PREPARING FOR A LEVEL CHEMISTRY PART 2

IONS, IONIC COMPOUNDS AND IONIC EQUATIONS

MOVING FORWARD

WITH EACH OF THESE LESSONS PLEASE FOLLOW THE PRESCRIBED FORMAT.

1. WATCH THE VIDEO LINKED ON THE VLE
2. READ THROUGH THE POWERPOINT
3. HAVE A GO AT ALL THE QUESTIONS

THE TOPICS MAY SEEM BASIC TO YOU BUT THE QUESTIONS SHOULD TEST YOU AT EACH STAGE.

IONS

Ions are what is formed when an atom loses or gains an electron.

CATION	ANION
• Formed when an atom or group of atoms loses an electron • The atom now has more protons than electrons • As a result has a + / positive charge Example: Sodium atom (Na): 11 Protons, 12 neutrons and 11 electrons Sodium Ion (Na^+): 11 Protons, 12 neutrons and <u>10 electrons</u>	• Formed when an atom or group of atoms gains an electron • The atom now has fewer protons than electrons • As a result has a - / negative charge Example: Fluorine atom (Cl): 9 Protons, 10 neutrons and 9 electrons Fluoride Ion (Cl^-): 9 Protons, 10 neutrons and <u>10 electrons</u> (Anions for elements change the ending of their name to ~ide e.g Oxide, sulphide, chloride.

IONS YOU SHOULD JUST KNOW

(IF NOT MEMEORISE THEM NOW!)

Elements from groups 1 – 8:

Based on their 'outer shell' (This idea will develop during A level chemistry)

Group / e^- in outer shell	1	2	3	4	5	6	7	0 / 8
Charge on ion	+1 (Lose 1 e^-)	+2 (Lose 2 e^-)	+3 (Lose 3 e^-)	+/- 4 (usually covalent compounds)	-3 (Gain 3 e^-)	-2 (Gain 2 e^-)	-1 (Gain 1 e^-)	Do not generally form ions

Transition metals: (At A level we call this the d-block)

Roman numerals (I, II, III etc) are used to show the POSITIVE charge on the metal in the species. This is because some D-block metals can have more than one charge. E.g Fe^{2+} or Fe^{3+}

Compound ions:

Groups of atoms with a particular charge. You will see how to work these out during the first term of A

Name	hydroxide	Nitrate	Carbonate	Sulphate	Phosphate	Ammonium
Formula	OH^-	NO_3^-	CO_3^{2-}	SO_4^{2-}	PO_4^{3-}	NH_4^+

IONIC COMPOUNDS

Working out the formula of an ionic compound can be tricky. The key is the overall charge on an ionic compound must be neutral, in other words have the same number of positives and negatives.

E.G What is the formula of Magnesium Chloride?

1. Start by identifying the ions present
   Magnesium, Mg^{2+} and Chlorine, Cl^-
2. Do the charges balance?
   (Mg^{2+} Cl^-) In this case No.
3. What do we need more of?
   In this case more negatives so we add another Chlorine ion.
   (Mg^{2+}, Cl^-, Cl^-)
4. Write the final formula out: $MgCl_2$ We can ignore the charges now as they have balanced out.

There should be no overall charge and no large numbers that is for balancing equations.

EXAMPLE 2

What is the formla of lead(II)Nitrate?

Difficult for various reasons. Roman numerals and compound ions. Same principle applies

1. Ions involved:
   Pb^{2+} (due to (II))
   NO_3^- (Formula of a nitrate ion)
2. Are the charges balanced? No. we need another nitrate ion
   Pb^{2+} NO_3^- NO_3^-
3. Putting it together we need 2 nitrates but cannot write it: $PbNO_{32}$ as this implies we have 1 Nitrogen and 32 Oxygen atoms! We need brackets. Very common with compound ions.
4. Final formula: $Pb(NO_3)_2$

SIMPLE WAY OF DOING IT

Once you have got your head round why we need multiple this method should make it easier.

Swap, Drop and Cancel

What is the formula of lead nitrate?

1.	Ions involved:	Pb^{2+}	NO_3^-
2.	Swap the charge	$Pb^{(1-)}$	$NO_3^{(2+)}$
3.	Drop them to be number of the atom	$Pb_{(1-)}$	$NO_{3(2+)}$
4.	Cancel them out	$Pb_{(1)}$	$NO_{3(2)}$
5.	Final formula:	$Pb(NO_3)_2$	

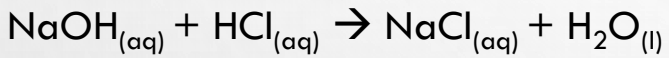
If you get the previous method then stick with it some people find this simpler.

IONIC EQUATIONS

An Ionic equation is used to show the changes that occur in a reaction. There are lots of ions present in many reactions that are not actually doing anything, we call those **spectator** ions.

E.G The simple neutralisation reaction between Sodium hudroxide and hydrochloric acid.

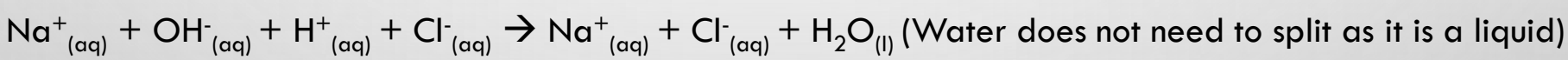
1. Write out a **fully balanced** symbol equation with **state symbols.**



$$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$$

If you think about it anything that is aqueous is dissolved, which means the ions are not stuck together they are floating around on their own.

2. So re-write the equation splitting any aqueous substances.

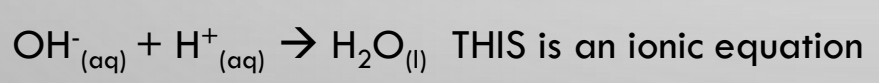


$$Na^+_{(aq)} + OH^-_{(aq)} + H^+_{(aq)} + Cl^-_{(aq)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$ (Water does not need to split as it is a liquid)

3. We now remove any ions that have not changed / done anything during the reaction in other words are the same on both sides.

$$Na^+_{(aq)} + OH^-_{(aq)} + H^+_{(aq)} + Cl^-_{(aq)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$

4. Re-write what is left

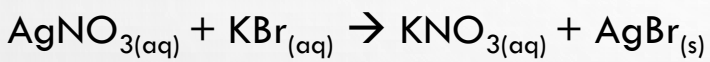


$$OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(l)}$$ THIS is an ionic equation

IONIC EQUATIONS EXAMPLE 2

E.g When silver nitrate solution reacts with potassium bromide solution to make a precipitate of silver chloride and potassium nitrate solution.

1. Write out a **fully balanced** symbol equation with **state symbols.**

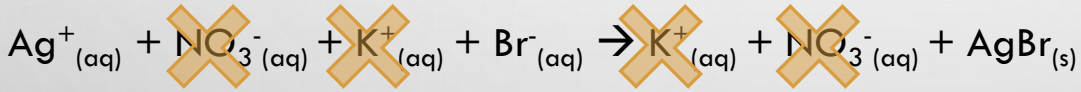


$$AgNO_{3(aq)} + KBr_{(aq)} \rightarrow KNO_{3(aq)} + AgBr_{(s)}$$

2. So re-write the equation splitting any aqueous substances.

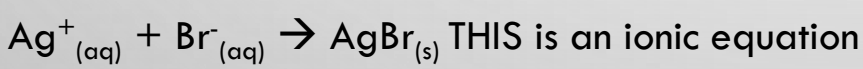
$$Ag^{+}_{(aq)} + NO_3^{-}{}_{(aq)} + K^{+}_{(aq)} + Br^{-}_{(aq)} \rightarrow K^{+}_{(aq)} + NO_3^{-}{}_{(aq)} + AgBr_{(s)}$$ (Silver bromide does not need to split as it is a solid)

3. We now remove any ions that have not changed / done anything during the reaction in other words are the same on both sides.



$$Ag^{+}_{(aq)} + NO_3^{-}{}_{(aq)} + K^{+}_{(aq)} + Br^{-}_{(aq)} \rightarrow K^{+}_{(aq)} + NO_3^{-}{}_{(aq)} + AgBr_{(s)}$$

4. Re-write what is left



$$Ag^{+}_{(aq)} + Br^{-}_{(aq)} \rightarrow AgBr_{(s)}$$ THIS is an ionic equation