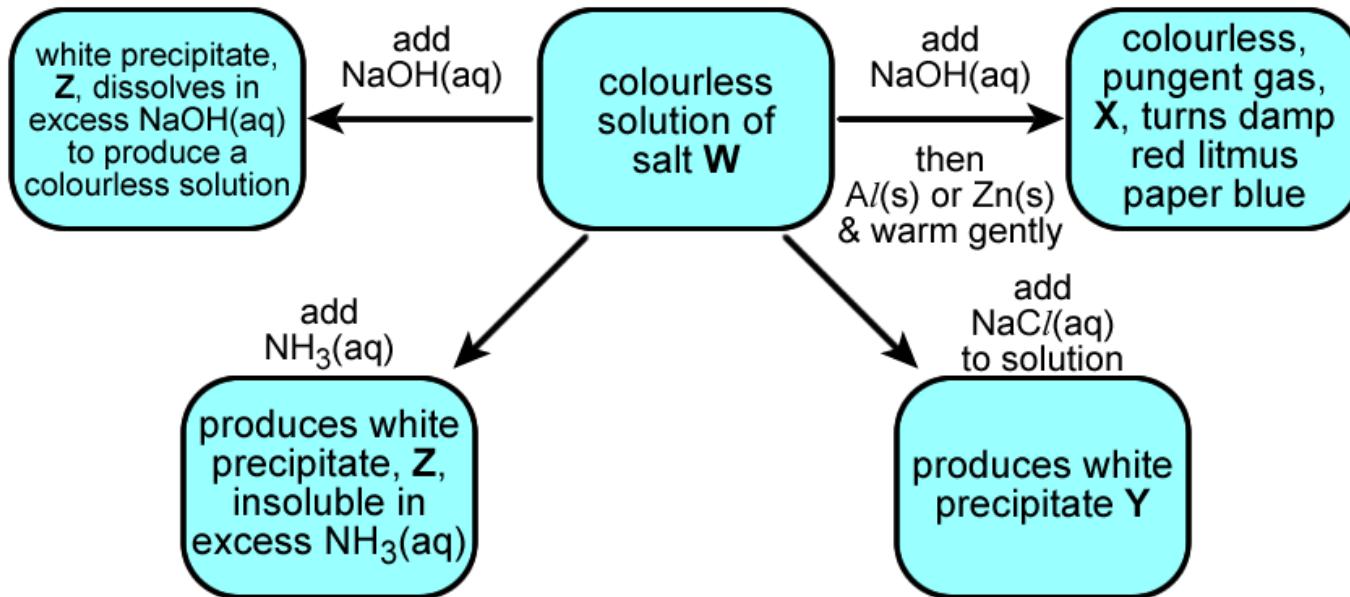
- Formation of X



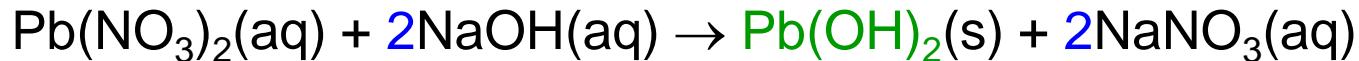
- Formation of Y



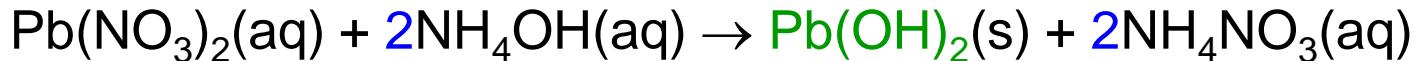
Complete Qualitative Analysis 29.



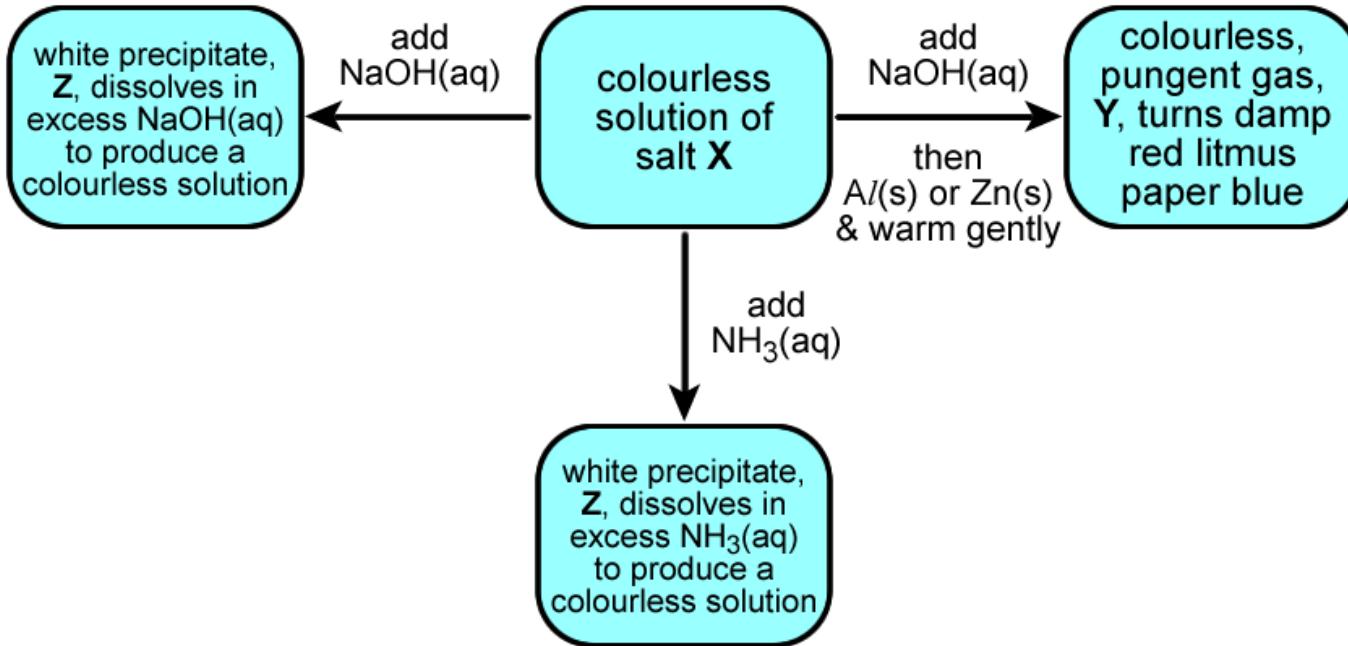
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 30.

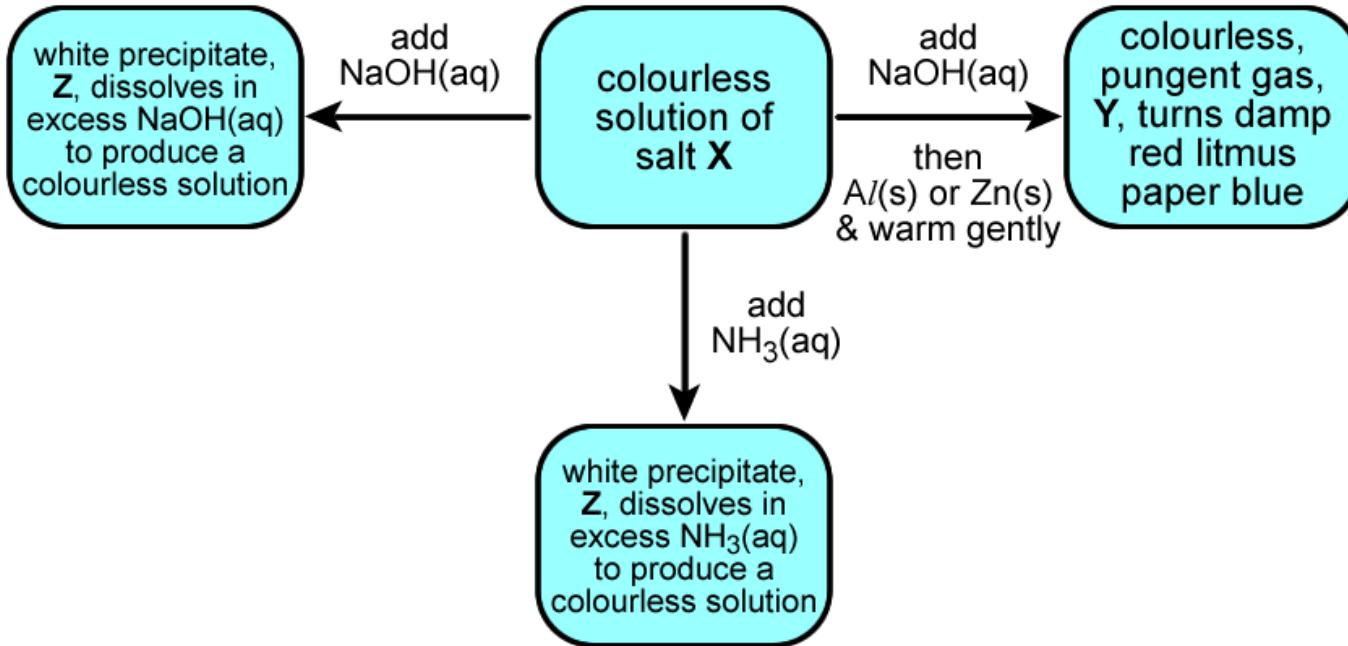


- Identify **X**, **Y** and **Z**.

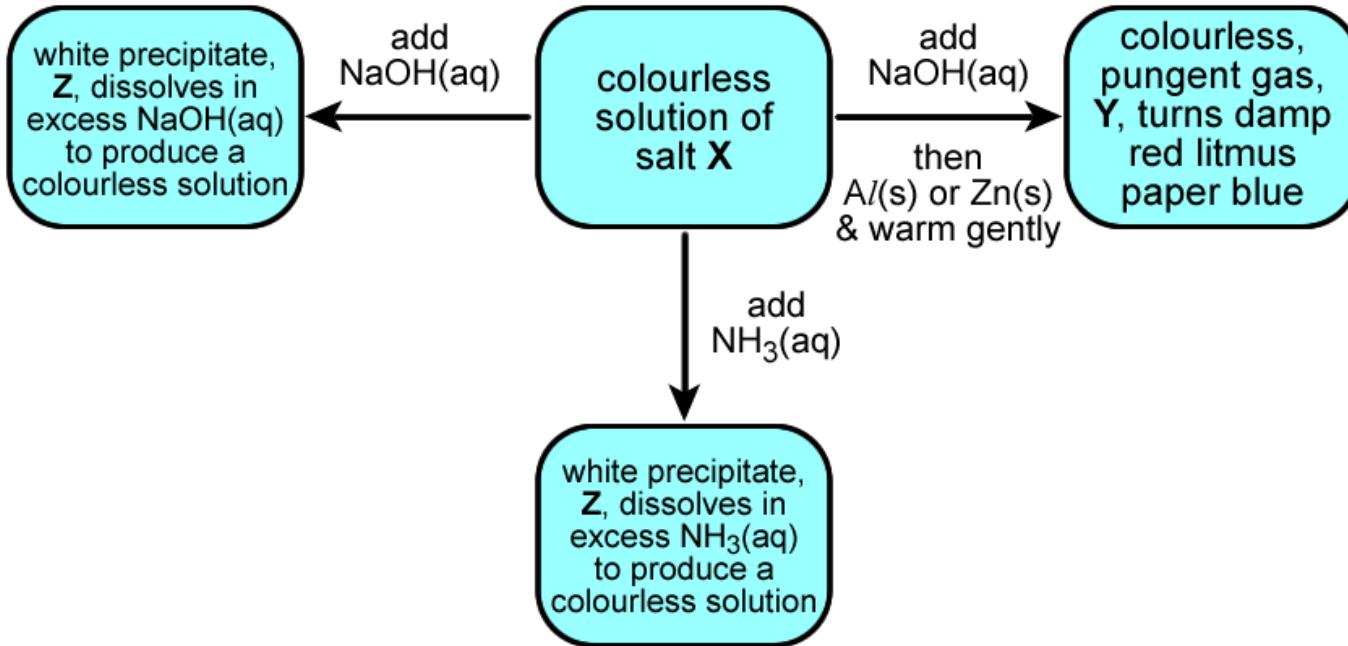
- Return to Index of Salts



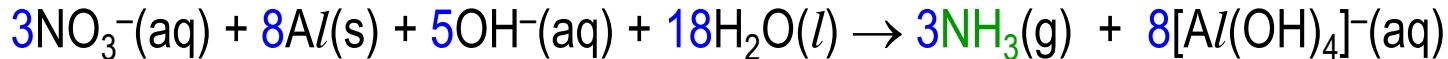
Complete Qualitative Analysis 30.



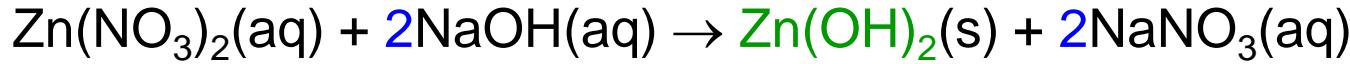
Complete Qualitative Analysis 30.



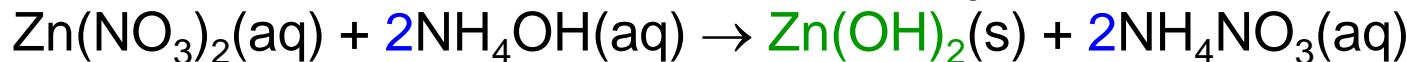
- Formation of Y



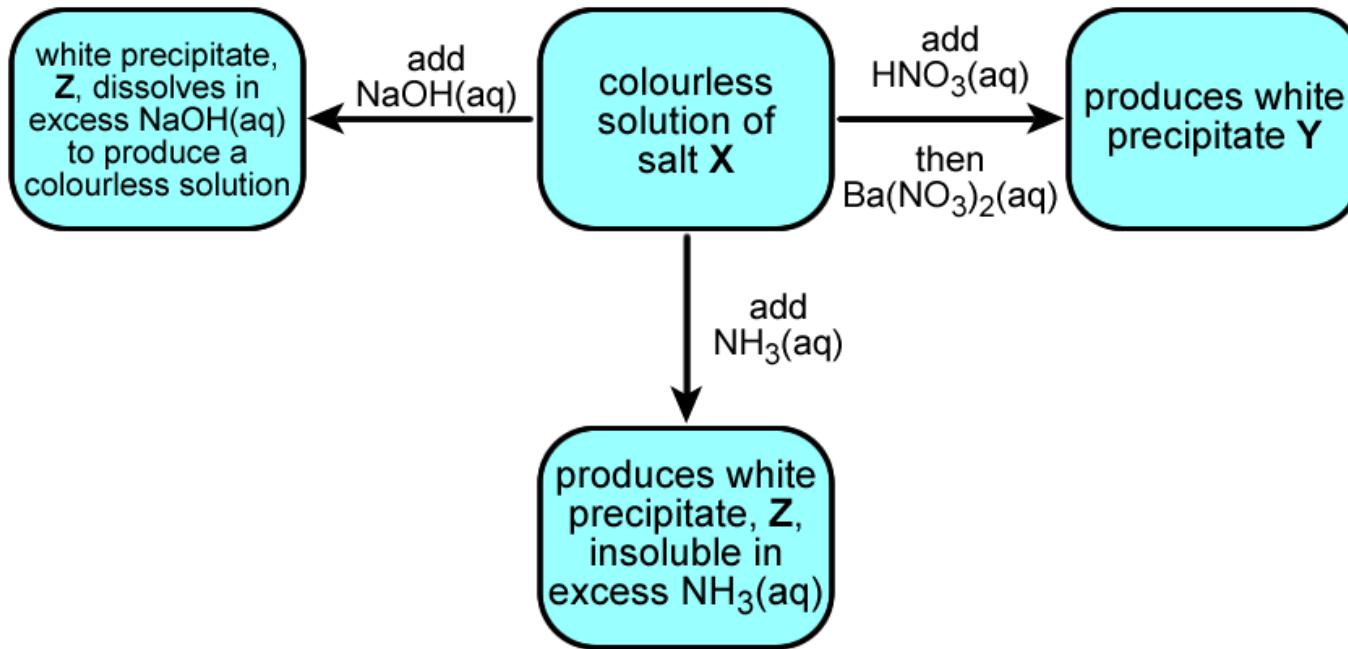
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 31.

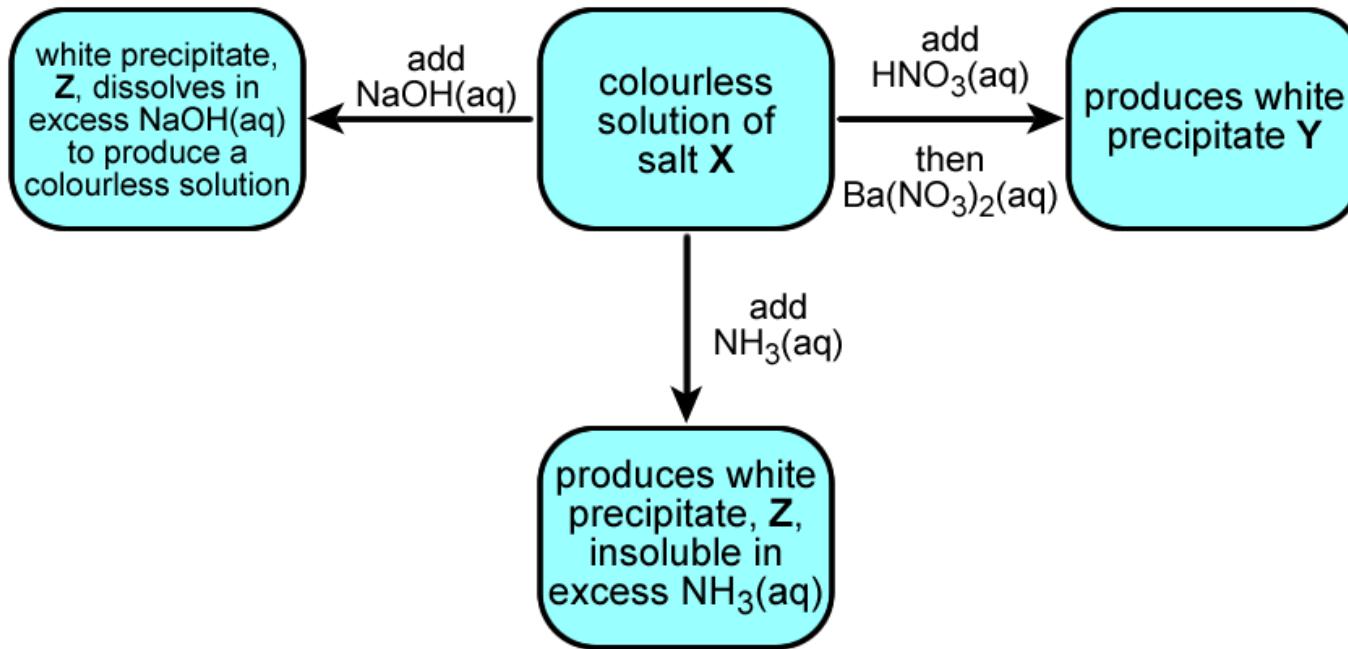


- Identify **X**, **Y** and **Z**.

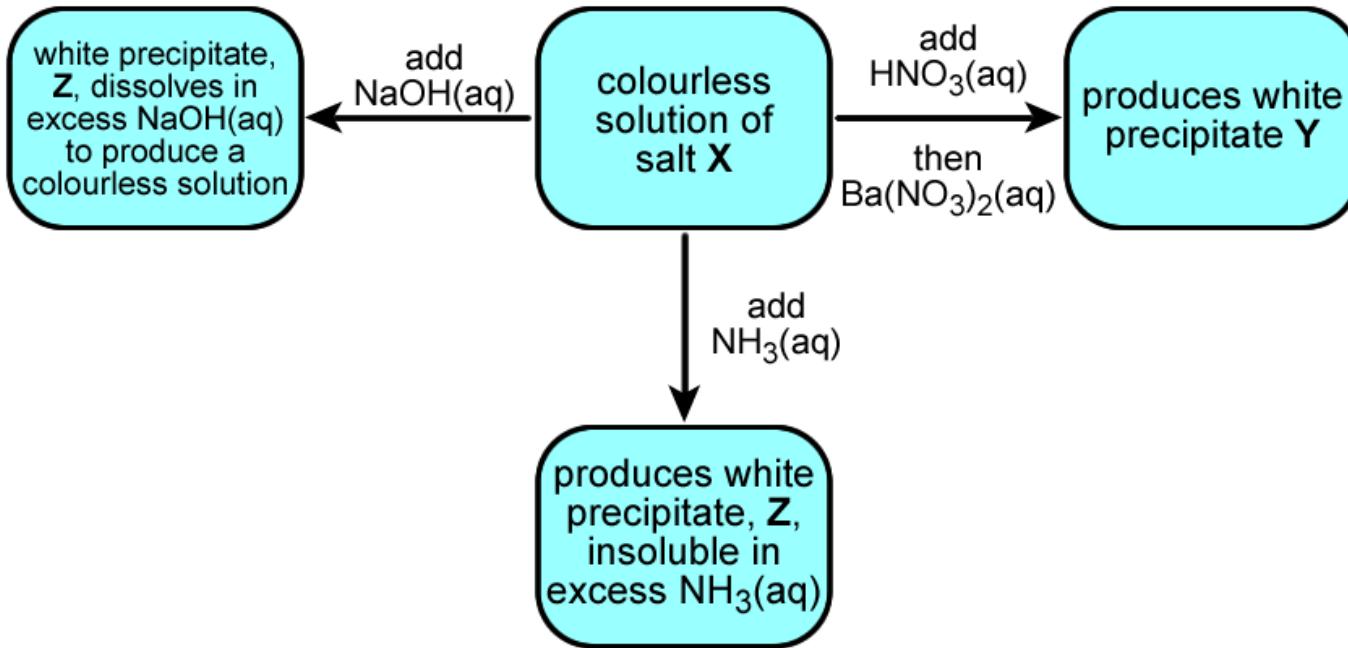
- Return to Index of Salts



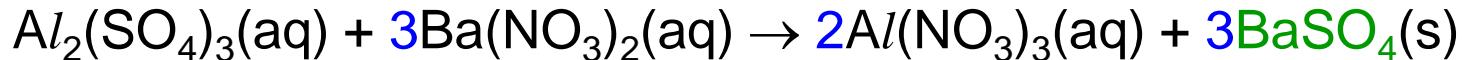
Complete Qualitative Analysis 31.



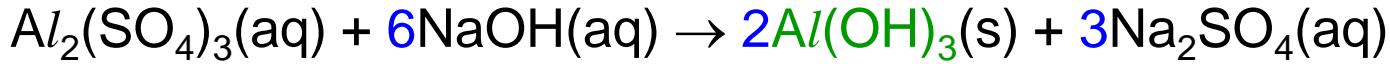
Complete Qualitative Analysis 31.



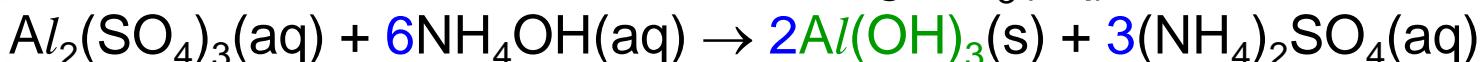
- Formation of **Y**



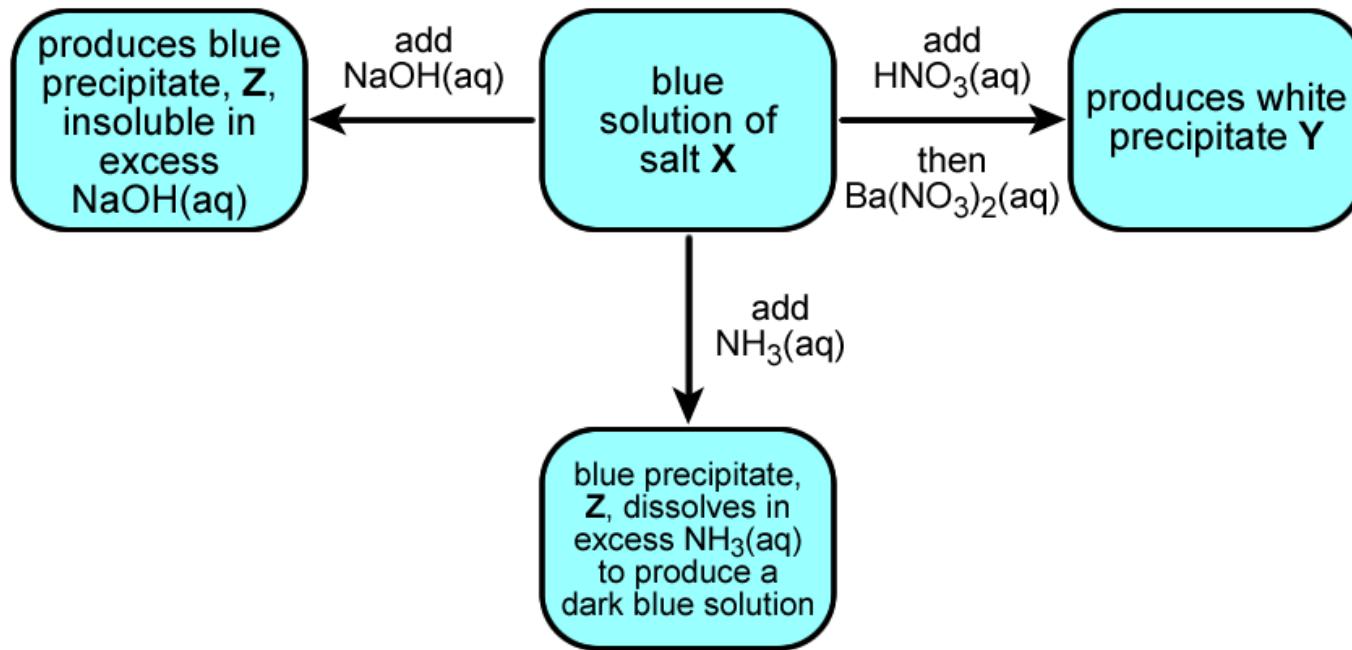
- Formation of **Z** using $NaOH(aq)$



- Formation of **Z** using $NH_3(aq)$



Complete Qualitative Analysis 32.

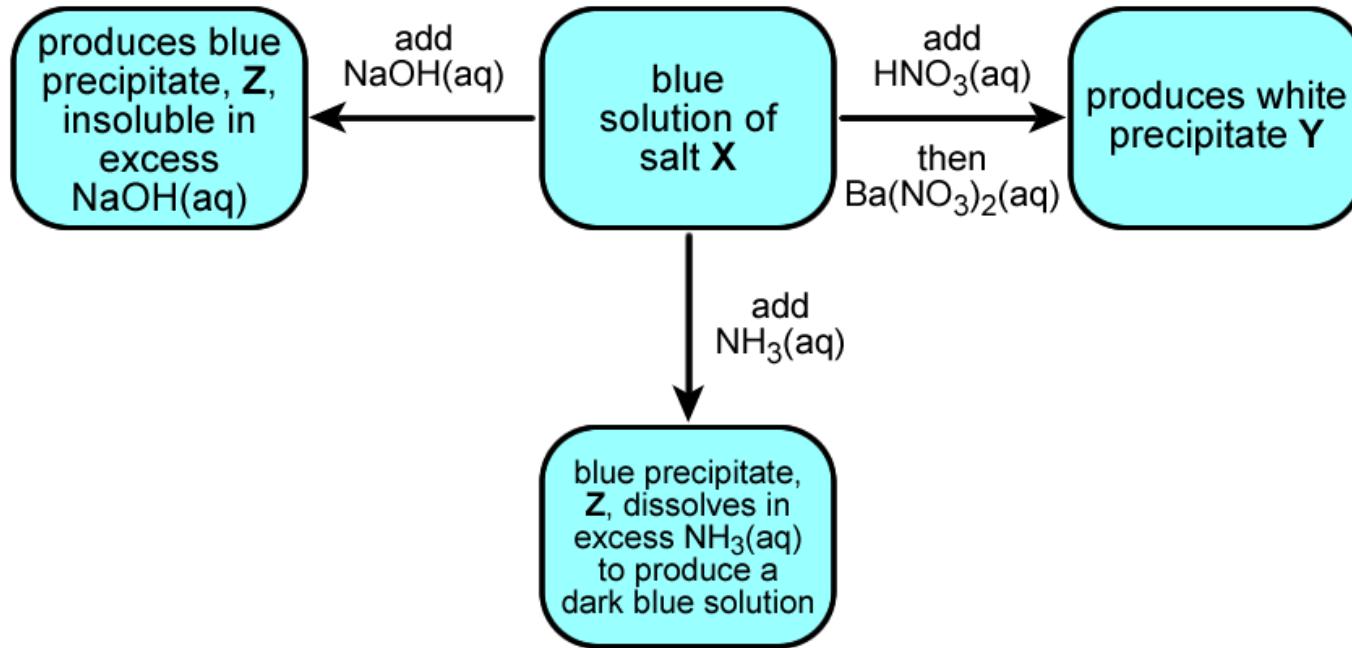


- Identify **X**, **Y** and **Z**.

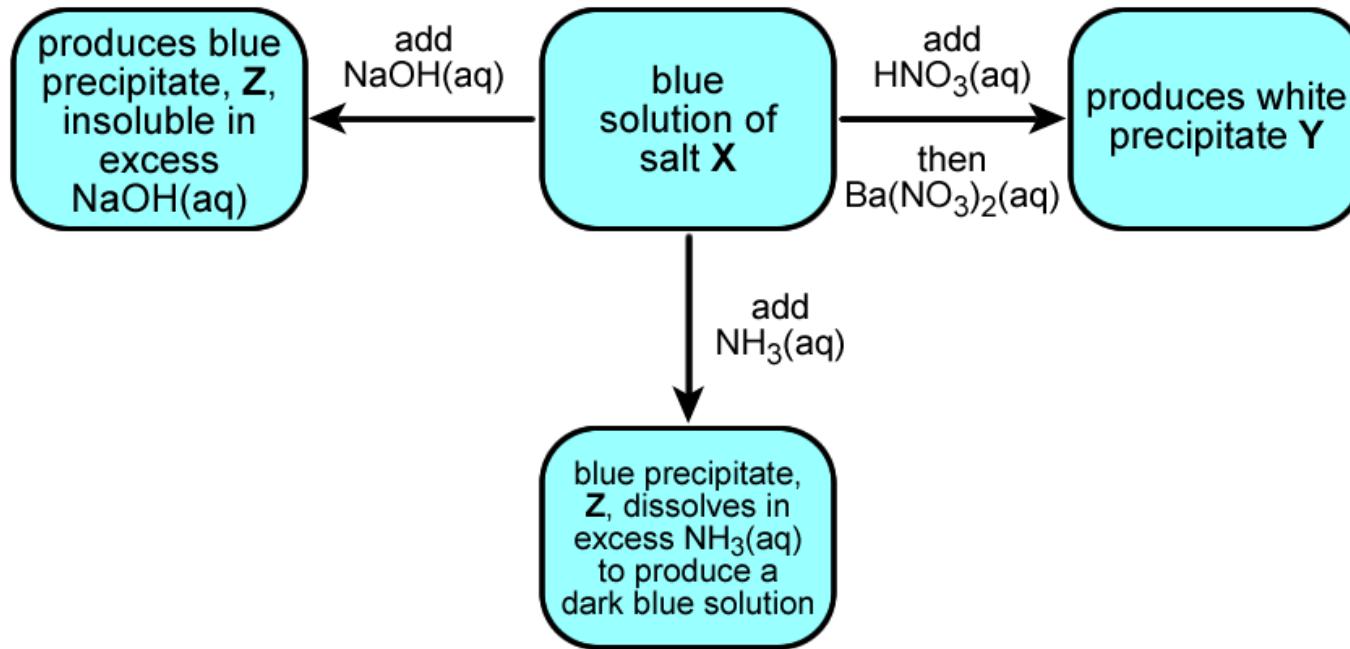
- Return to Index of Salts



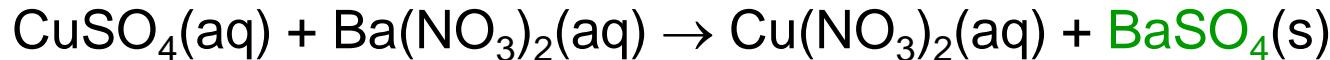
Complete Qualitative Analysis 32.



Complete Qualitative Analysis 32.



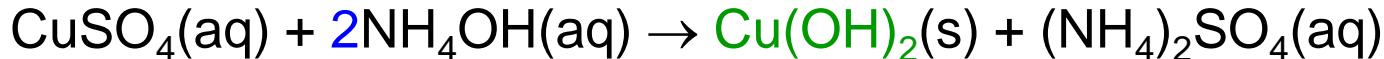
- Formation of Y



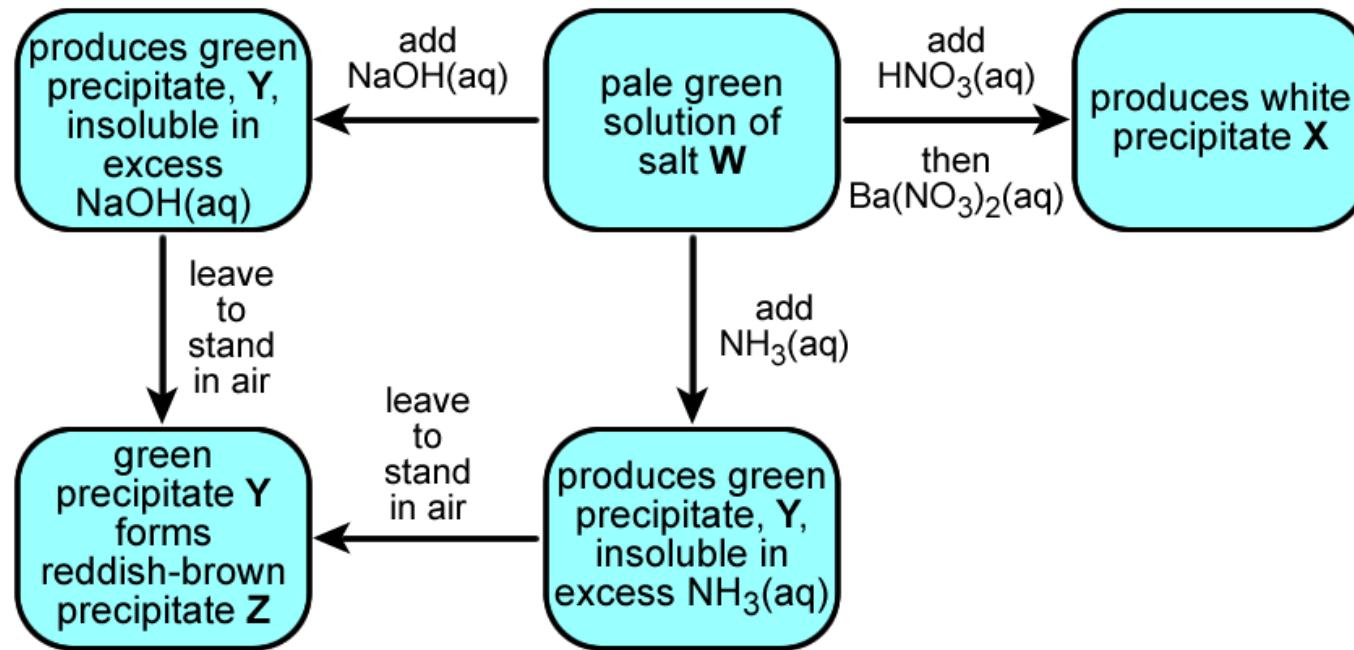
- Formation of Z using NaOH(aq)



- Formation of Z using NH₃(aq)



Complete Qualitative Analysis 33.

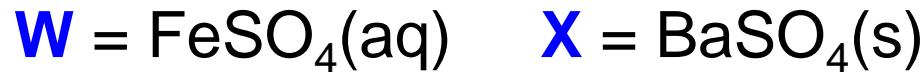
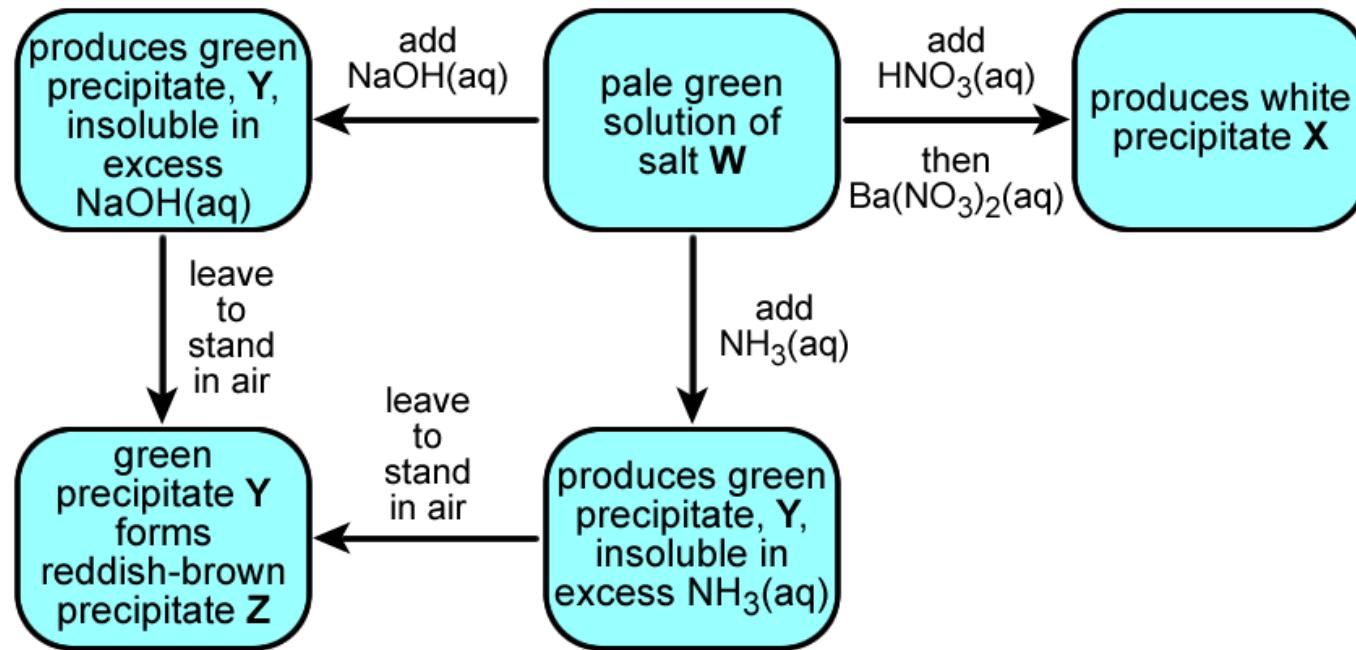


- Identify **W, X, Y** and **Z**.

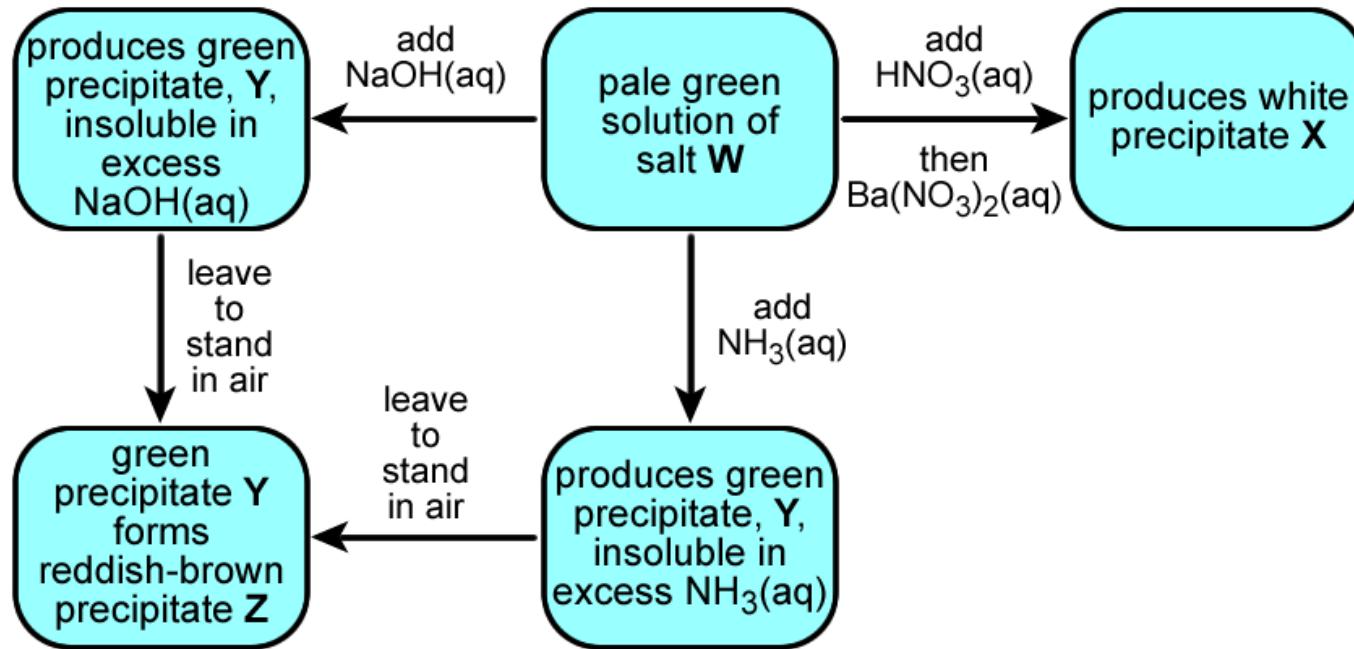


- Return to Index of Salts

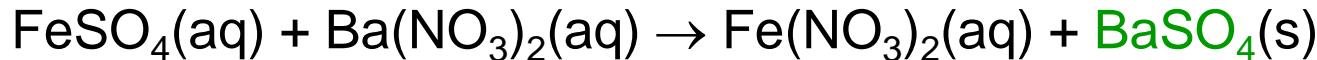
Complete Qualitative Analysis 33.



Complete Qualitative Analysis 33.



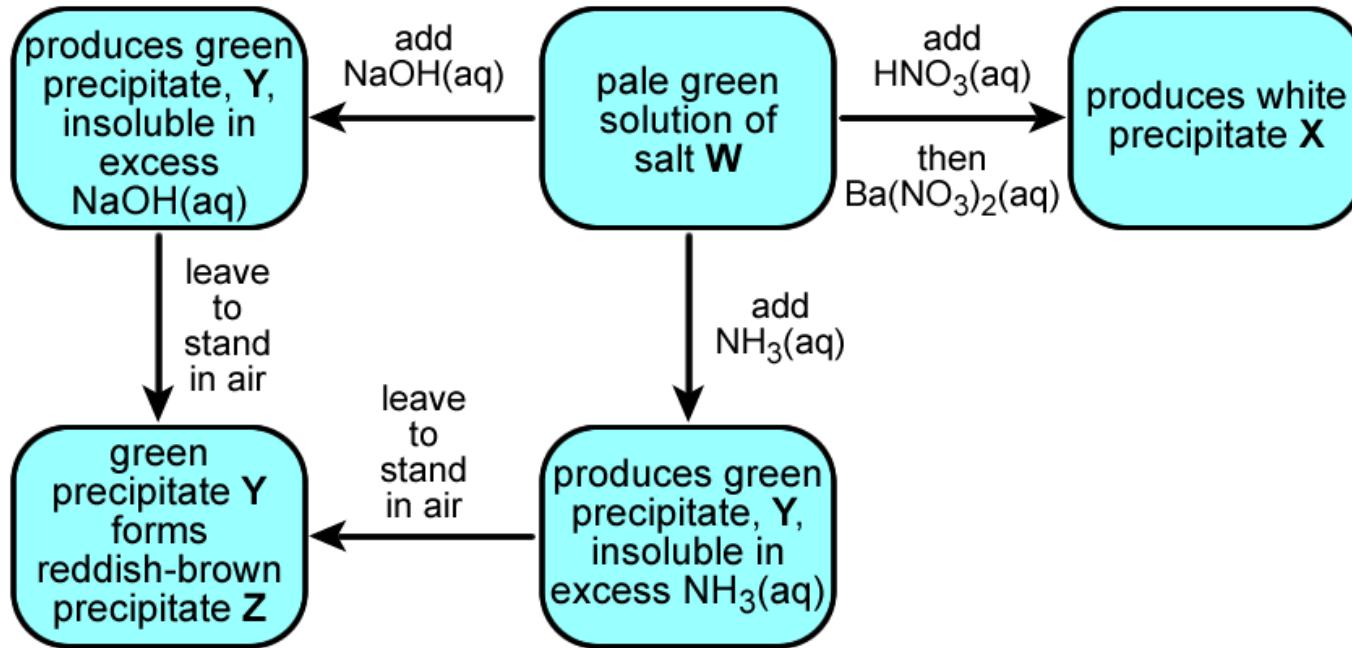
- Formation of **X**



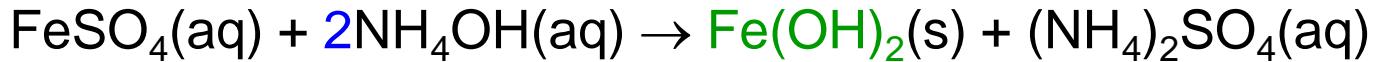
- Formation of **Y** using NaOH(aq)



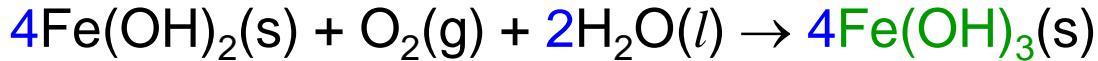
Complete Qualitative Analysis 33.



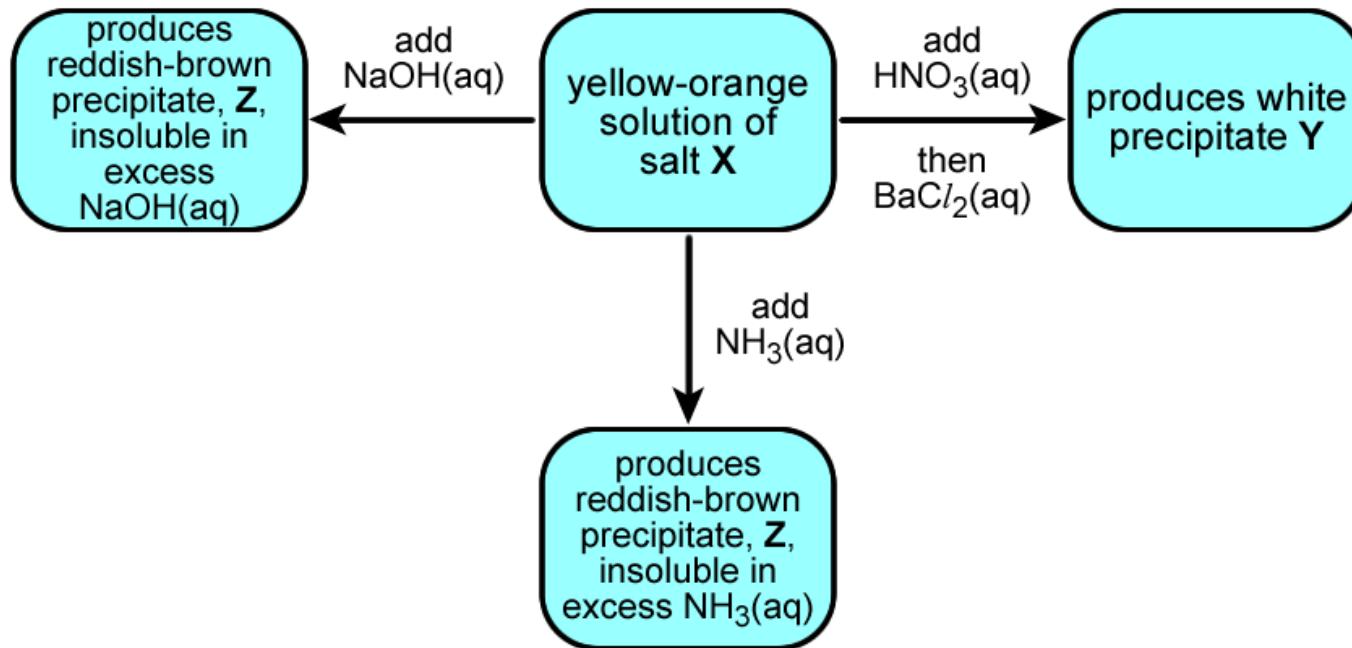
- Formation of **Y** using NH₃(aq)



- Formation of **Z** – the aerial oxidation of Fe²⁺(aq) to Fe³⁺(aq):



Complete Qualitative Analysis 34.

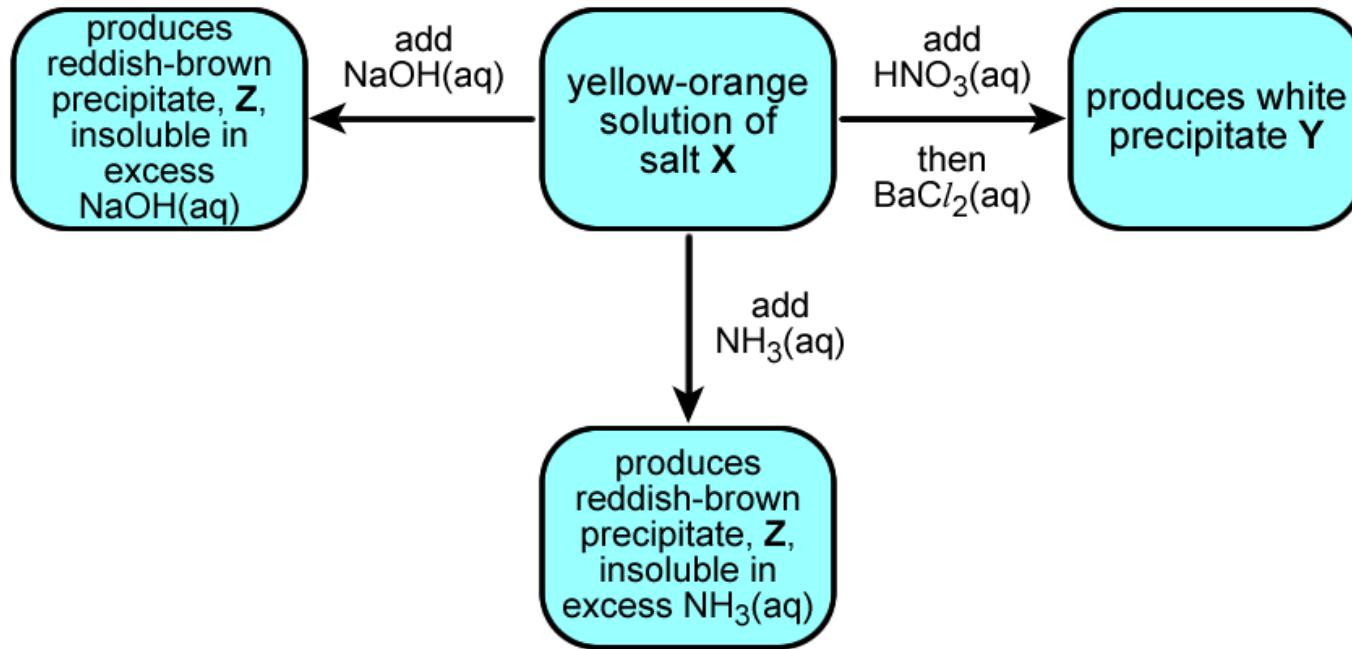


- Identify **X**, **Y** and **Z**.

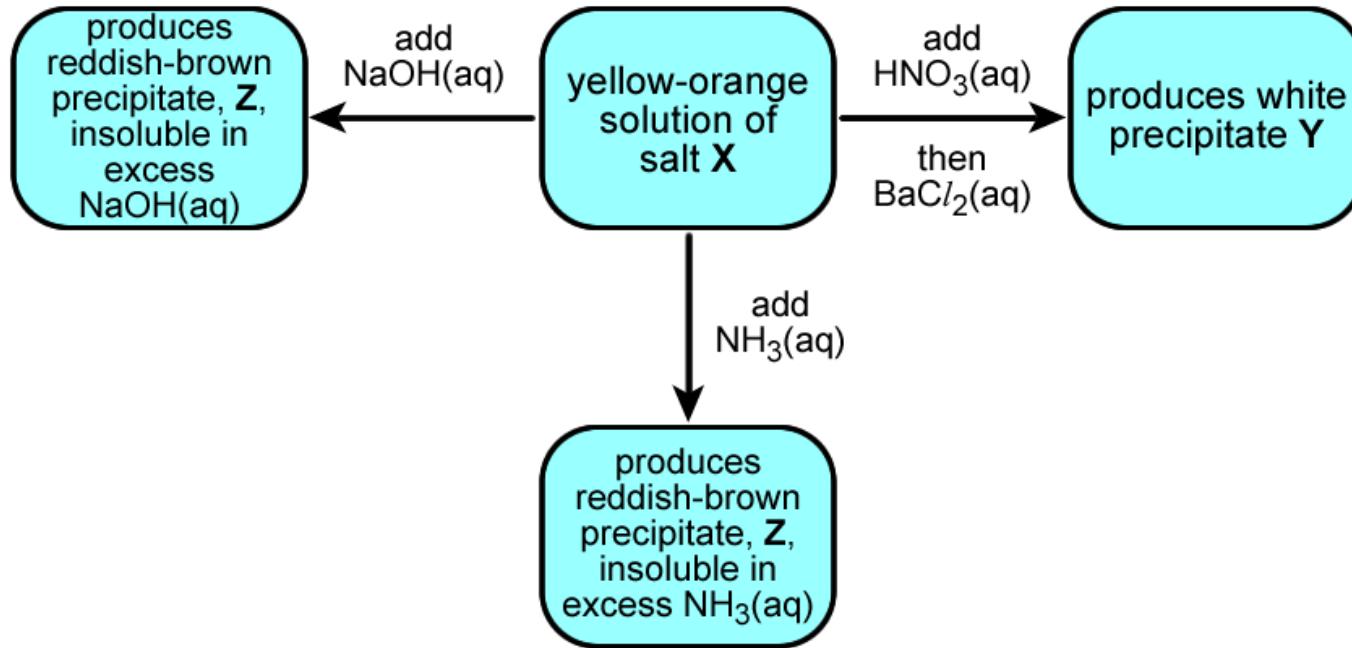
- Return to Index of Salts



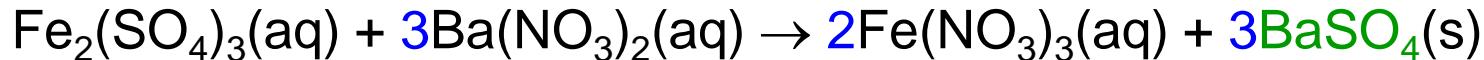
Complete Qualitative Analysis 34.



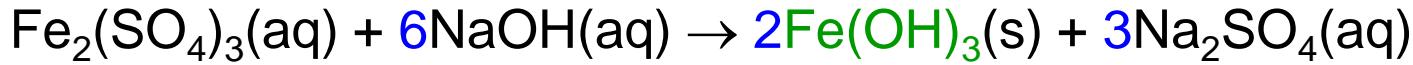
Complete Qualitative Analysis 34.



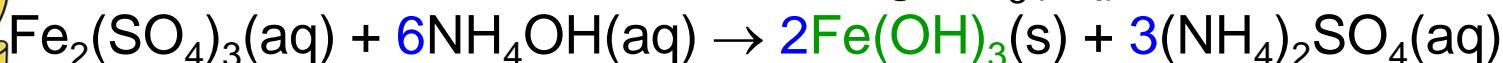
- Formation of **Y**



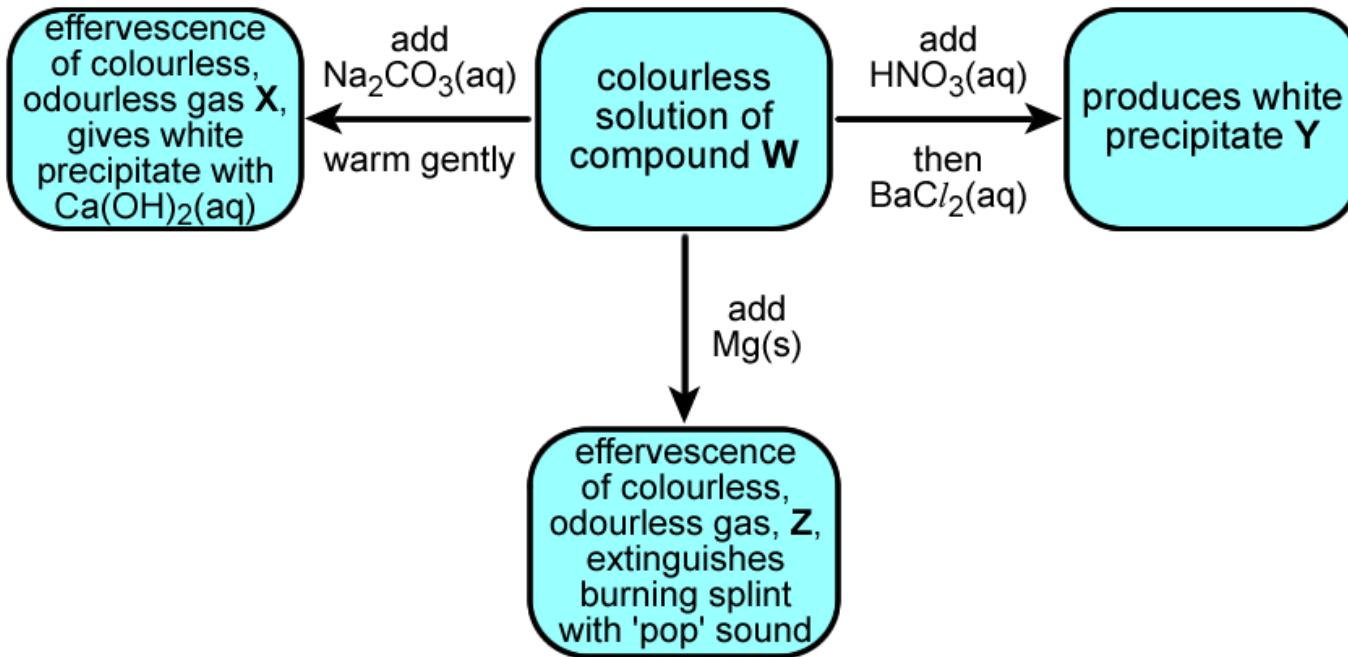
- Formation of **Z** using $\text{NaOH}(\text{aq})$



- Formation of **Z** using $\text{NH}_3(\text{aq})$



Complete Qualitative Analysis 35.

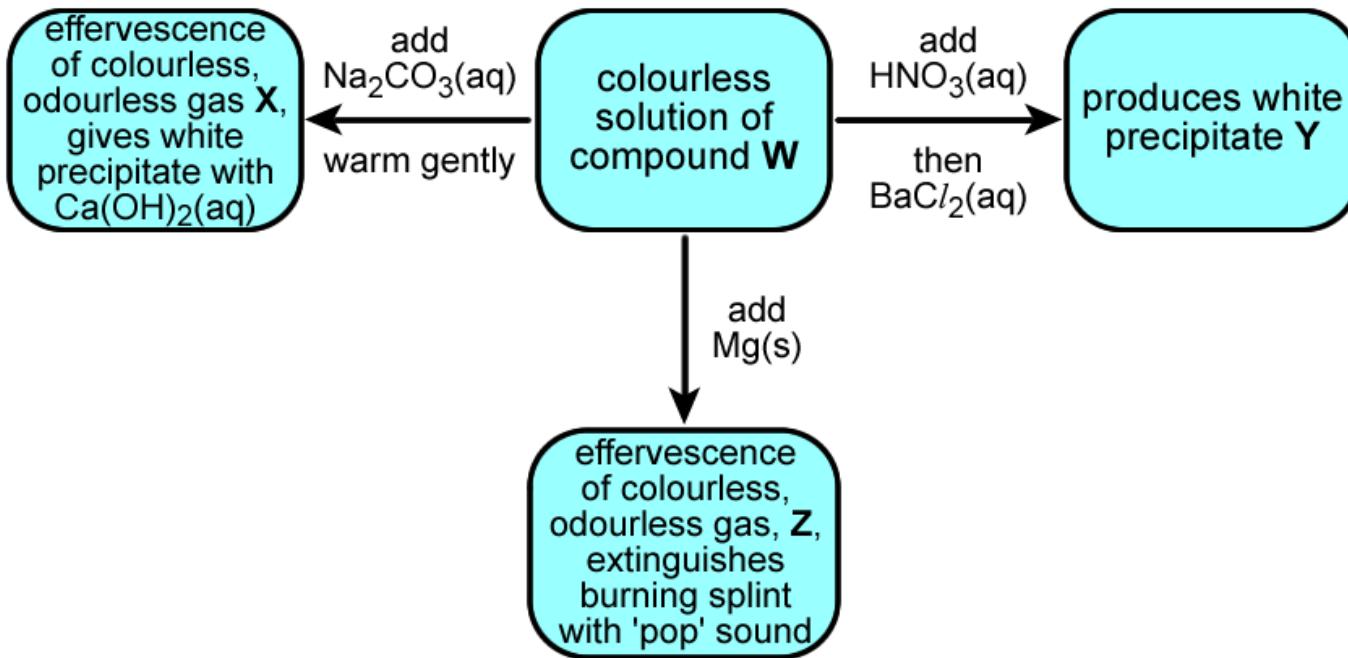


- Identify **W**, **X**, **Y** and **Z**.

- Return to Index of Salts



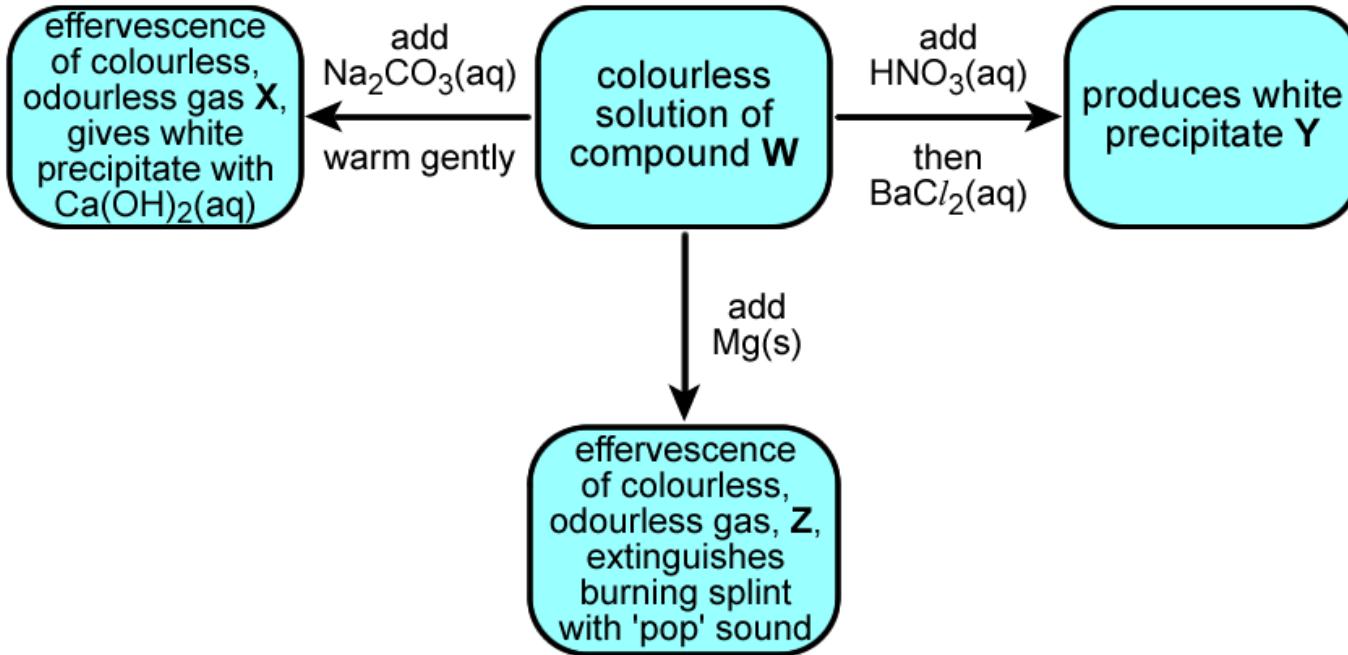
Complete Qualitative Analysis 35.



$$\mathbf{W} = \text{H}_2\text{SO}_4(\text{aq}) \quad \mathbf{X} = \text{CO}_2(\text{g}) \quad \mathbf{Y} = \text{BaSO}_4(\text{s}) \quad \mathbf{Z} = \text{H}_2(\text{g})$$



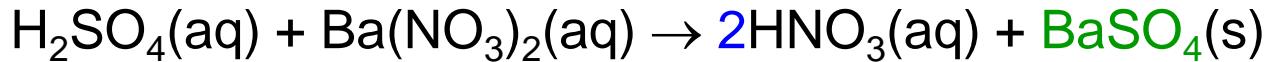
Complete Qualitative Analysis 35.



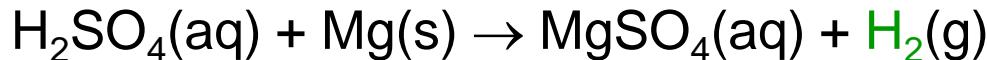
- Formation of **X**



- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 36.

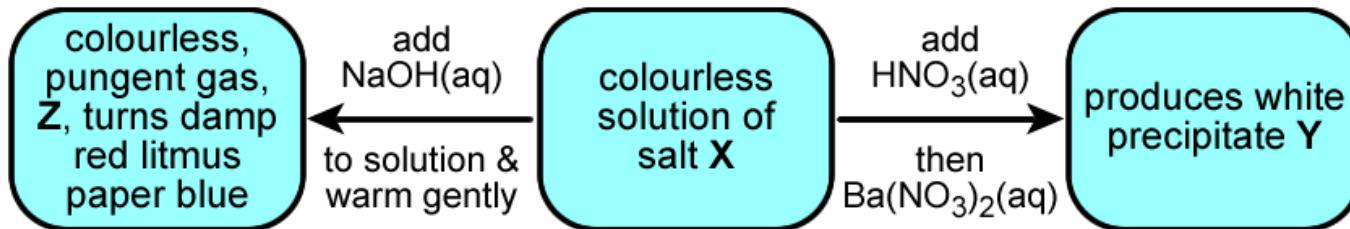


- Identify **X**, **Y** and **Z**.

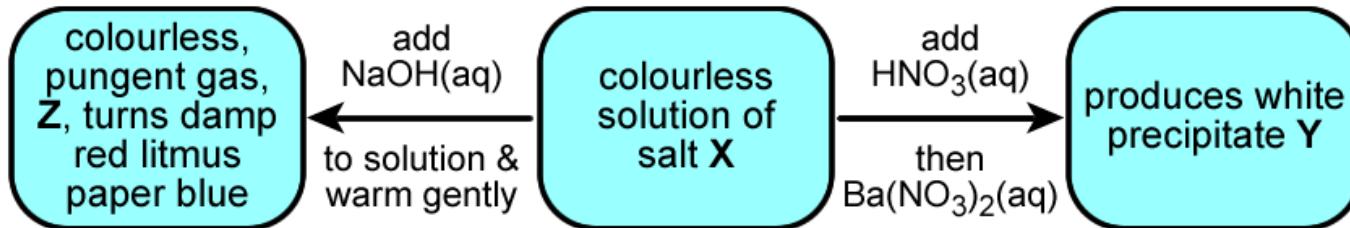
- Return to Index of Salts



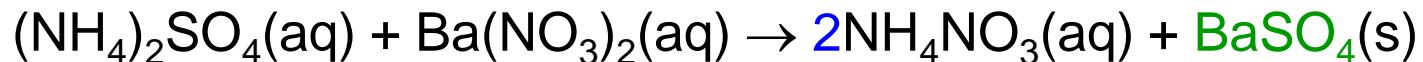
Complete Qualitative Analysis 36.



Complete Qualitative Analysis 36.



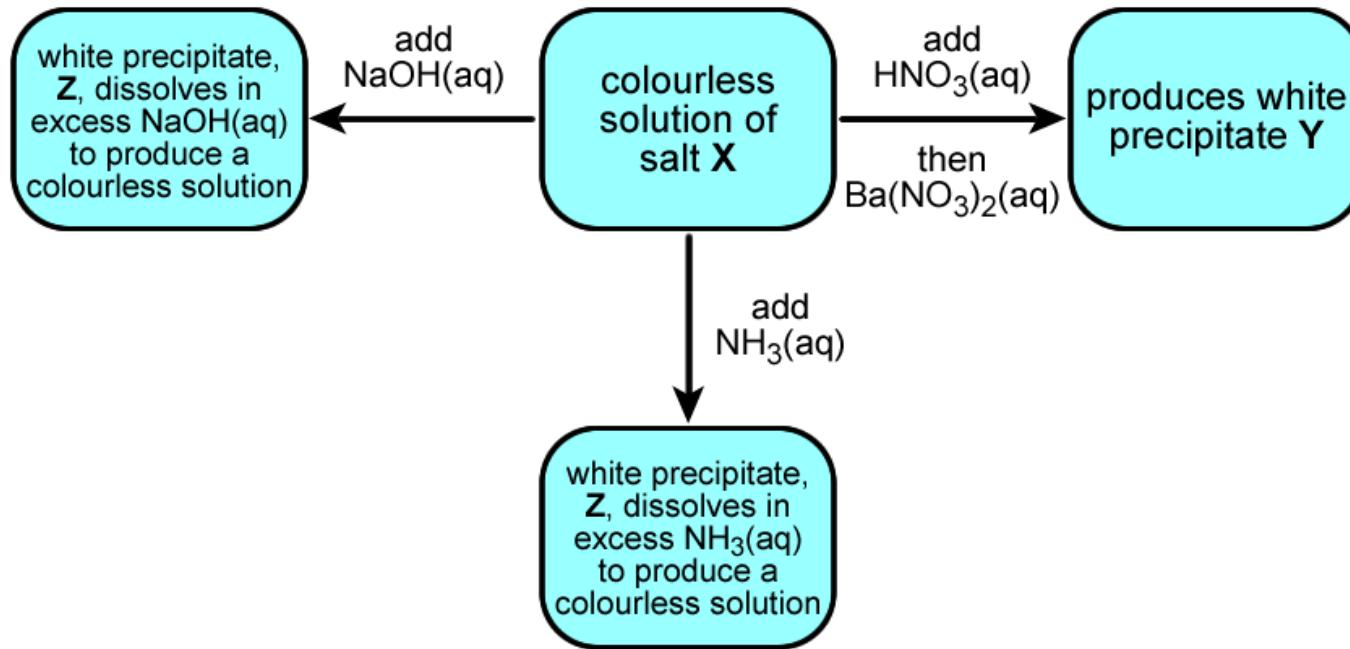
- Formation of **Y**



- Formation of **Z**



Complete Qualitative Analysis 37.

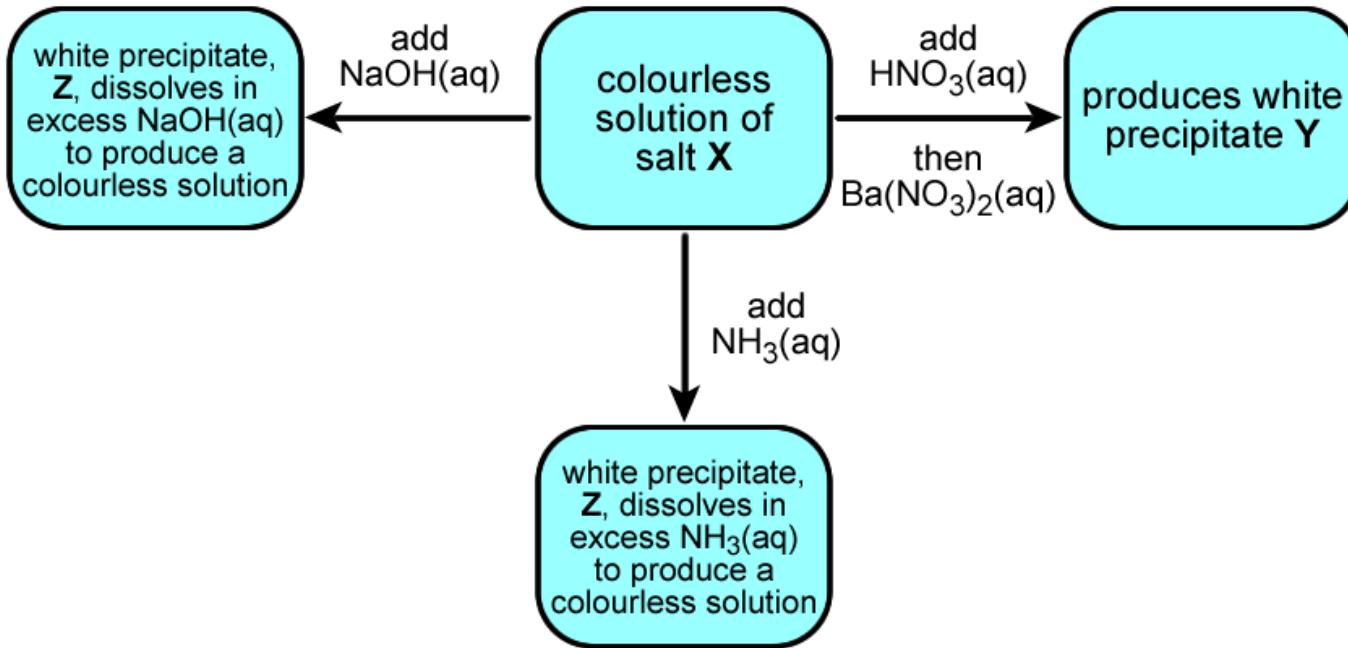


- Identify **X**, **Y** and **Z**.

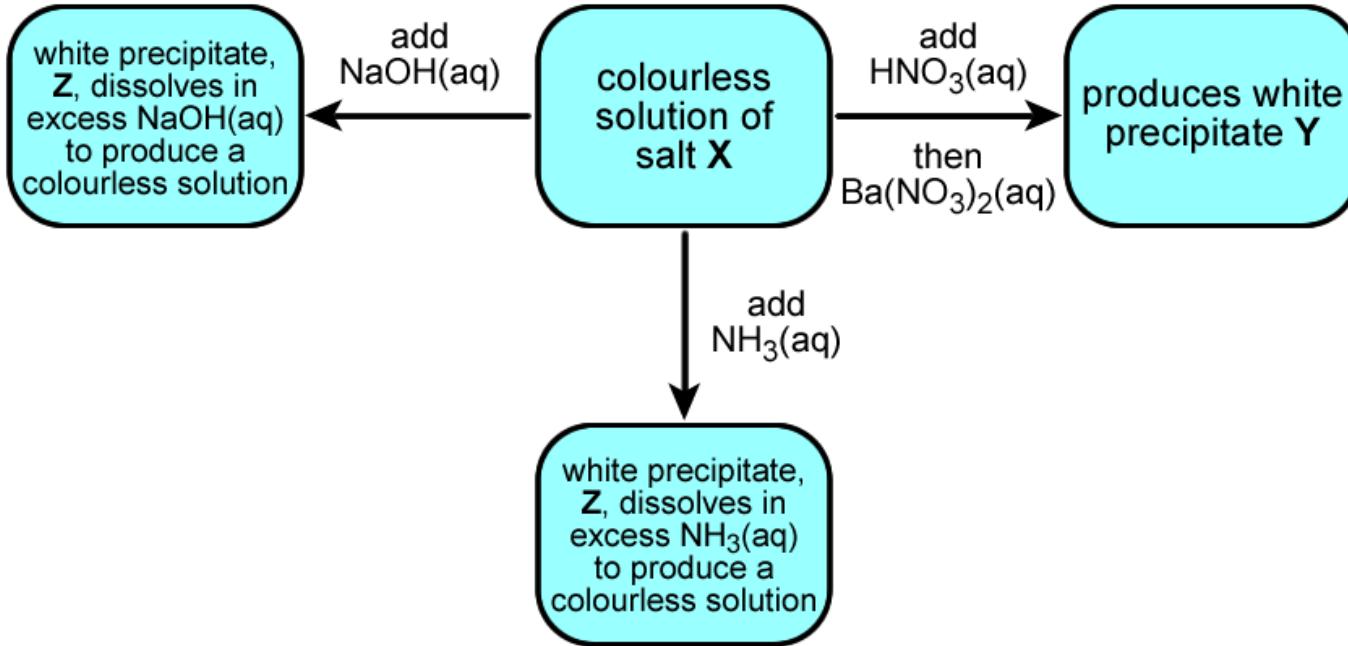


- Return to Index of Salts

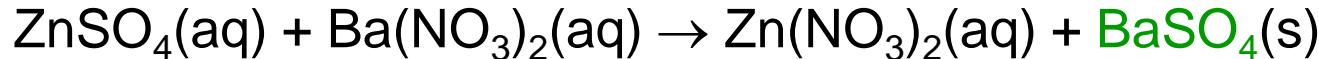
Complete Qualitative Analysis 37.



Complete Qualitative Analysis 37.



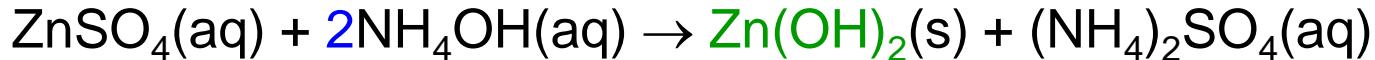
- Formation of **Y**



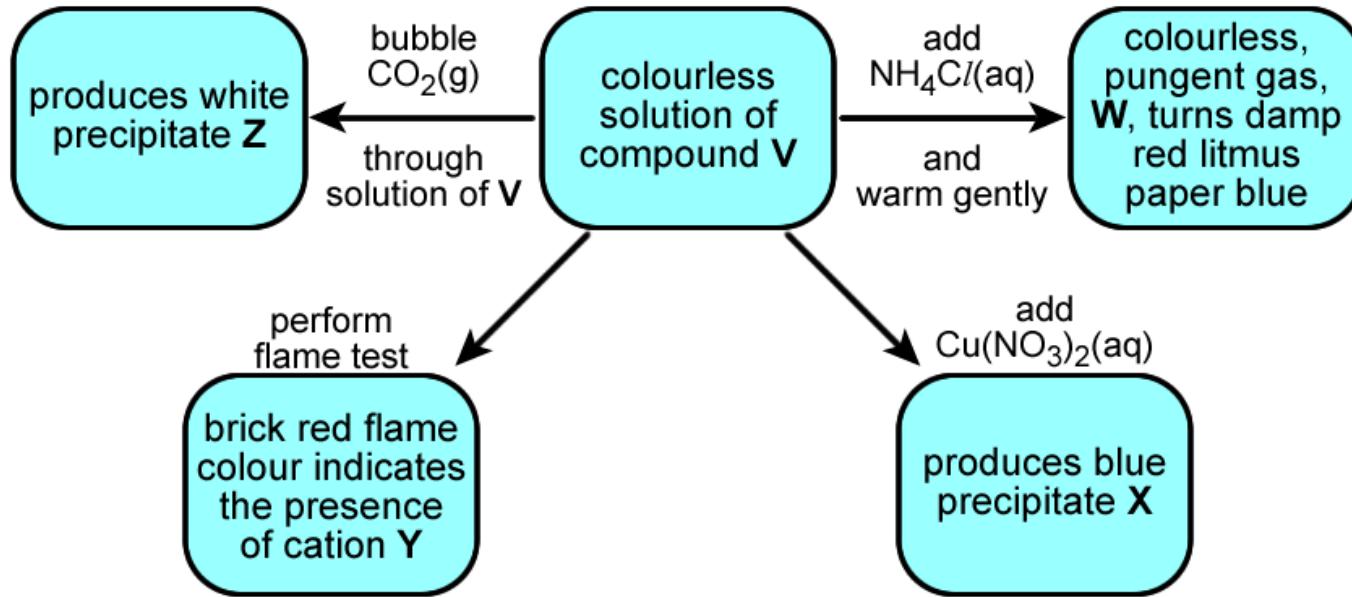
- Formation of **Z** using $\text{NaOH}(\text{aq})$



- Formation of **Z** using $\text{NH}_3(\text{aq})$



Complete Qualitative Analysis 38.

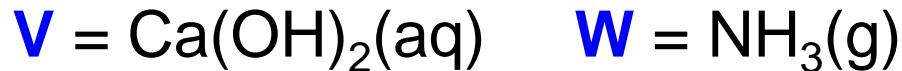
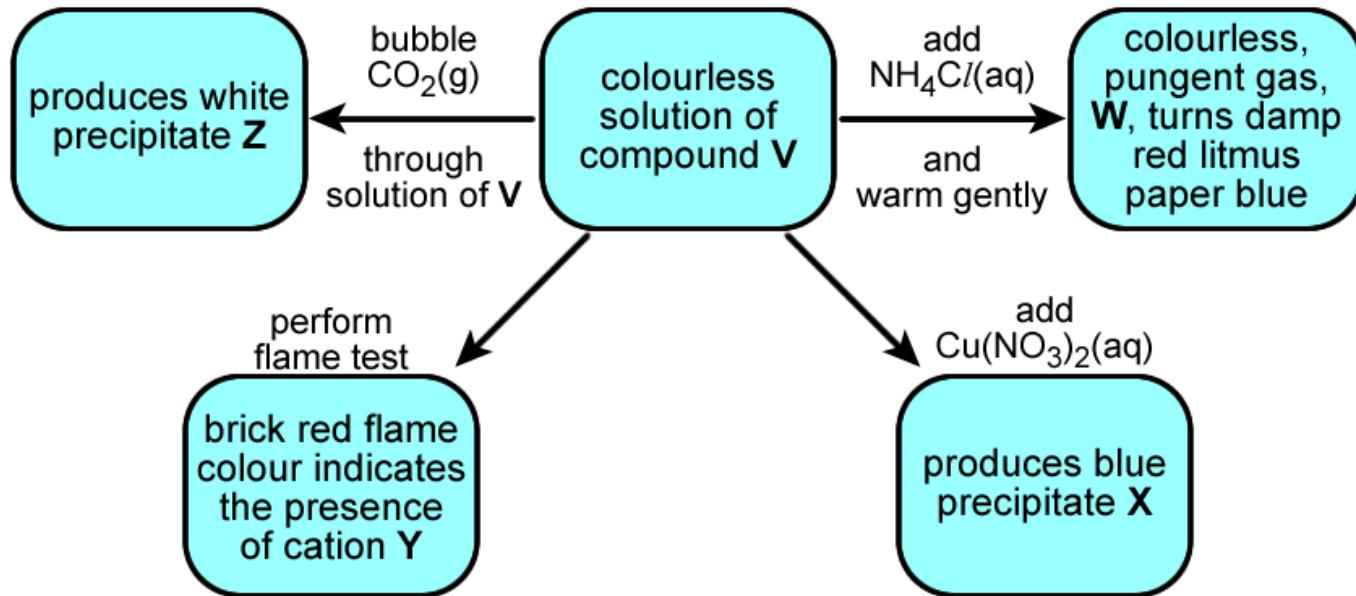


- Identify **V**, **W**, **X**, **Y** and **Z**.

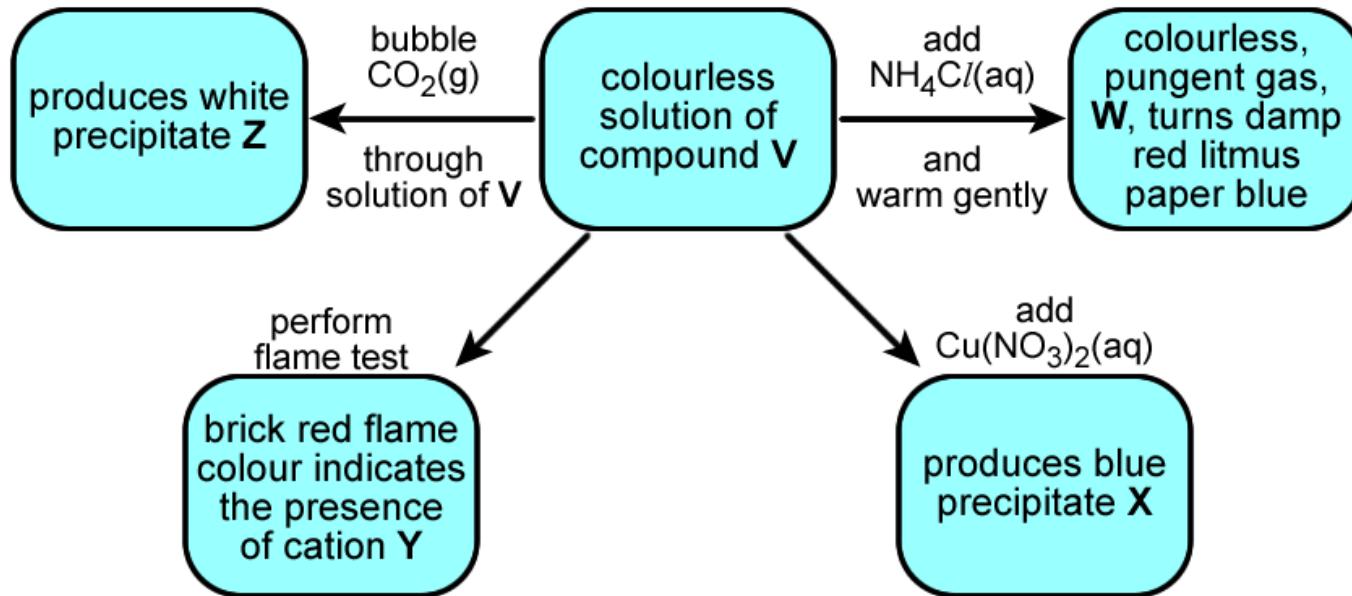
- Return to Index of Salts



Complete Qualitative Analysis 38.



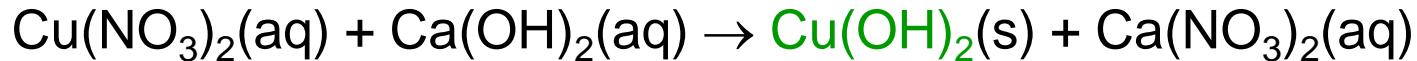
Complete Qualitative Analysis 38.



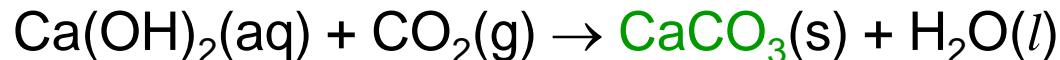
- Formation of W



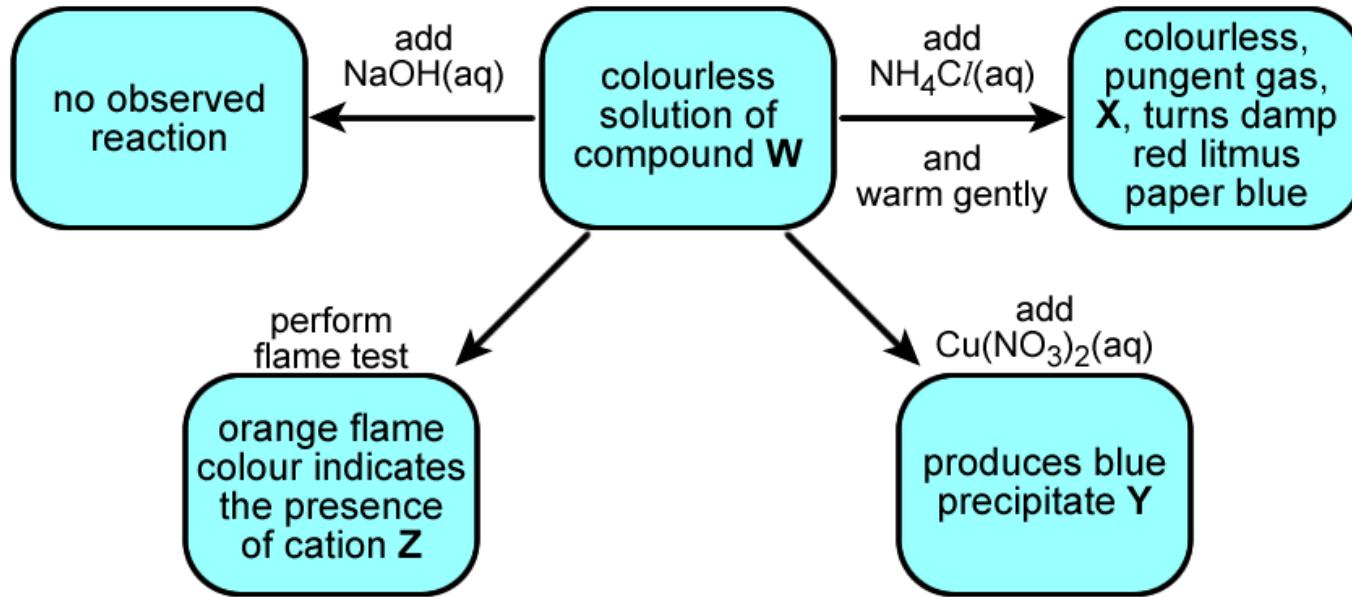
- Formation of X



- Formation of Z



Complete Qualitative Analysis 39.

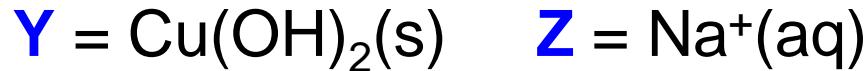
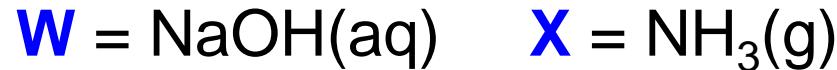
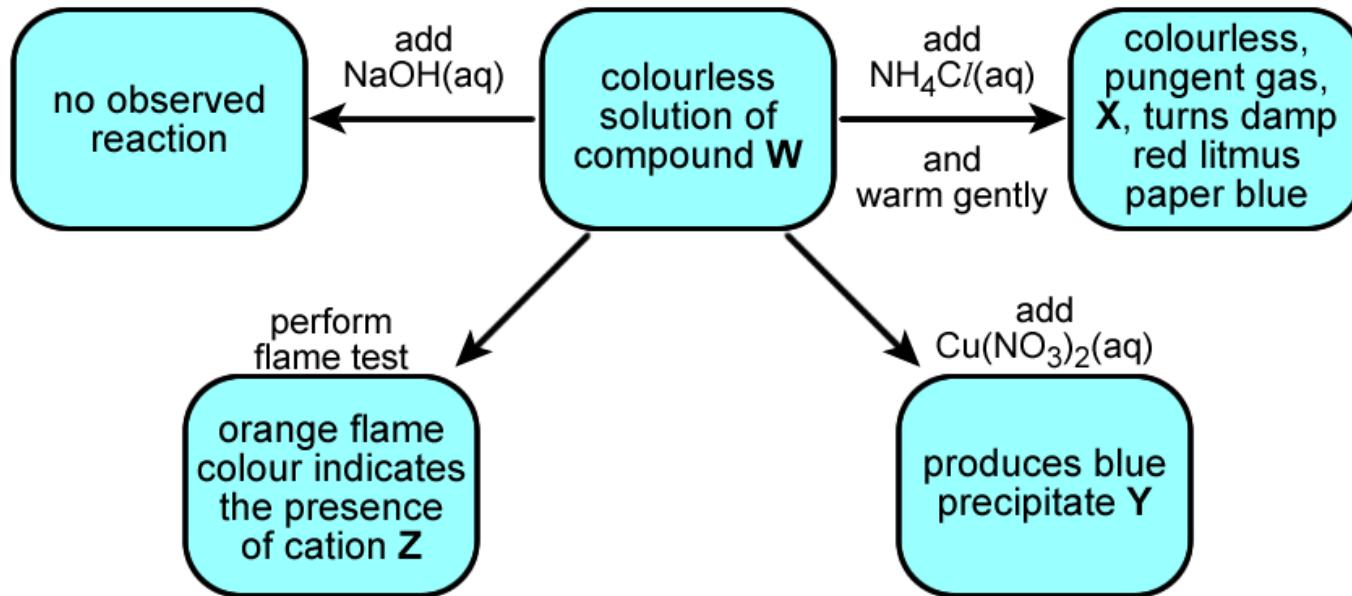


- Identify **W, X, Y** and **Z**.

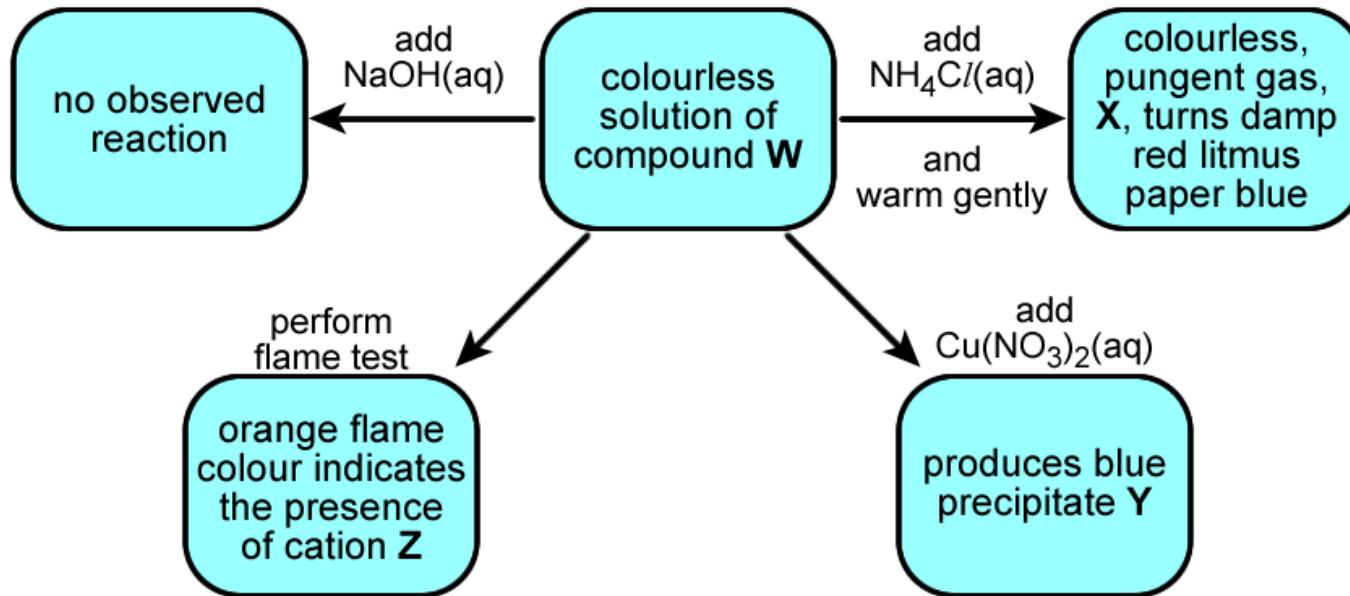
- Return to Index of Salts



Complete Qualitative Analysis 39.



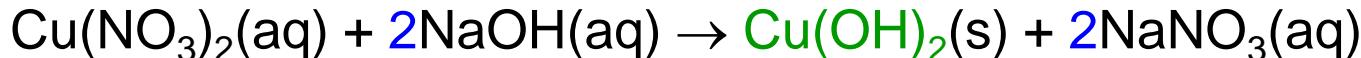
Complete Qualitative Analysis 39.



- Formation of X



- Formation of Y





Part Four: Index of Salts

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Complete Qualitative Analysis

Index of Salts (*Click to Link*)

1. CaCO_3	2. CuCO_3	3. FeCO_3	4. $\text{Fe}_2(\text{CO}_3)_3$	5. $(\text{NH}_4)_2\text{CO}_3$	6. PbCO_3	7. ZnCO_3
8. AlCl_3	9. CaCl_2	10. CuCl_2	11. FeCl_2	12. FeCl_3	13. HCl	14. NH_4Cl
15. ZnCl_2	16. AlI_3	17. CaI_2	18. FeI_2	19. FeI_3	20. NH_4I	21. ZnI_2
22. $\text{Al}(\text{NO}_3)_3$	23. $\text{Ca}(\text{NO}_3)_2$	24. $\text{Cu}(\text{NO}_3)_2$	25. $\text{Fe}(\text{NO}_3)_2$	26. $\text{Fe}(\text{NO}_3)_3$	27. HNO_3	28. NH_4NO_3
29. $\text{Pb}(\text{NO}_3)_2$	30. $\text{Zn}(\text{NO}_3)_2$	31. $\text{Al}_2(\text{SO}_4)_3$	32. CuSO_4	33. FeSO_4	34. $\text{Fe}_2(\text{SO}_4)_3$	35. H_2SO_4
36. $(\text{NH}_4)_2\text{SO}_4$	37. ZnSO_4	38. $\text{Ca}(\text{OH})_2$	39. NaOH			





Presentation on
Complete Qualitative
Analysis

By Dr. Chris Slatter

Nanyang Girls'
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