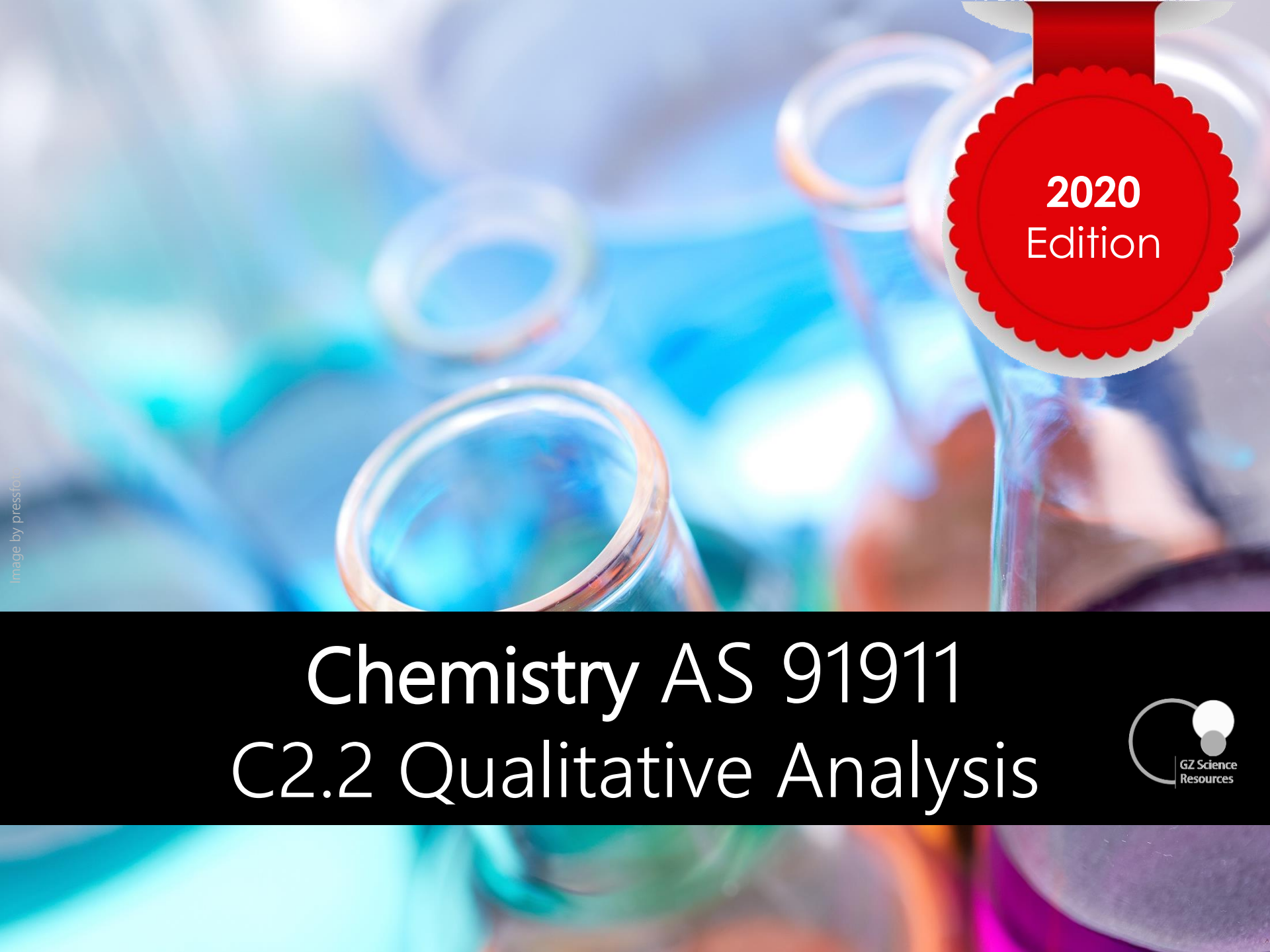


Chemistry AS 91911
C2.2 Qualitative Analysis

GZ Science Resources

What is this NCEA Achievement Standard?

When a student achieves a standard, they gain a number of credits. Students must achieve a certain number of credits to gain an NCEA certificate (80 for Level 2)

The standard you will be assessed on is called **Chemistry 2.2 Carry out an investigation into chemical species present in a sample using qualitative analysis**
It will be internally (in Class) assessed as part of a **Investigation** and will count towards **3 credits** for your Level 2 NCEA in Chemistry

What are the main steps required in this Internal Assessment?

AS91911 Investigating the Ions in a Solution

The method

Carry out procedures to identify ions involves collecting primary data and using these observations to **identify ions** in a solution using a procedure provided.

Identification of ions must be supported by **experimental observations** and identification of all precipitates formed. You must state the significance of an identified chemical species for people and/or the environment.

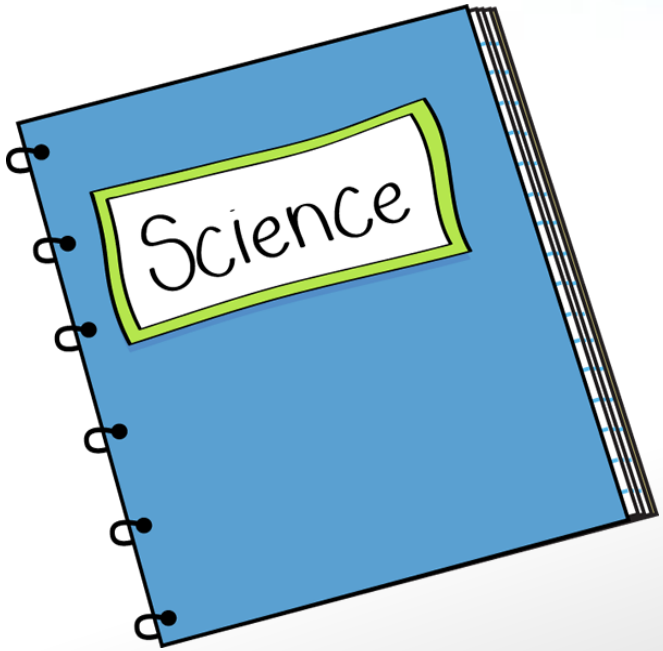
Ions to be identified will be limited to: Ag^{+}, Al^{3+}, Ba^{2+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Mg^{2+}, Pb^{2+}, Na^{+}, Zn^{2+}, Cl^{-}, CO_3^{2-}, I^{-}, NO_3^{-}, OH^{-}, SO_4^{2-}. (Na^{+} and NO_3^{-} are identified by a process of elimination.)

Complex ions are limited to $[FeSCN]^{2+}$ and those formed when $OH^{-}_{(aq)}$ or $NH_{3(aq)}$ react with cations listed above, such as $[Ag(NH_3)_2]^{+}$, $[Al(OH)_4]^{-}$, $[Pb(OH)_4]^{2-}$, $[Zn(OH)_4]^{2-}$, $[Zn(NH_3)_4]^{2+}$, $[Cu(NH_3)_4]^{2+}$.

Aiming for Merit and Excellence

Interpretation of evidence for Merit

In addition to Achieved you have also linked observations to ions in solution, written a balanced equation for any precipitates that form and explained an impact of the identified chemical species for people and/or the environment.



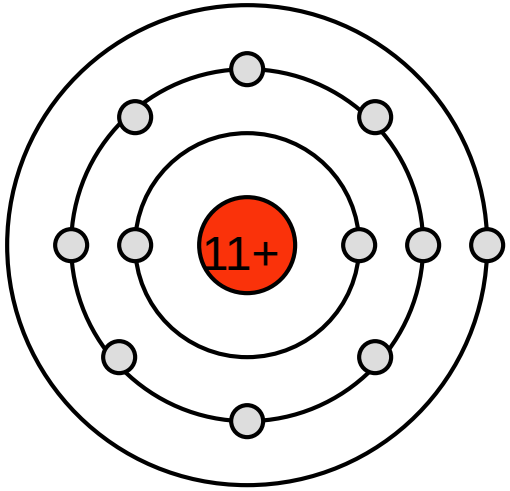
Interpretation of evidence for Excellence

In addition to Merit you have also linked the observations to the formation of a complex ion, written an equation for the formation of a complex ion, discussed the positive and negative impacts one of the ions has on humans or the environment and provided a list of resources used

Anions and Cations

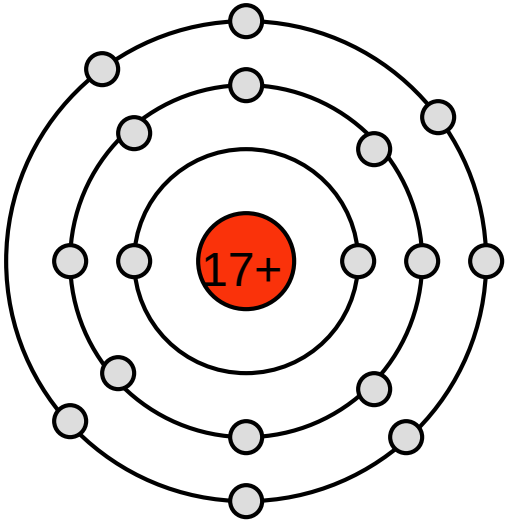
Ions are atoms or groups of atoms with electrical charge. Ions form when atoms gain or lose electrons.
Elements are most stable when the outer shell (valence shell) is full.
Elements can lose or gain electrons when they react with other chemicals to form ions.

Cation Sodium (Na)



Sodium now becomes the sodium ion Na^+

Anion Chlorine (Cl)



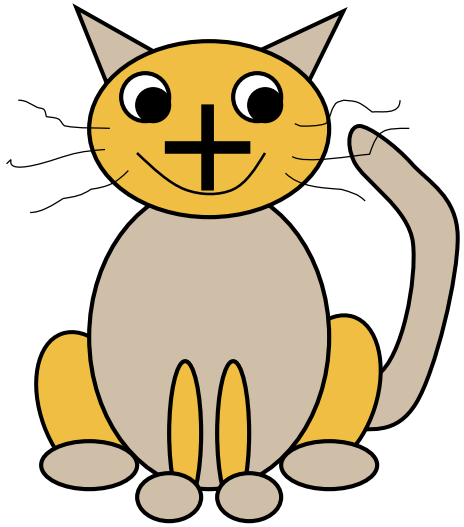
Chlorine now becomes the chloride ion Cl^-

Anions and Cations

Atoms that lose electrons form positively charged ions, or **cations**.

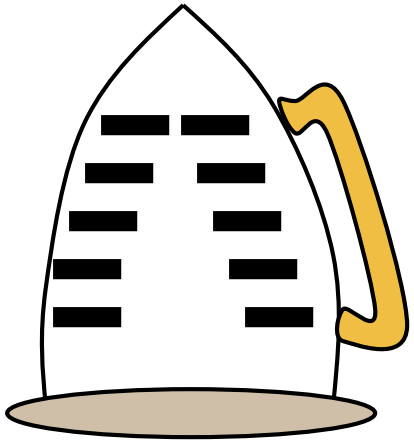
Atoms that gain electrons form negatively charged ions, or **anions**.

Cation (Cat)



Metals lose electrons to form Cations. They have 1-3 electrons in their outside shell

Anion (an Iron)



Non-Metals gain electrons to form Anions. They have 7-8 electrons in their outside shell.

GZ Science Resources

Ion Chart - Cations

1+	2+	3+
sodium Na^+	magnesium Mg^{2+}	aluminium Al^{3+}
potassium K^+	iron (II) Fe^{2+}	iron (III) Fe^{3+}
silver Ag^+	copper (II) Cu^{2+}	
ammonium NH_4^+	zinc Zn^{2+}	
Hydrogen H^+	barium Ba^{2+}	
Lithium Li^+	lead Pb^{2+}	

GZ Science Resources

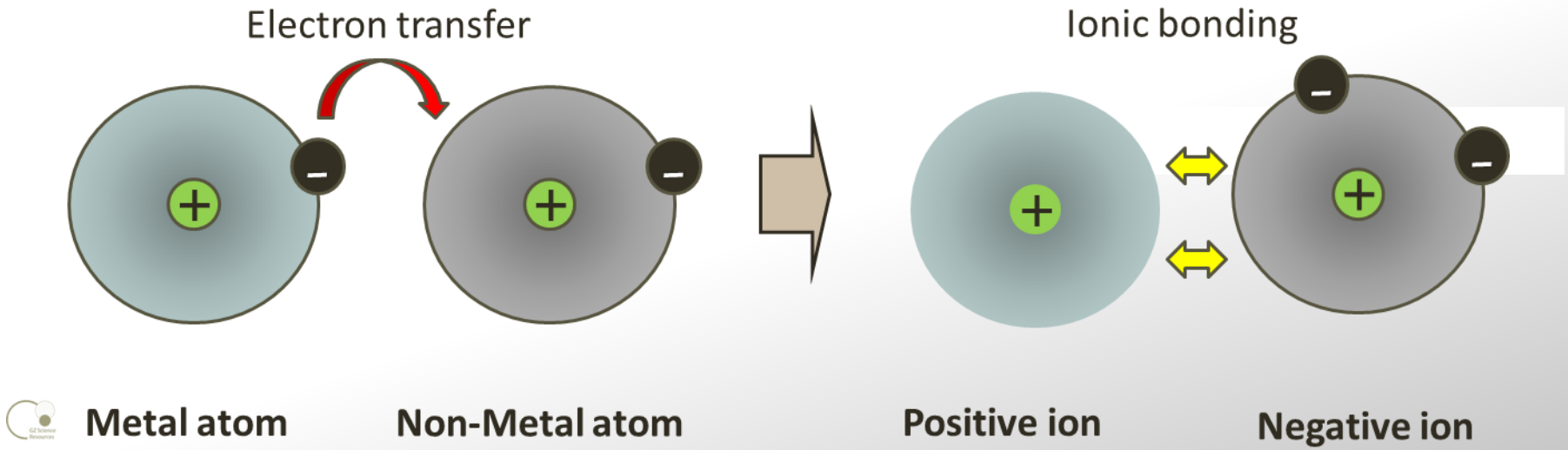
Ion chart - anions

1-		2-	
chloride	Cl^-	carbonate	CO_3^{2-}
iodide	I^-	oxide	O^{2-}
hydroxide	OH^-	sulfide	S^{2-}
hydrogen carbonate	HCO_3^-	sulfate	SO_4^{2-}
fluoride	F^-	sulfite	SO_3^{2-}
bromide	Br^-		
nitrate	NO_3^-		
		3-	
		phosphate	PO_4^{-3}

Ionic Bonding

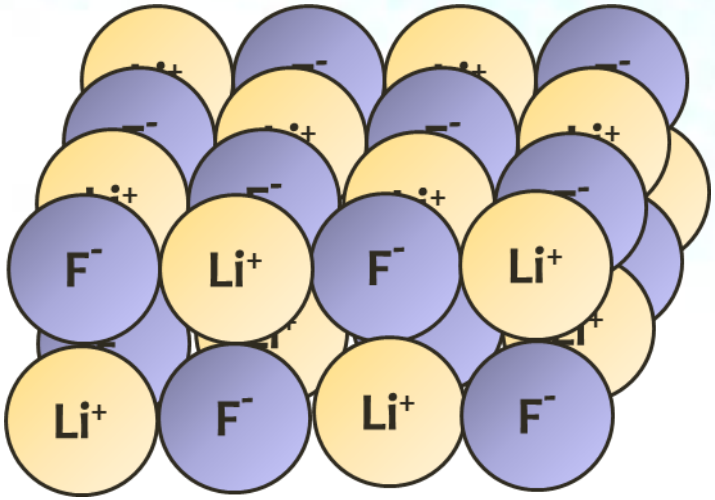
Ionic Bonding is where one atom takes valence (outside energy level) electrons from another to form ions and the resulting negative and positive ions hold together with **electrostatic attraction**. This type of bonding occurs when a **metal** and **non-metal** react and there is a **transfer of electrons** to form ions.

The ions then combine in a set ratio to form a neutral compound with negative and positive charges balanced out.



Ionic compounds are the product of chemical reactions between metal and non-metal ions

Some compounds are ionic compounds, since they are made up of cations and anions.



Compounds are neutral substances. For ionic compounds, the charges of the positive ions are balanced by the charges of the negative ions.

The Anion (F) takes the electrons off the Cation (Li) so their outer energy levels have a stable 8 electrons each.
Anions and Cations have a strong electrostatic attraction for each other so they bond together as a compound.

Chemical compound formula

A formula tells you the type of atoms that are in a compound and the number of each atom.

2 Mg atoms 4 N atoms 12 O atoms

$$2\,Mg(NO_3)_2$$

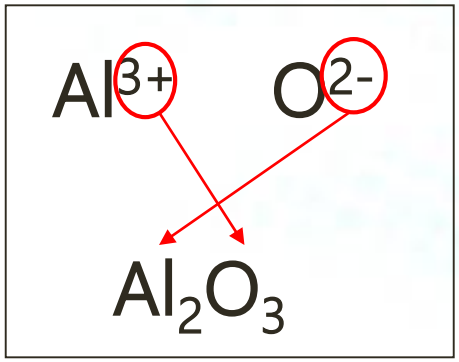
A number in front of the compound tells you how many molecules there are.

A number after an atom tells you how many atoms of that type are in the molecule.

A number after brackets tells you how many times to multiply every atom inside the brackets.

Writing Chemical compound formula

1. Write down the ions (with charges) that react to form the compound. Cation comes before Anion.



2. Cross and drop the charge numbers.
3. Place brackets around a compound ion.
4. If the numbers are both the same remove.
5. If any of the numbers are a 1 they are removed
6. Remove any brackets if not followed by a number

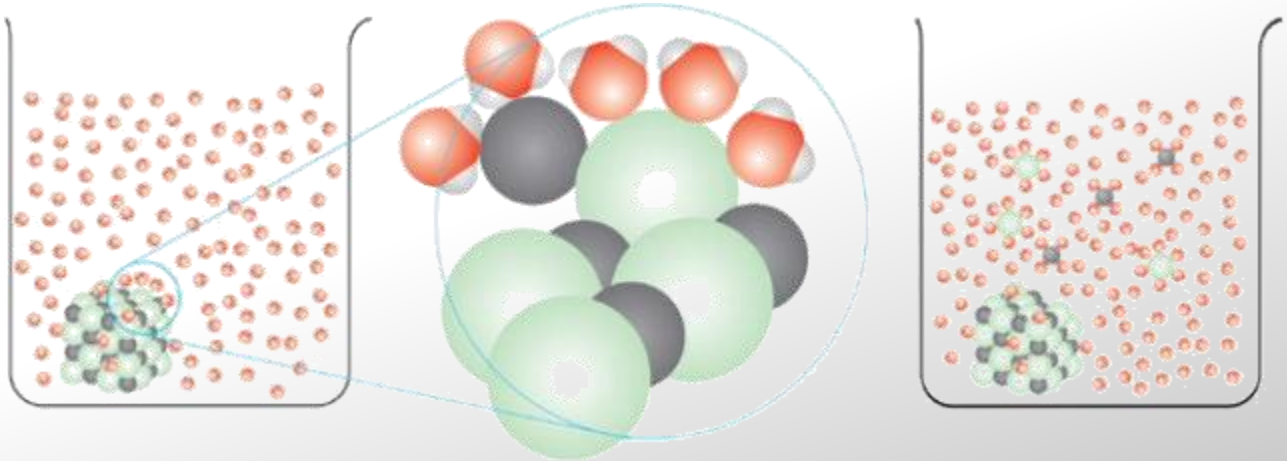
Ions in solution

The ions of the ionic compound are in an aqueous solution – dissolved in water. They are therefore free moving and available to form bonds with other ions

Soluble -dissolves in water form a solution
e.g. $NaCl_{(s)} \rightarrow Na^{+}_{(aq)} + Cl^{-}_{(aq)}$ Solubility = 35g/100g

Sparingly Soluble - slightly soluble
e.g. Calcium hydroxide Solubility = 0.1 g/100g

Insoluble extremely solubility
e.g. Silver chloride Solubility = 0.0002 g/100g



Ionic Solution equations

Ionic compounds in solution break down into their ions.

$$NaCl_{(s)} \xrightarrow{\text{dissolving}} Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$

Write ionic solution equations for the following

a. potassium hydroxide

b. sodium nitrate

c. magnesium chloride

d. copper sulfate

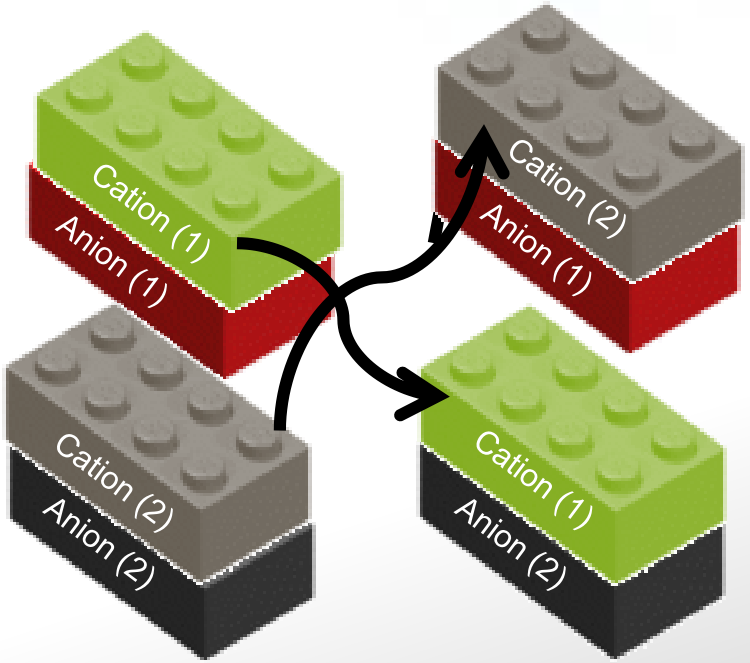
e. sodium carbonate

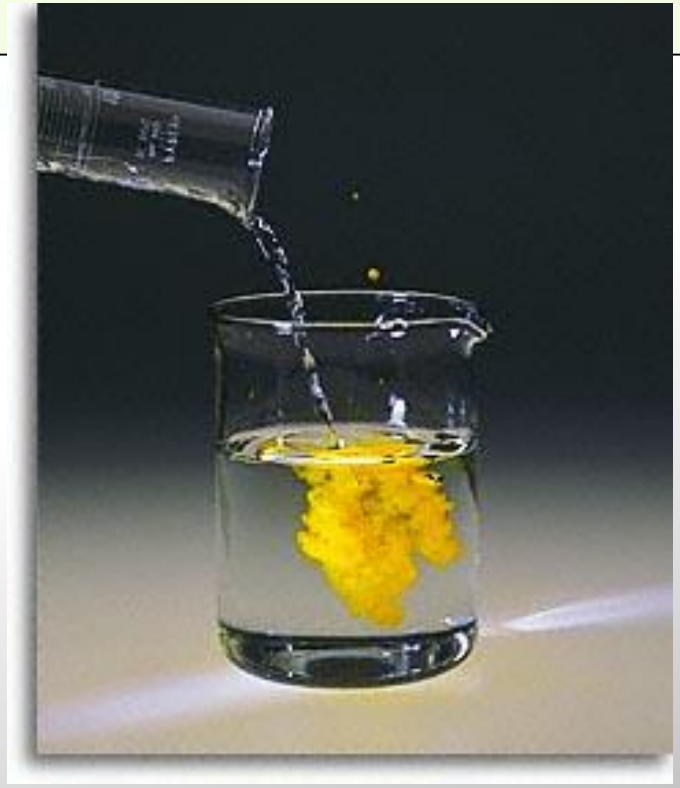
f. aluminium nitrate

Precipitation (exchange) reactions

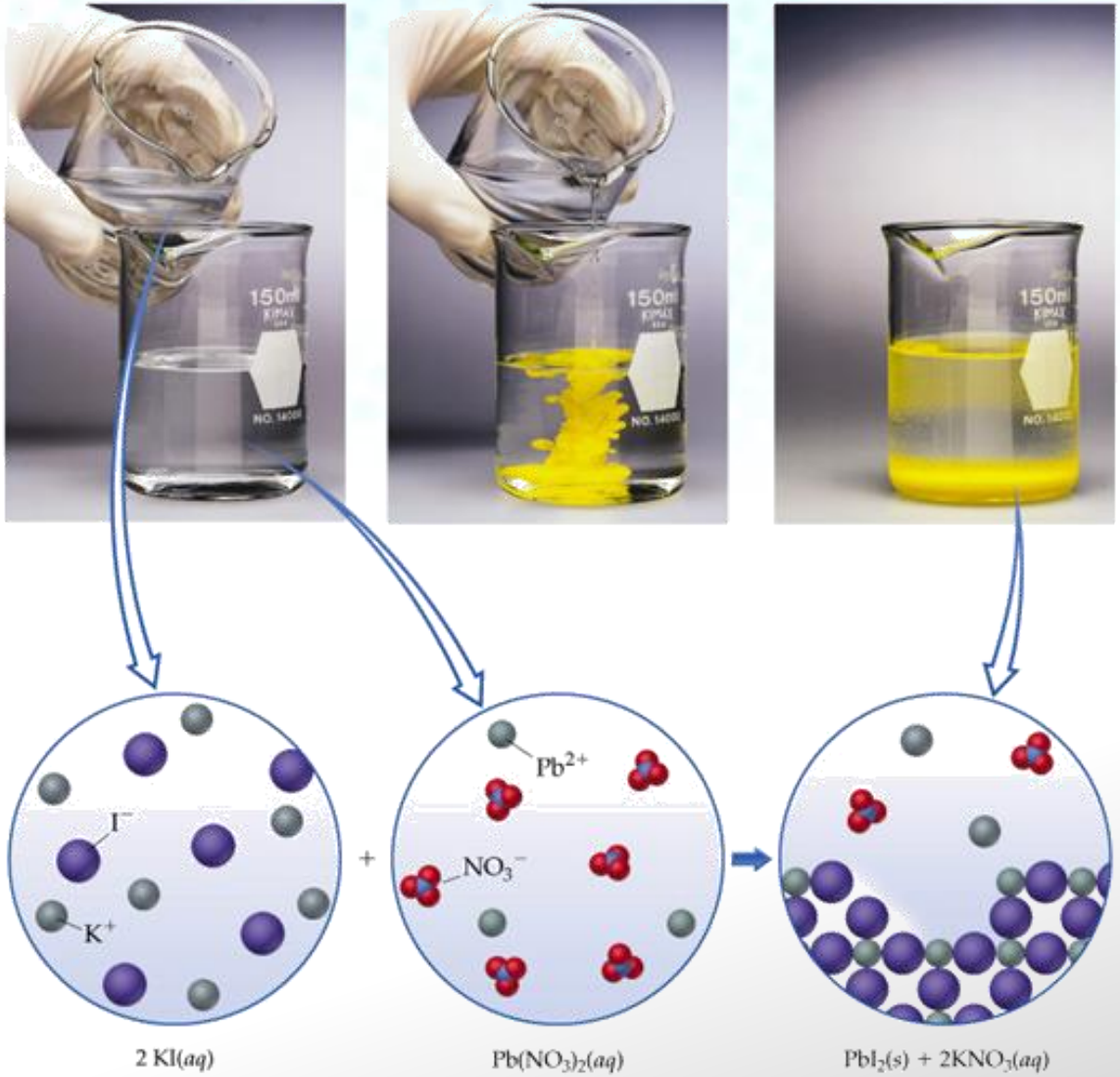
Precipitation reactions occur when two solutions react together to form a solid that settles out of the solution. The solid formed is called the precipitate.

An example is a lead (II) nitrate solution mixed with a potassium iodide solution to form a lead iodide precipitate.





Precipitation - What's going on?



When ionic compounds are in solution the ions remain separated from each other and mixed amongst the water molecules.
If solutions are added to each other and a new combination of ions (an anion and a cation) are more attracted to each other than the water molecules then a solid ionic compound precipitate forms. The other ions not forming a precipitate remain in solution.

GZ Science Resources

Solubility Rules

Some ions will form precipitates and are insoluble. Other ions will not form precipitates and are soluble.

Ion	Rule	Exceptions
NO_3^-	soluble	
Cl^-, I^-	soluble	Ag^+ and Pb^{2+}
SO_4^{2-}	soluble	Pb^{2+} , Ca^{2+} , Ba^{2+}
CO_3^{2-}	insoluble	Na^+, K^+ and NH_4^+
OH^-	insoluble	Na^+, K^+
Na^+, K^+, NH_4^+	all soluble	

Solubility Rules

- All **Group 1** compounds are soluble
- All **ammonium** compounds are soluble
- All **nitrate** compounds are soluble
- Most **sulfates** are soluble **except** for calcium sulfate, barium sulfate and lead sulfate
- Most halides are soluble **except** for those salts with silver and lead
- All **carbonates** are insoluble **except** those of Group 1 and ammonium ion
- All **oxides, hydroxides** are insoluble **except** those of Group 1 and ammonium ion
- All **sulfides** are insoluble **except** those of Group 1 and ammonium ion.

This secondary data will be provided to you in the assessment. You can use the rules to justify the identification of the ions.

Solubility Grids

When adding one ionic solution to another we use a solubility grid to decide if a precipitate has formed or not.

e.g.

$CaCl_2(aq) + Na_2CO_3(aq) \rightarrow \quad ?$

	Na^+	CO_3^{2-}
Ca2+	-	?
$2Cl^{1-}$	?	-

The Na^+ and the Cl^- ions are dissolved in solution in the beginning and remain in solution at the end. They are not involved in the precipitation reaction so they are known as **spectator ions**. They do not need to be written in the equations for the reactions.

GZ Science Resources

Solubility

For each ionic compound decide whether it is soluble or not. If insoluble, write the formula of the solid down. If soluble, write the formulae of the ions present in a solution of the compound.

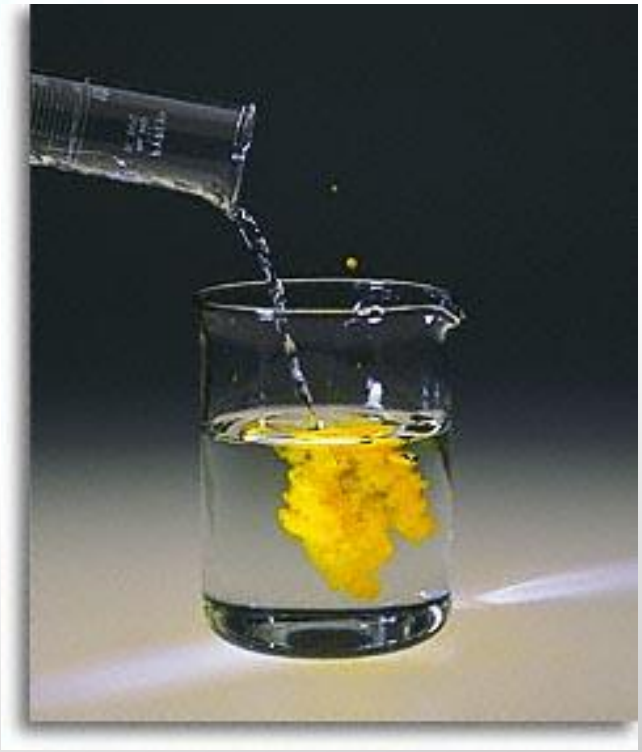
a. sodium chloride
b. copper hydroxide
c. ammonium nitrate
d. barium sulfate
e. potassium carbonate
f. silver chloride
g. sodium sulfate
h. magnesium nitrate
i. silver iodide
j. aluminum hydroxide
k. zinc nitrate
l. copper (II) carbonate
m. barium sulfate
n. iron (III) chloride
o. zinc hydroxide
p. potassium chloride
q. sodium bicarbonate
r. sodium bromide
s. iron (II) sulfate
t. ammonium carbonate
u. calcium carbonate
v. aluminum oxide

Equations

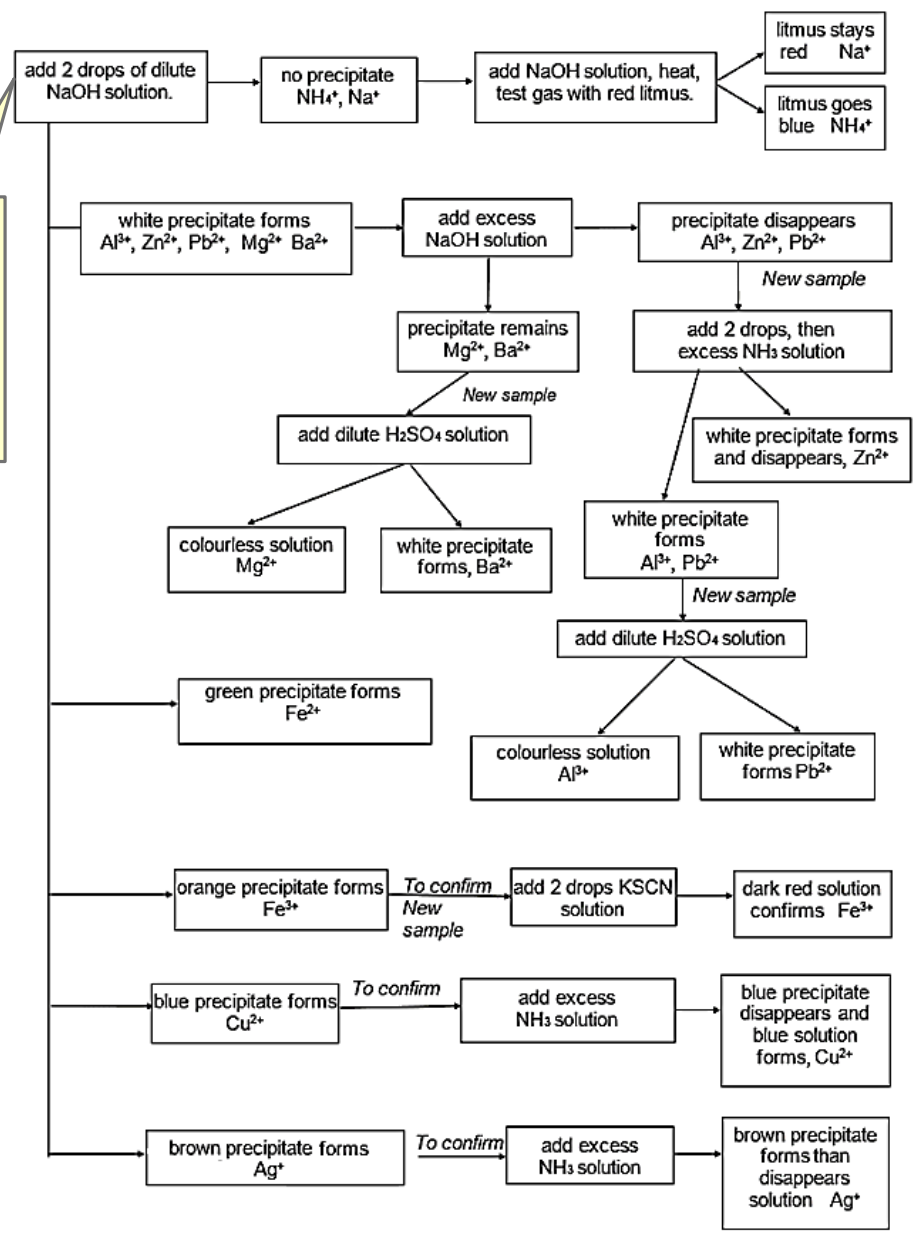
$$CaCl_{2(aq)} + Na_2CO_{3(aq)} \longrightarrow CaCO_{3(s)} + 2NaCl_{(aq)}$$

Use solubility grids and solubility rules to complete the following equations
Write formal equations and ionic equations where a ppt reaction occurs.

a. $Ba(NO_3)_{2\ (aq)} + Na_2SO_{4(aq)}$
b. $Cu(NO_3)_{2(aq)} + NaOH_{\ (aq)}$
c. $AgNO_{3\ (aq)} + K_2CO_{3(aq)}$
d. $Cu(NO_3)_{2(aq)} + MgCl_{2(aq)}$
e. $Ca(NO_3)_{2(aq)} + (NH_4)_2SO_{4(aq)}$
f. $KCl_{(aq)} + AgNO_{3(aq)}$
g. $NH_4OH_{(aq)} + FeCl_{3(aq)}$
h. $CuSO_{4(aq)} + NaOH_{(aq)}$
i. $AgNO_{3(aq)} + KI_{(aq)}$



Ion identification flow chart



These charts will be provided to you to assist with ion identification in your sample. You will have a separate chart for anions and cations

You follow the steps, and use your observations to

- ❑ Give the name or formula for the ion present in the solutions
- ❑ describe the steps you used to identify each ion
- ❑ describe the observations you made during each step of the procedure for each ion identified
- ❑ identify by name or formula all precipitates formed

GZ Science Resources

Precipitate observations

Copper hydroxide
$Cu(OH)_{2(ppt)}$

Silver hydroxide
$AgOH_{(ppt)}$

Iron(III) hydroxide
$Fe(OH)_{3(ppt)}$

Lead hydroxide
$Pb(OH)_{2(ppt)}$

Iron(II) hydroxide
$Fe(OH)_{2(ppt)}$

Magnesium hydroxide
$Mg(OH)_{2(ppt)}$

Aluminium hydroxide
$Al(OH)_{3(ppt)}$

Barium hydroxide
$Ba(OH)_{2(ppt)}$

Zinc hydroxide
$Zn(OH)_{2(ppt)}$

Some precipitates formed will have distinctive colours – and should be easily identified. Many others form white precipitates, but will have subtle differences.

You will have the opportunity to identify a wide range of ions to become familiar with the process.

Important reagents - Ammonia / Ammonium Hydroxide solution

Ammonia reacts with water in a reversible reaction

$$NH_{3\,(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

The same solution contains two reactants

OH^- and NH_3

The $OH^-{}_{(aq)}$ concentration is quite low, but is important in the reactions of ammonia solutions

The reagents react with the ions to form precipitates or complex ions.

Instructions for using these are on the flow chart – it is important to follow the correct procedure for the amount required.

Ion Equations

Under each step of the flow chart that produces a precipitate the correct ionic equation will need to be written.

Use your ion chart

your solubility rules

and solubility grids

For example

Add 2 drops $NaOH_{(aq)}$.
1.No ppt. **NH_4^+, Na^+**
Add 1 mL $NaOH_{(aq)}$ Heat. Test for gas with wet red litmus.
- No reaction **Na^+**
- turns litmus blue/smell of ammonia, (fishy) **NH_4^+**

$$NH_4^+ + OH^-_{(g)} \longrightarrow NH_{3(g)} + H_2O$$

GZ Science Resources

Complex Ions

A complex ion is a compound rather than an atom that has more or less **total** electrons than **total** protons – therefore a complex ion has a charge.
A central metal atom bonded to a specific number of other molecules or ions.

tetrahydroxy plumbate(II)	$[Pb(OH)_4]^{2-}$
tetrahydroxyzincate(II)	$[Zn(OH)_4]^{2-}$
tetrahydroxyaluminate(III)	$[Al(OH)_4]^{-}$
tetraamminezinc(II)	$[Zn(NH_3)_4]^{2+}$
tetraamminecopper(II)	$[Cu(NH_3)_4]^{2+}$
diamminesilver(I)	$[Ag(NH_3)_2]^{+}$
iron(III) thiocyanate	$[FeSCN]^{2+}$

You will be provided with the formula of the highlighted complex ions

You will not need to use the names of the complex ions – just the formula + write ionic equations for their production if required.

GZ Science Resources

Ion Equations – Summary of ppts and complex ions

$X(OH)_{\text{charge of X}}$ **Add NaOH (ppt)**	XSO_4 **Add $BaSO_4$ (ppt)**	AgX **Add $AgNO_3$ (ppt)**	$[X(NH_3)_{2x\text{charge}}]^{\text{charge}}$ **Complex ion (aq)**	$[X(OH)_4]^{\text{charge-4}}$ **Complex ion (aq)**	$XSCN^{\text{charge}-1}$ **Complex ion (aq)**
Mg^{2+} Ag^{+} Fe^{2+} Fe^{3+} Cu^{2+} Al^{3+} Pb^{2+} Zn^{2+} Ba^{2+}	Pb^{2+} Ba^{2+}	Cl^{-} I^{-}	Ag^{+} Cu^{2+} Zn^{2+}	Al^{3+} Pb^{2+} Zn^{2+}	Fe^{3+}
Example $Mg(OH)_{2(ppt)}$ $Al(OH)_{3(ppt)}$	**Example** $PbSO_{4(ppt)}$ $BaSO_{4(ppt)}$	**Example** $AgCl_{(ppt)}$ $AgI_{(ppt)}$	**Example** $[Ag(NH_3)_2]^{+}_{(aq)}$ $[Cu(NH_3)_4]^{2+}_{(aq)}$ $[Zn(NH_3)_4]^{2+}_{(aq)}$	**Example** $[Al(OH)_4]^{-}_{(aq)}$ $[Pb(OH)_4]^{2-}_{(aq)}$ $[Zn(OH)_4]^{2-}_{(aq)}$	**Example** $FeSCN^{2+}_{(aq)}$

Complex Ions

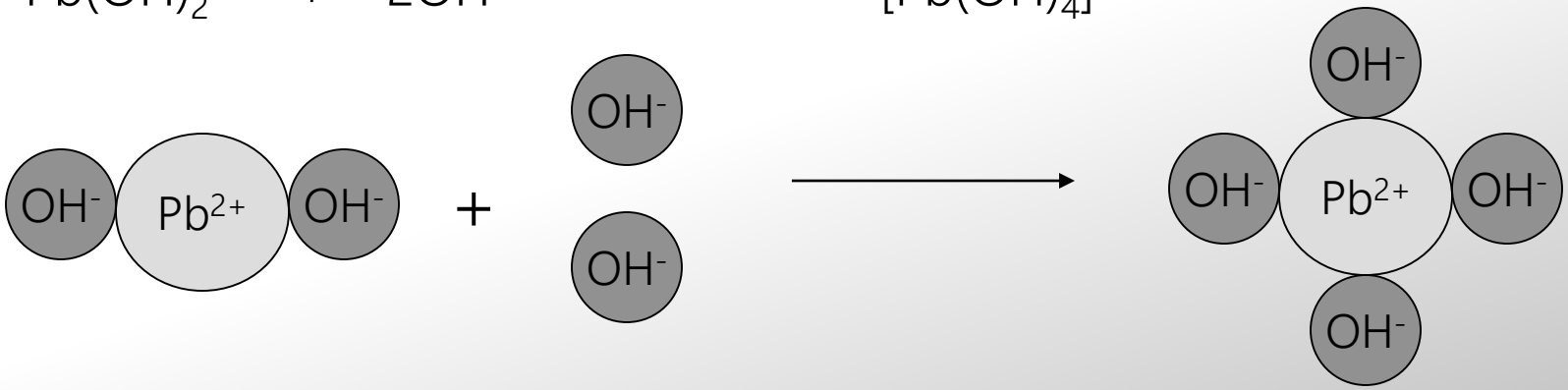
tetrahydroxy plumbate(II)	$[Pb(OH)_4]^{2-}$
tetrahydroxyzincate(II)	$[Zn(OH)_4]^{2-}$

Step one – add NaOH

$$Pb^{2+} + 2OH^- \longrightarrow Pb(OH)_2$$

Step two – add excess NaOH

$$Pb(OH)_2 + 2OH^- \longrightarrow [Pb(OH)_4]^{2-}$$



Complex Ions

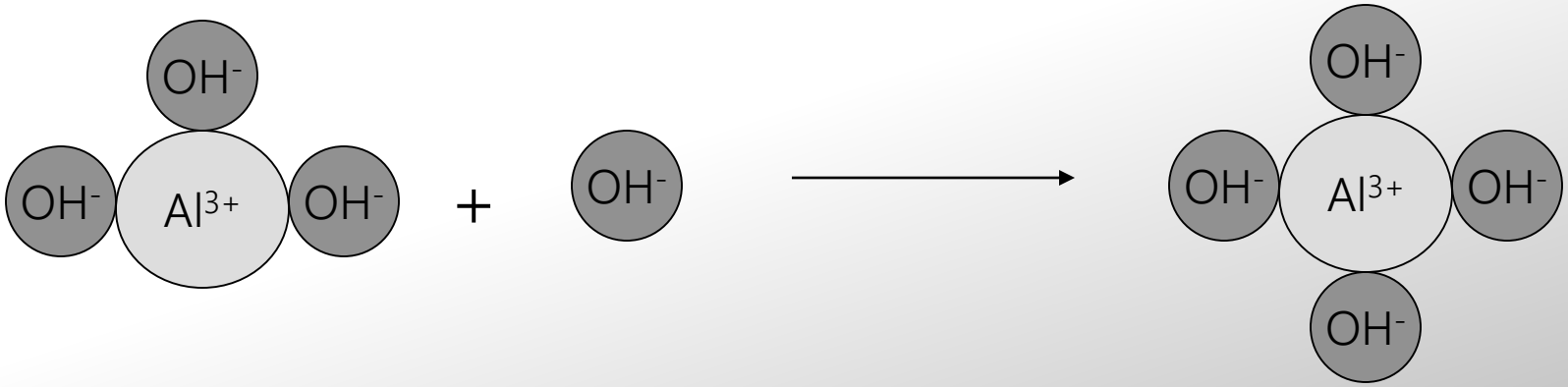
tetrahydroxyaluminate(III)	$[Al(OH)_4]^-$

Step one – add NaOH

$$Al^{3+} + 3OH^- \longrightarrow Al(OH)_3$$

Step two – add excess NaOH

$$Al(OH)_3 + OH^- \longrightarrow [Al(OH)_4]^-$$



Complex Ions

tetraamminezinc(II)	$[Zn(NH_3)_4]^{2+}$
tetraamminecopper(II)	$[Cu(NH_3)_4]^{2+}$

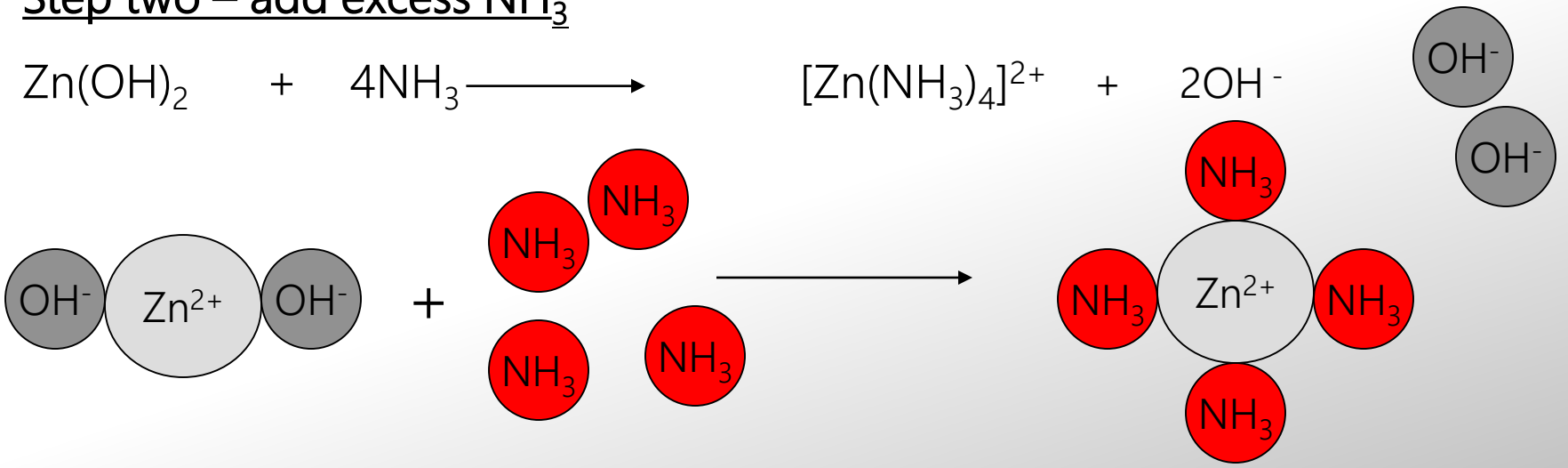
$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$

Step one – add 2 drops NH_3

$$Zn^{2+} + 2OH^- \longrightarrow Zn(OH)_2$$

Step two – add excess NH_3

$$Zn(OH)_2 + 4NH_3 \longrightarrow [Zn(NH_3)_4]^{2+} + 2OH^-$$



Complex Ions

diamminesilver(I)	$[Ag(NH_3)_2]^+$

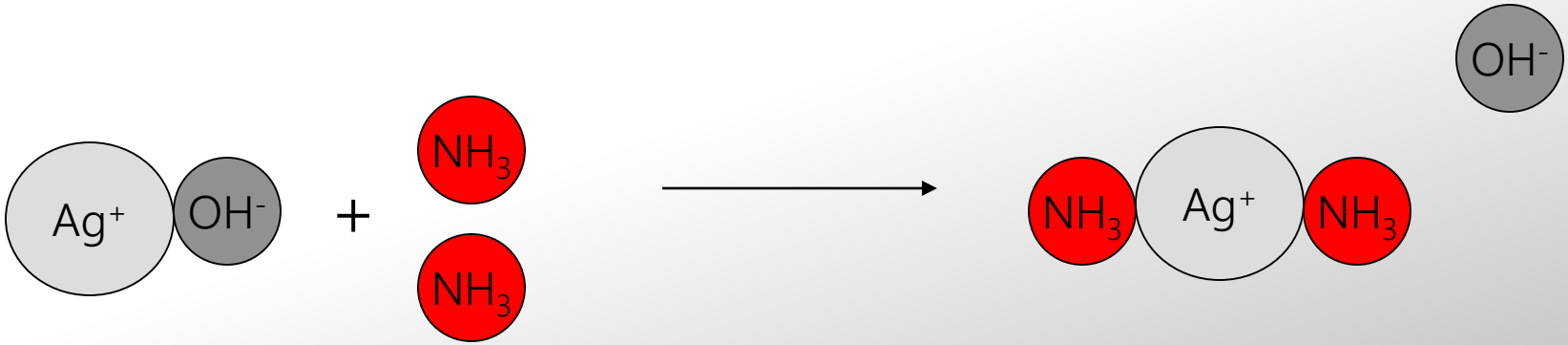
$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$

Step one – add 2 drops NH_3

$$Ag^+ + OH^- \longrightarrow AgOH$$

Step two – add excess NH_3

$$AgOH + 2NH_3 \longrightarrow [Ag(NH_3)_2]^+ + OH^-$$

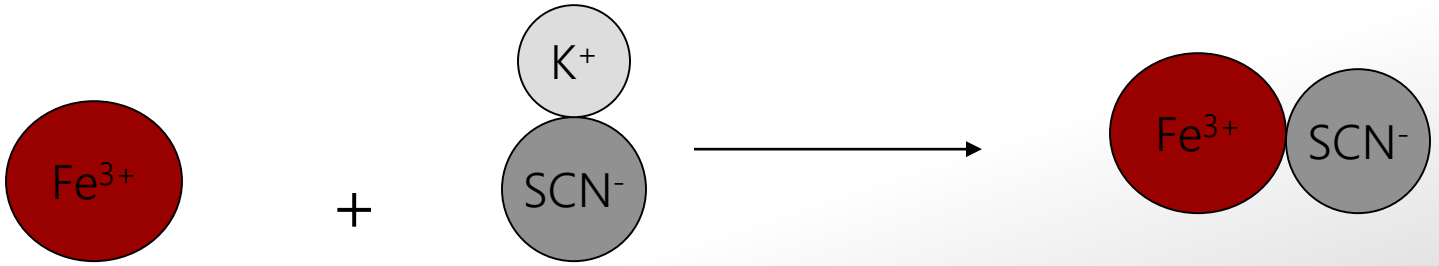


Complex Ions

iron(III) thiocyanate	$FeSCN^{2+}$

Step one – add KSCN

$Fe^{3+} + SCN^- \longrightarrow FeSCN^{2+}$



Assessment

Task One

Identify the **cation** present in solution A.

cation	Description of test	observations	precipitate	equations
	Add 2 drops of dilute NaOH solution	Brown ppt forms	AgOH	$Ag^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow AgOH_{(ppt)}$
	New sample Add 2 drops of NH^3	Brown ppt	AgOH	$Ag^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow AgOH_{(ppt)}$
	then excess NH_3 solution	colourless solution		$Ag^{+}_{(aq)} + 2NH_{3(aq)} \rightarrow [Ag(NH_3)_2]^{+}_{(aq)}$

Ion present is $Ag^{+}_{(aq)}$

NOTE:
There is no precipitate for a complex ion

Assessment

Task One

Identify the **cation** present in solution B.

Cation	Description of test	observations	precipitate	equations
	Add 2 drops of dilute NaOH	orange ppt forms	$Fe(OH)_3$	$Fe^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Fe(OH)_{3\ (ppt)}$
	solution New sample. Add 2 drops, KSCN solution	Dark red solution confirms		$Fe^{3+}_{(aq)} + SCN^-_{(aq)} \rightarrow FeSCN^{2+}_{(aq)}$

Ion present is $Fe^{3+}_{(aq)}$

Assessment

Task Two

Identify the **anion** present in solution B.

Anion	Description of test(s) carried out	observations	precipitate	equations
	Test with red litmus	Litmus goes blue		
	Add dilute HNO_3	No bubbles of gas		

NOTE:
There is no equation for testing with litmus paper

Ion present is $OH^-_{(aq)}$

Assessment

Task Two

Identify the **anion** present in solution B.

Anion	Description of test(s) carried out	observations	precipitate	equations
	Test with red litmus	Litmus goes blue		
	Add dilute HNO_3	bubbles of gas		

NOTE:
The bubbles forming are only small and require good observation

Ion present is CO_3^{2-}

Assessment

Cation present is $Zn^{2+}_{(aq)}$

Task Three

Solution C is an aqueous solution of a metal nitrate. Identify the **cation** present.

Description of test(s) carried out	observations	precipitate	equations
add a small volume of NaOH produces a white precipitate	White ppt produced	$Zn(OH)_{2(s)}$	$Zn^{2+}_{(aq)} + 2\ OH^-_{(aq)} \rightarrow Zn(OH)_{2(s)}$
Add excess NaOH	the precipitate disappears		$Zn^{2+}_{(aq)} + 4\ OH^-_{(aq)} \rightarrow [Zn(OH)_4]^{2-}_{(aq)}$
New Sample addition of aqueous NH_3	White ppt produced	$Zn(OH)_{2(s)}$	$Zn^{2+}_{(aq)} + 2\ OH^-_{(aq)} \rightarrow Zn(OH)_{2(s)}$
Add excess NH_3	Ppt disappears in excess NH_3		$Zn^{2+}_{(aq)} + 4\ NH_{3(aq)} \rightarrow [Zn(NH_3)_4]^{2+}_{(aq)}$

NOTE:
There are 4 equations here

NOTE:
2 different complex ions form

Assessment

NOTE:
There are 4 equations here

Task Three

Solution C is an aqueous solution of a metal nitrate. Identify the **cation** present.

Description of test(s) carried out	observations	precipitate	equations
Add 2 drops of dilute NaOH solution	White ppt forms	$Pb(OH)_2$	$Pb^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Pb(OH)_{2\ (ppt)}$
Add excess NaOH solution	Precipitate disappears		$Pb(OH)_{2(s)} + OH^-_{(aq)} \rightarrow [Pb(OH)_4]^{2-}_{\ (ppt)}$
New sample. Add 2 drops, then excess NH_3 solution	White ppt forms	$Pb(OH)_2$	$Pb^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Pb(OH)_{2\ (ppt)}$
New sample. Add dilute H_2SO_4 solution	White ppt forms	$PbSO_4$	$Pb^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow PbSO_{4(ppt)}$

NOTE:
2 different ppts form

Cation present is $Pb^{2+}_{(aq)}$

Assessment

Task Four

Solution D is an aqueous solution of a sodium salt. Identify the **anion** present.

Description of test(s) carried out	observations	precipitate	equations
Test with red litmus	Litmus remains red		
Add $Ba(NO_3)_2$ solution	No ppt.		
New sample. Add 2 drops, dry test tube. Add $AgNO_3$ solution. 2 drops wait 1 min.	Precipitate	AgI	$Ag^+_{(aq)} + I^-_{(aq)} \rightarrow AgI_{(ppt)}$
Add dilute NH_3 solution.	Ppt remains		

Anion present is $I^-_{(aq)}$

Assessment

Task Four

Solution D is an aqueous solution of a sodium salt. Identify the **anion** present.

Description of test(s) carried out	observations	precipitate	equations
Test with red litmus	Litmus remains red		
Add $Ba(NO_3)_2$ solution	No ppt.		
New sample. Add 2 drops, dry test tube. Add $AgNO_3$ solution. 2 drops wait 1 min.	Precipitate	AgCl	$Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl_{(ppt)}$
Add dilute NH_3 solution.	Ppt disapears		$AgCl_{(s)} + 2NH_{3(aq)} \rightarrow [Ag(NH_3)_2]^+_{(aq)} + Cl^-_{(aq)}$

Anion present is $Cl^-_{(aq)}$

Task Five Identify the anion and the cation present in solution E

GZ Science Resources

Description of test(s) carried out	observations	precipitate	equations
Test for anion Test with red litmus	Litmus remains red		
Add $Ba(NO_3)_2$ solution	White ppt.	$BaSO_4$	$Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow BaSO_{4(aq)}$
Test for cation Add 2 drops of dilute NaOH solution	White ppt. Forms	$Al(OH)_3$	$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(ppt)}$
Add excess NaOH solution	ppt. disappears		$Al^{3+}_{(aq)} + 4OH^-_{(aq)} \rightarrow [Al(OH)_4]^-$
New sample. add 2 drops, then excess NH_3 solution	White ppt forms	$Al(OH)_3$	$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(ppt)}$
New sample. Add dilute H_2SO_4 solution	Colourless solution		

Anion present is SO_4^{2-} Cation present is Al^{3+}

Task six Identify the anion and the cation present in solution F.

Description of test(s) carried out	observations	precipitate	equations
Test for anion Test with red litmus	Litmus remains red		
Add $Ba(NO_3)_2$ solution	no ppt.		
New sample, 2 drops, dry test tube. Add $AgNO_3$ solution, 2 drops wait 1 min.	No precipitate		
Test for cation Add 2 drops of dilute NaOH solution	Blue ppt. forms	$Cu(OH)_2$	$Cu^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Cu(OH)_{2(ppt)}$
New sample. add 2 drops, then excess NH_3 solution	Blue ppt then deep blue solution	$Cu(OH)_2$	$Cu^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Cu(OH)_{2(ppt}$ $Cu^{2+}_{(aq)} + 4NH_{3(aq)} \rightarrow [Cu(NH_3)_4]^{2+}$

Anion present is NO_3^- Cation present is Cu^{2+}

Ions and the Environment

As part of your assessment you are required to explain the ***Significance of one of your identified ions for humans and the environment.***

Achieved level: You can state 2 ways that one of the ions impact humans and/or the environment.

Merit level: You explain 2 ways that one of the ions impact humans and/or the environment.

Excellence level: You discuss the positive and negative impacts one of the ions have on humans or the environment

You will be provided with some research material from your teacher, but will also be required to research further sources.
A reference list will need to be submitted with your sourced information.

You will have **three class periods** to conduct both the practical component, write-up of observations, method and any equations plus your research above