KS4 to KS5
Bridging Work
for
Chemistry A Level

Name: _____

Our Lady's Catholic College

Sixth Form

SALUS POPULI

This document is designed to help you with the transition from GCSE chemistry / combined science to A Level Chemistry. There is a quite a significant overlap in the topics that are studied and we will presume some prior knowledge of these topics.

During our current period of lockdown and in the absence of studying and revising for your GCSE examinations, it becomes even more important that you do this work in preparation for this next step.

The key topics from GCSE which you will need prior knowledge of are in the following list:

- Atomic Structure – protons neutrons, electrons, mass number, atomic number, isotopes
- Electron arrangement – how many electrons can occupy each shell
- Ionic Bonding – dot and cross diagrams, ionic formulae, properties of ionic compounds
- Covalent Bonding of simple molecules - dot and cross diagrams, properties of these compounds
- Metallic bonding – labelled diagram, properties of metals
- Giant structures with covalent bonding – uses and properties of graphite, diamond and graphene
- Reactions of acids with bases, carbonates and metals
- Relative Atomic Mass calculations
- Empirical Formula Calculations
- Balancing Symbol Equations

Please work through each page by looking at the webpages given and then working through the questions.

The answers to each section are included at the end as scanned pages.

See you in September!

Mrs Lowe

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Before you get started, if you need any more support or information on these topics, please look at the following websites.

https://edu.rsc.org/resources/secondary

https://www.chemguide.co.uk/atommenu.html#top

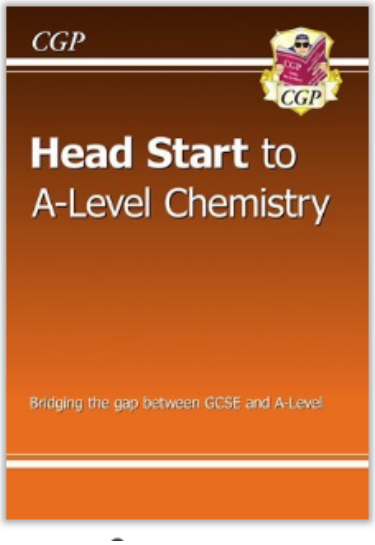
You can download a copy of the OCR chemistry specification from:

https://www.ocr.org.uk/qualifications/as-and-a-level/chemistry-a-h032-h432-from-2015/#as-level

Transition Guides are also available on the OCR website from the link below. These are more advanced so don't worry too much if you struggle with some sections.

https://www.ocr.org.uk/qualifications/as-and-a-level/chemistry-a-h032-h432-from-2015/planning-and-teaching/

There are some publications which will help give you more practise. For example



Head Start to A-level Chemistry

Product code: CBR71
ISBN: 9781782942801

★★★★★ (5)

Write a review

Atomic Structure

Look at

https://www.bbc.co.uk/bitesize/guides/z3sg2nb/revision/3

https://edu.rsc.org/resources/build-an-atom-simulation/1433.article

to revise this topic – pages 3 -5 are most relevant.

Questions

1. Complete the following table:

Particle	Relative Charge	Relative Mass	Location
Proton	**1+**		
Neutron		**1**	
Electron			**Outside nucleus**

2.

Name	Symbol	Atomic number	Mass number	Number of		
				protons	neutrons	electrons
hydrogen		1	1			
lead			204	82		
aluminium	Al			13	14	
		79	197			
		4			5	

3. Complete the table and the sentences below about isotopes of hydrogen.

Name	Atomic number	Mass number	Number of		
			protons	neutrons	electrons
hydrogen	1	1			
hydrogen	1	2			
hydrogen	1	3			

What are isotopes?

_____

_____

Electron Arrangement and the Periodic Table

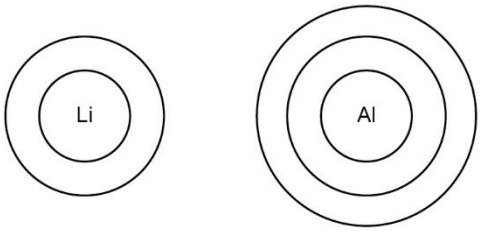
Look at

https://www.bbc.co.uk/bitesize/guides/zxmmsrd/revision/3

Pages 3 – 4 only

Questions

1. Complete the diagrams below. Show each electron as a cross. The correct number of shells have already been drawn for you.



2 Write the electronic configurations for the following elements:

a helium _____

b carbon _____

c oxygen _____

d chlorine _____

e calcium _____

f In The table below shows the electronic configurations for three different elements.

Element	lithium	sodium	potassium
Electronic configuration	2.1	2.8.1	2.8.8.1

In terms of their electronic configurations, explain which group these elements belong to.

_____

_____

g The table below shows the electronic configurations for four different elements.

Element	lithium	beryllium	nitrogen	neon
Electronic configuration	2.1	2.2	2.5	2.8

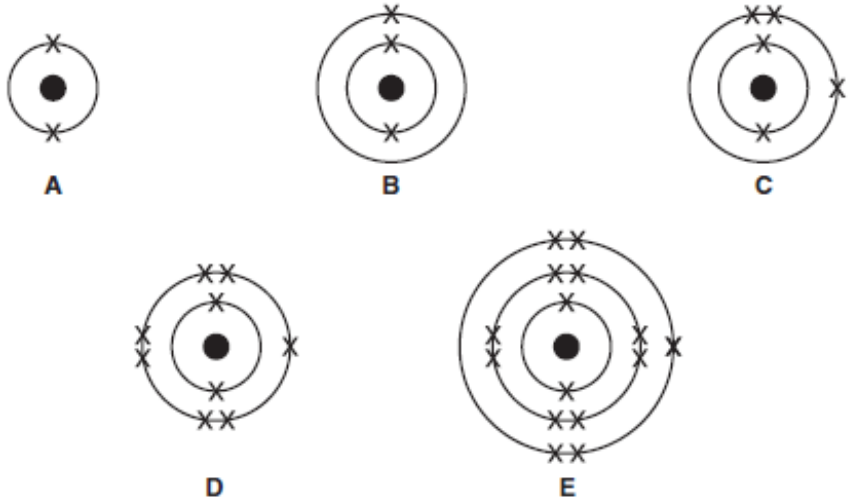
In terms of their electronic configurations, explain which period these elements belong to.

_____

_____

Look at the diagrams. They show the atoms of some elements.

The letters do not represent the symbols for the elements.



(a) (i) Element **B** is in Group 1.

How can you tell?

.....

[1]

(ii) Element **E** is in Period 3.

How can you tell?

.....

[1]

Ionic Bonding

Look at

https://www.bbc.co.uk/bitesize/guides/zy98msg/revision/1

Look at all 7 pages and play the videos.

Questions

1 Complete these statements about **ions**.

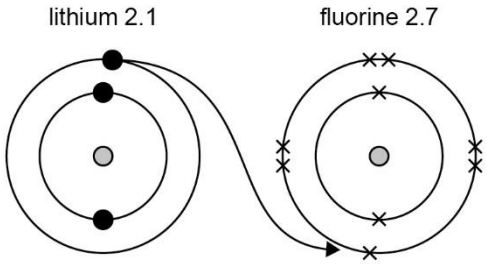
a An atom that has lost or gained _____ is called an ion.

b A cation is a _____ charged ion. It is formed when an atom _____ electrons.

c An **anion** is a _____ charged ion. It is formed when an atom _____ electrons.

d When atoms form ions they become more stable as they gain a _____ outer shell of electrons, like the _____ elements.

2 Use the diagram below to answer the questions that follow.



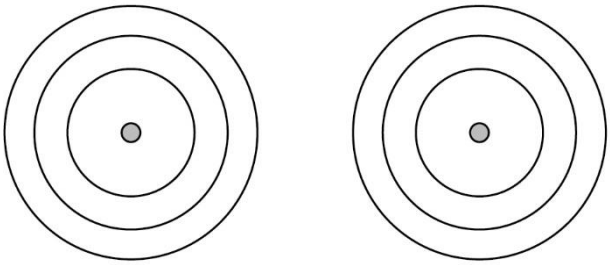
a Which atom loses an electron? _____

b Which atom gains an electron? _____

c Write the symbols for the positive and negative ions formed: _____and_____

3 Complete the dot and cross diagrams below to show the electron arrangements of the ions formed in question **2**. You will not need electrons in all the shells.

abel each ion with the correct charge.



4 Complete the table below.

Ion symbol	Atomic number	Mass number	Protons	Neutrons	Electrons
K^+	19	39			
S^{2-}	16	32			

5. **Write the formula of the ionic compounds in the boxes below:**

potassium chloride	iron II carbonate
magnesium bromide	copper II fluoride
aluminium iodide	sodium carbonate
potassium sulfide	aluminium nitrate
barium hydroxide	ammonium sulfate
iron III oxide	aluminium sulfate

Covalent Bonding in Simple Molecules

https://www.bbc.co.uk/bitesize/guides/zqrxdxs/revision/1

Look at all 4 pages and play the video

Questions

Complete the following sentences:

A covalent bond is formed when two atoms _____ a _____ of electrons.

They do this to gain a _____ _____ _____ of electrons.

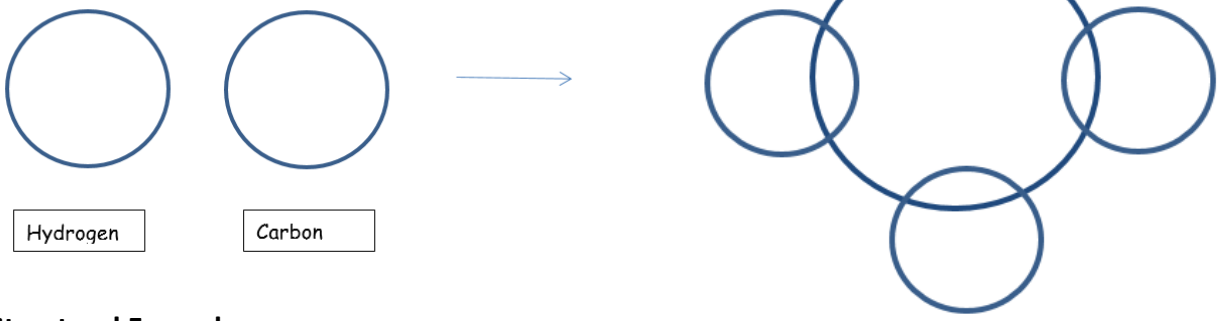
Covalent bonds form between _____ atoms only.

A _____ is formed when two or more atoms are covalently bonded together.

For example: **Methane**

Molecular Formula = CH_4

(complete the outer shells of electrons only)



Structural Formula:

The dot and cross diagram above shows a _____ of methane which contains _____ single covalent bonds.

We say that substances like methane have a **simple molecular structure.**

They have _____ melting points because the intermolecular forces (forces between molecules) are very _____

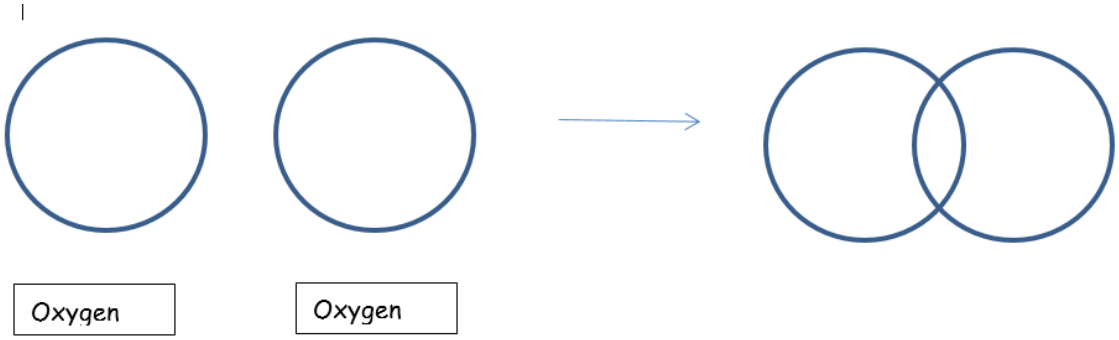
They do not conduct electricity because there are no mobile _____ or _____

Double Covalent Bonds

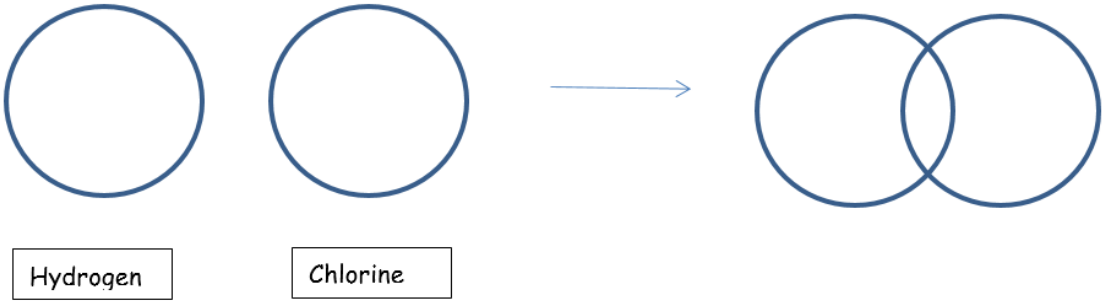
Sometimes atoms share two pairs of electrons – this is called a DOUBLE bond.

For example: **Oxygen**

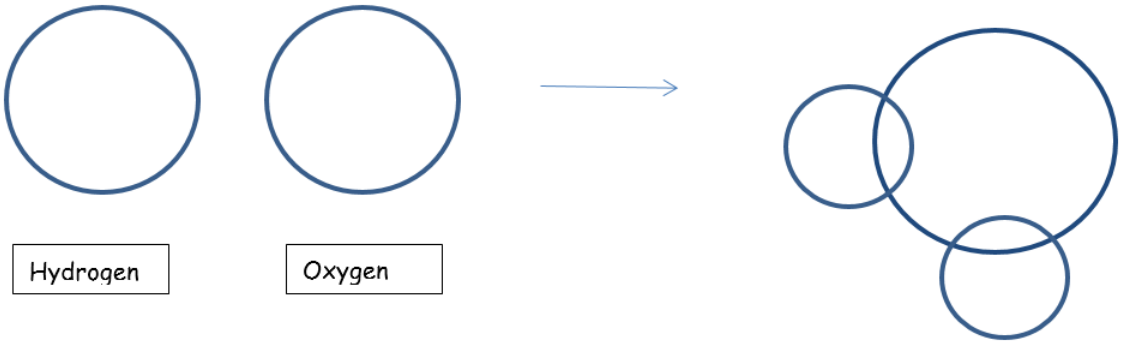
Molecular Formula = O_2



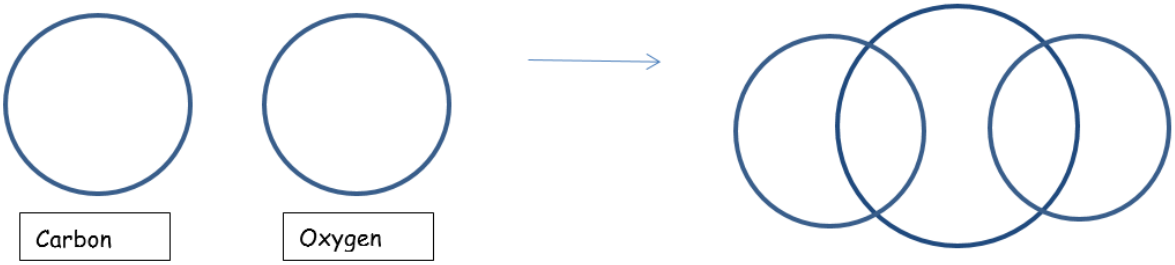
Hydrogen Chloride - HCl



Water – H_2O



Carbon Dioxide – CO_2

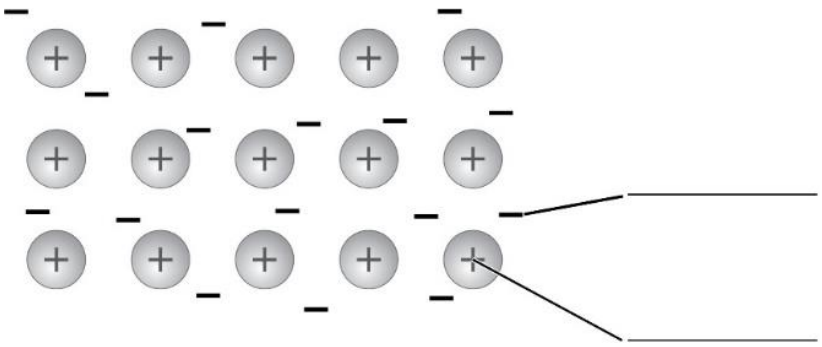


Metallic bonding

https://www.bbc.co.uk/bitesize/guides/zgmpgdm/revision/1 **Look at page 1.**

Questions

The diagram below shows the particles in a metal. Label the particles.



Complete the definition of metallic bonding:

The electrostatic attraction between positive metal _____ and a

_____ 'sea' of electrons.

For each of the following sentences, state whether it is true or false.

	True	**False**
All **non-metals** are gases.		
All **metals** are magnetic.		
Most metals are shiny when polished.		
Metals can be bent and hammered into shape.		
Non-metals do not conduct electricity, except for graphite.		
Metals have high melting points because strong covalent bonds have to be broken to melt them.		
Metals are **malleable** because the electrons can slide over each other.		
Metals conduct electricity because ions are free to move through the structure.		
Metals have high densities because the ions are packed closely together.		

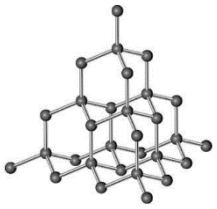
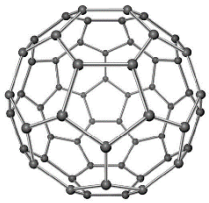
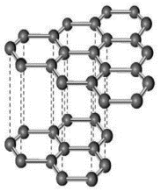
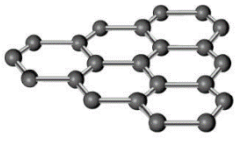
Giant structures with covalent bonding

https://www.bbc.co.uk/bitesize/guides/z9vrjty/revision/1

Look at all 3 pages

Questions

Complete the following table:

Material	Properties	Uses
_____ 	_____ conductor of electricity as no mobile _____ particles. A very _____ material due to giant structure with many strong _____ bonds.	Used in _____ tools due to exceptional _____
_____ 	_____ conductor of electricity as no mobile _____ particles _____ melting point as weak intermolecular forces. Slippery and _____	Used to cage molecules in _____ delivery systems. Used in lubricants because it is _____
_____ 	_____ conductor of electricity because _____ electrons act as charge carriers. _____ and soft due to weak intermolecular forces between layers	Used as a dry _____ because it is slippery. Used to make _____ for electrolysis because it is a _____ conductor of electricity.
_____ 	Conducts electricity well due to free _____ Exceptional strength Very _____	Future uses in electrical _____ and nanomaterials.

Reactions of acids with bases, carbonates and metals

https://www.youtube.com/watch?v=wmhOttroIrw

https://www.youtube.com/watch?v=4pIHhXfGZlE

https://www.youtube.com/watch?v=QlSsle_jSQ8

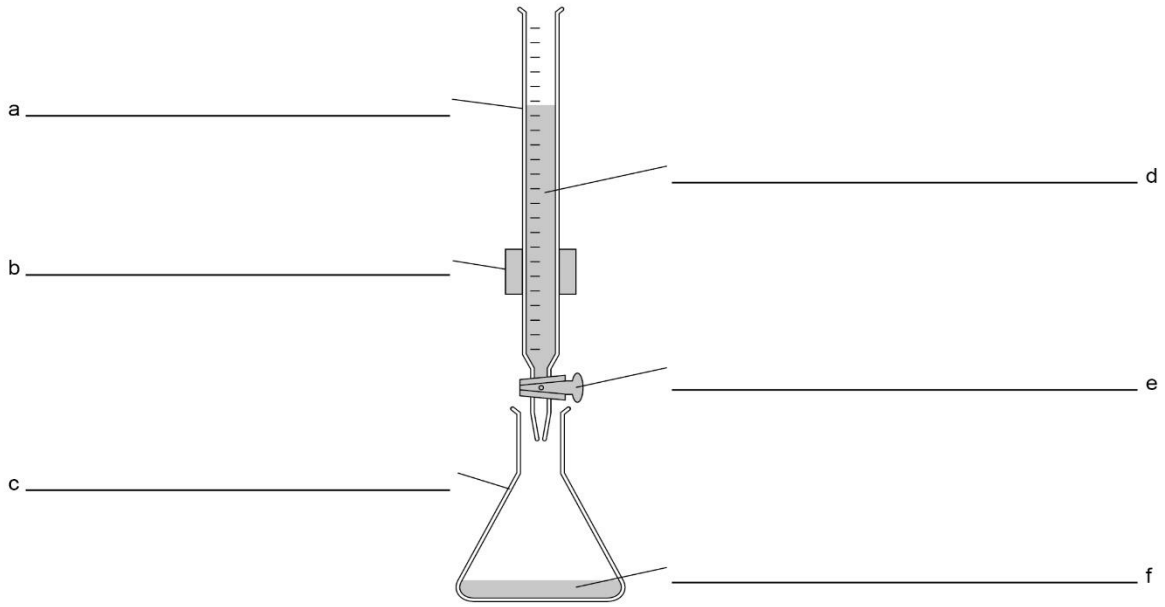
Watch these 3 videos to revise the properties and reactions of acids

Questions

Draw lines to join up the boxes and make correct sentences about solutions.

An acid solution always …	... does not dissociate completely into ions.
As the concentration of H+ ions increases, it ...	... contains excess hydrogen ions.
When a strong acid dissolves it ...	... a dilute acid.
A concentrated acid contains more solute in the solution than ...	... lowers the pH.
When a weak acid dissolves it ...	... completely dissociates into ions.

Label the diagram below with the names of the apparatus used in titration.



Complete the equation below to show what happens during neutralisation.

$H^+(aq) + OH^-(aq) \rightarrow$ _____

$NaCl$	$CaSO_4$	Na_2SO_4	$CaCl_2$	$NaNO_3$	Na_3PO_4	$Ca(NO_3)_2$	$Ca_3(PO_4)_2$

For each of the following word equations, write a balanced symbol equation beneath it.

The formulae for each substance is given in the table above.

a sodium hydroxide + nitric acid → sodium nitrate + water

_____

b calcium hydroxide + sulfuric acid → calcium sulfate + water

_____

c sodium hydroxide + sulfuric acid → sodium sulfate + water

_____

d calcium hydroxide + hydrochloric acid → calcium chloride + water

_____

e calcium hydroxide + nitric acid → calcium nitrate + water

_____

f sodium hydroxide + phosphoric acid → sodium phosphate + water

_____

Relative Formula Mass Calculations

https://www.bbc.co.uk/bitesize/guides/z2ty97h/revision/1

The relative formula mass of a substance is the sum of the relative atomic mass of all the atoms present in the formula of the substance.

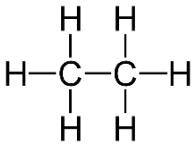
Formula	No of atoms of each element	Mass of each element	Relative Formula Mass
CO_2	1 x carbon 2 x oxygen	1 x 12 = 12 2 x 16 = 32	12 + 32 = 44
NH_3	__ x nitrogen __ x hydrogen		
Li_2O	__ x lithium __ x oxygen		
C_2H_6	__ x carbon __ x hydrogen		
$NaNO_3$	___x sodium __ x nitrogen __ x oxygen		
K_2SO_4	___x potassium __ x sulfur __ x oxygen		
$Ca(NO_3)_2$	___x calcium __ x nitrogen __ x oxygen		
$Al_2(SO_4)_3$	___x aluminium __ x sulfur __ x oxygen		
$(NH_4)_2CO_3$	__ x nitrogen ___ x hydrogen __ x carbon ___ x oxygen		

Empirical Formula Calculations

https://www.bbc.co.uk/bitesize/guides/z2ty97h/revision/2

Questions

The empirical Formula of a compound is the simplest whole number ratio of atoms of each element in the compound

e.g. ethane 

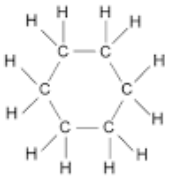
molecular formula: _____

empirical formula: _____

Write the **empirical formula** of each of the following substances.

a H_2O_2

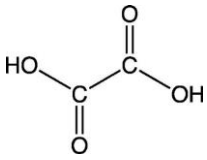
b C_4H_8

g 

c C_5H_{12}

d $C_4H_8O_2$

e $C_6H_{12}O_6$

f 

Calculate the empirical formula of each of the following substances with the following compositions.

a) 3.60 g of magnesium and 10.65 g of chlorine

b) 9.1 g of lithium and 10.4 g of oxygen

A compound contains 70% iron and 30% oxygen. Calculate the empirical formula of this compound.

Balancing Symbol Equations

Balance the equations below:

1) ____ N_2 + ____ H_2 → ____ NH_3

2) ____ $KClO_3$ → ____ KCl + ____ O_2

3) ____ NaCl + ____ F_2 → ____ NaF + ____ Cl_2

4) ____ H_2 + ____ O_2 → ____ H_2O

5) ____ $Pb(OH)_2$ + ____ HCl → ____ H_2O + ____ $PbCl_2$

6) ____ $AlBr_3$ + ____ K_2SO_4 → ____ KBr + ____ $Al_2(SO_4)_3$

7) ____ CH_4 + ____ O_2 → ____ CO_2 + ____ H_2O

8) ____ C_3H_8 + ____ O_2 → ____ CO_2 + ____ H_2O

9) ____ C_8H_{18} + ____ O_2 → ____ CO_2 + ____ H_2O

10) ____ $FeCl_3$ + ____ NaOH → ____ $Fe(OH)_3$ + ____NaCl

11) ____ P + ____O_2 → ____P_2O_5

12) ____ Na + ____ H_2O → ____ NaOH + ____H_2

Atomic Structure ANSWERS

Look at

https://www.bbc.co.uk/bitesize/guides/z3sg2nb/revision/3

to revise this topic – pages 3 -5 are most relevant.

Questions

1. Complete the following table:

Particle	Relative Charge	Relative Mass	Location
Proton	1+	1	nucleus
Neutron	0	1	nucleus
Electron	1-	$\frac{1}{2000}$	Outside nucleus

2.

Name	Symbol	Atomic number	Mass number	Number of		
				protons	neutrons	electrons
hydrogen	H	1	1	1	0	1
lead	Pb	82	204	82	122	82
aluminium	Al	13	27	13	14	13
gold	Au	79	197	79	118	79
beryllium	Be	4	9	4	5	4

3. Complete the table and the sentences below about isotopes of hydrogen.

Name	Atomic number	Mass number	Number of		
			protons	neutrons	electrons
hydrogen	1	1	1	0	1
hydrogen	1	2	1	1	1
hydrogen	1	3	1	2	1

What are isotopes?

Atoms of the SAME ELEMENT which have the same no of protons but a different no of neutrons

Electron Arrangement and the Periodic Table

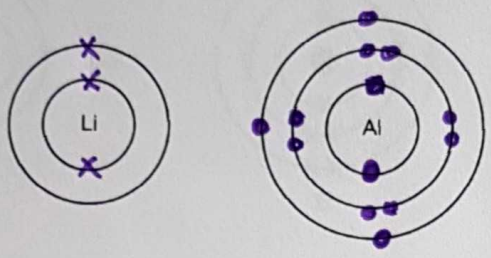
Look at

https://www.bbc.co.uk/bitesize/guides/zxmmsrd/revision/3

Pages 3 – 4 only

Questions

1. Complete the diagrams below. Show each electron as a cross. The correct number of shells have already been drawn for you.



2 Write the electronic configurations for the following elements:

a helium 2

b carbon 2,4

c oxygen 2,6

d chlorine 2,8,7

e calcium 2,8,8,2

f In The table below shows the electronic configurations for three different elements.

Element	lithium	sodium	potassium
Electronic configuration	2.1	2.8.1	2.8.8.1

In terms of their electronic configurations, explain which group these elements belong to.

GROUP 1 - they all have ONE electron in their outer shell

g The table below shows the electronic configurations for four different elements.

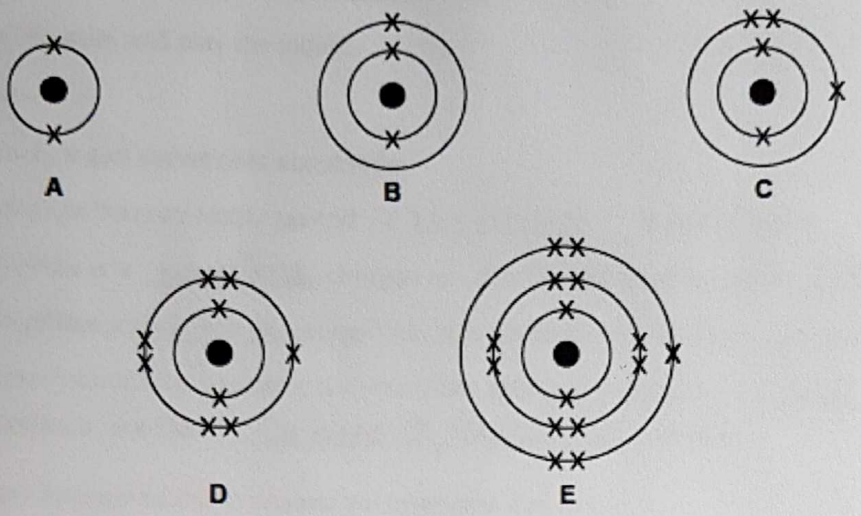
Element	lithium	beryllium	nitrogen	neon
Electronic configuration	2.1	2.2	2.5	2.8

In terms of their electronic configurations, explain which period these elements belong to.

PERIOD 2 - they all have TWO shells occupied by electrons.

Look at the diagrams. They show the atoms of some elements.

The letters do not represent the symbols for the elements.



(a) (I) Element **B** is in Group 1.

How can you tell?

It has ONE electron in its outer shell [1]

(II) Element **E** is in Period 3.

How can you tell?

Electrons occupy THREE shells [1]

Ionic Bonding

Look at

https://www.bbc.co.uk/bitesize/guides/zy98msg/revision/1

Look at all 7 pages and play the videos.

Questions

1 Complete these statements about **ions**.

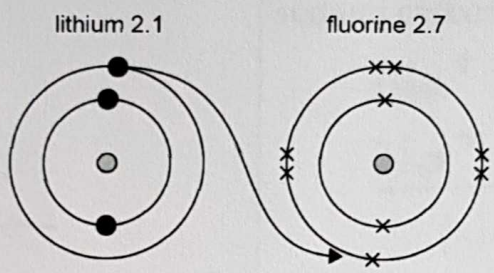
a An atom that has lost or gained electrons is called an ion.

b A cation is a positive charged ion. It is formed when an atom loses electrons.

c An **anion** is a negative charged ion. It is formed when an atom gains electrons.

d When atoms form ions they become more stable as they gain a Full outer shell of electrons, like the Group 0/Noble Gas elements.

2 Use the diagram below to answer the questions that follow.



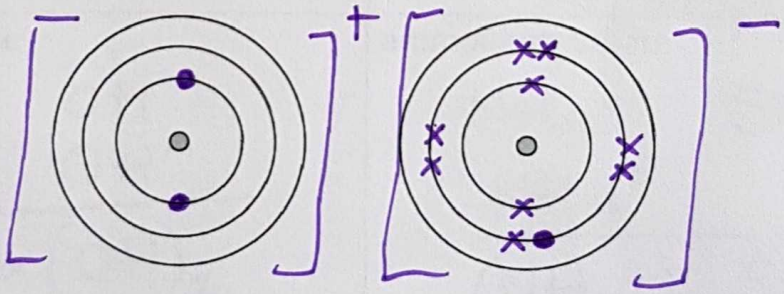
a Which atom loses an electron? Lithium

b Which atom gains an electron? Fluorine

c Write the symbols for the positive and negative ions formed: Li^+ and F^-

3 Complete the dot and cross diagrams below to show the electron arrangements of the ions formed in question **2**. You will not need electrons in all the shells.

abel each ion with the correct charge.



4 Complete the table below.

Ion symbol	Atomic number	Mass number	Protons	Neutrons	Electrons
K^+	19	39	19	20	18
S^{2-}	16	32	16	16	18

5. Write the formula of the ionic compounds in the boxes below:

potassium chloride $K^+ \quad Cl^-$ KCl	iron II carbonate $Fe^{2+} \quad CO_3^{2-}$ $FeCO_3$
magnesium bromide $Mg^{2+} \quad Br^-$ $\quad\quad Br^-$ $MgBr_2$	copper II fluoride $Cu^{2+} \quad F^-$ $\quad\quad F^-$ CuF_2
aluminium iodide $Al^{3+} \quad I^-$ $\quad\quad I^-$ $\quad\quad I^-$ AlI_3	sodium carbonate $Na^+ \quad CO_3^{2-}$ Na^+ Na_2CO_3
potassium sulfide $K^+ \quad S^{2-}$ K^+ K_2S	aluminium nitrate $Al^{3+} \quad NO_3^-$ $\quad\quad NO_3^-$ $\quad\quad NO_3^-$ $Al(NO_3)_3$
barium hydroxide $Ba^{2+} \quad OH^-$ $\quad\quad OH^-$ $Ba(OH)_2$	ammonium sulfate $NH_4^+ \quad SO_4^{2-}$ NH_4^+ $(NH_4^+)_2SO_4$
iron III oxide $Fe^{3+} \quad O^{2-}$ $Fe^{3+} \quad O^{2-}$ $\quad\quad O^{2-}$ Fe_2O_3	aluminium sulfate $Al^{3+} \quad SO_4^{2-}$ $Al^{3+} \quad SO_4^{2-}$ $\quad\quad SO_4^{2-}$ $Al_2(SO_4)_3$

Covalent Bonding in Simple Molecules

https://www.bbc.co.uk/bitesize/guides/zqrxdxs/revision/1

Look at all 4 pages and play the video

Questions

Complete the following sentences:

A covalent bond is formed when two atoms share a pair of electrons.

They do this to gain a full outer shell of electrons.

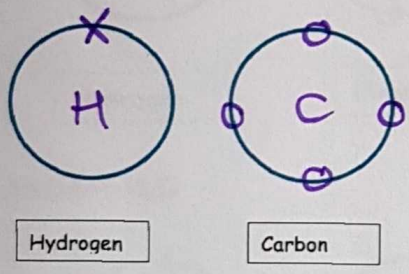
Covalent bonds form between non-metal atoms only.

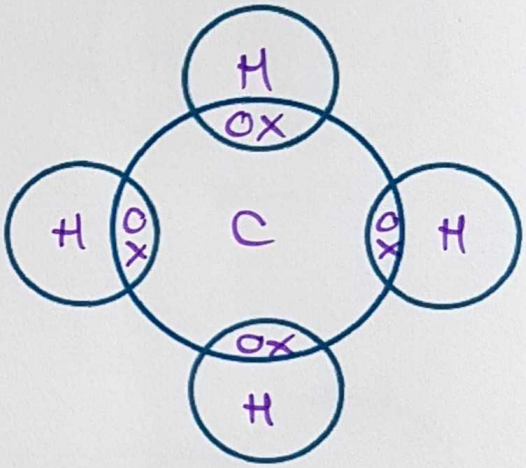
A molecule is formed when two or more atoms are covalently bonded together.

For example: **Methane**

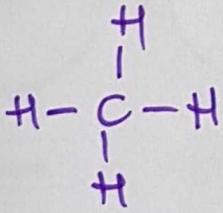
Molecular Formula = CH_4

(complete the outer shells of electrons only)





Structural Formula:



The dot and cross diagram above shows a molecule of methane which contains 4 single covalent bonds.

We say that substances like methane have a **simple molecular structure.**

They have low melting points because the intermolecular forces (forces between molecules) are very weak

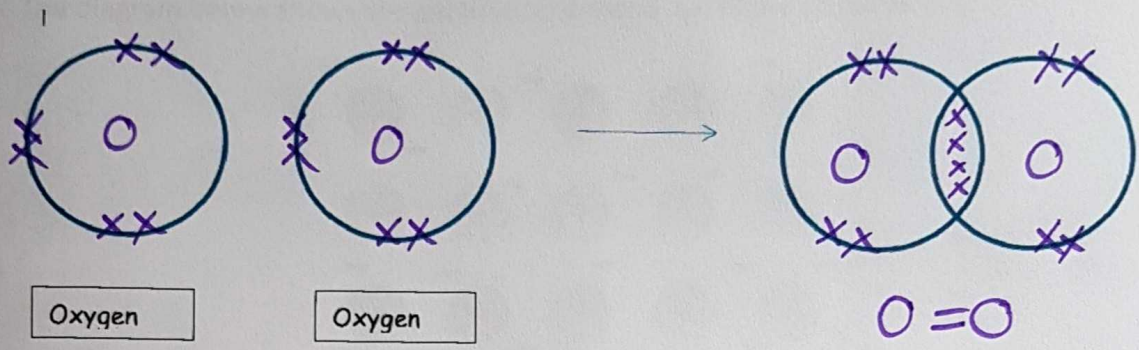
They do not conduct electricity because there are no mobile ions or electrons

Double Covalent Bonds

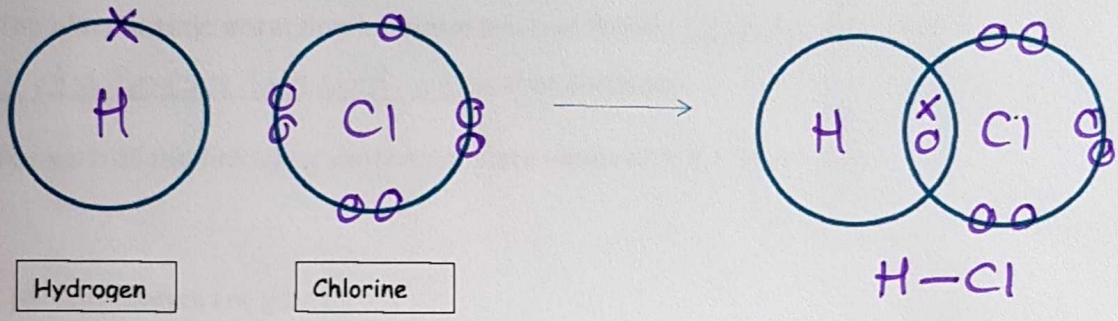
Sometimes atoms share two pairs of electrons – this is called a DOUBLE bond.

For example: **Oxygen**

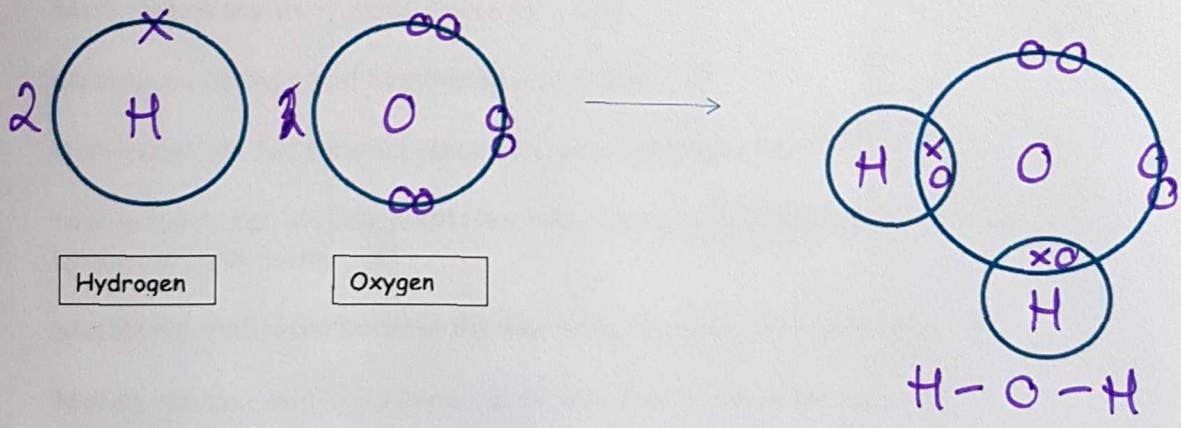
Molecular Formula = O_2



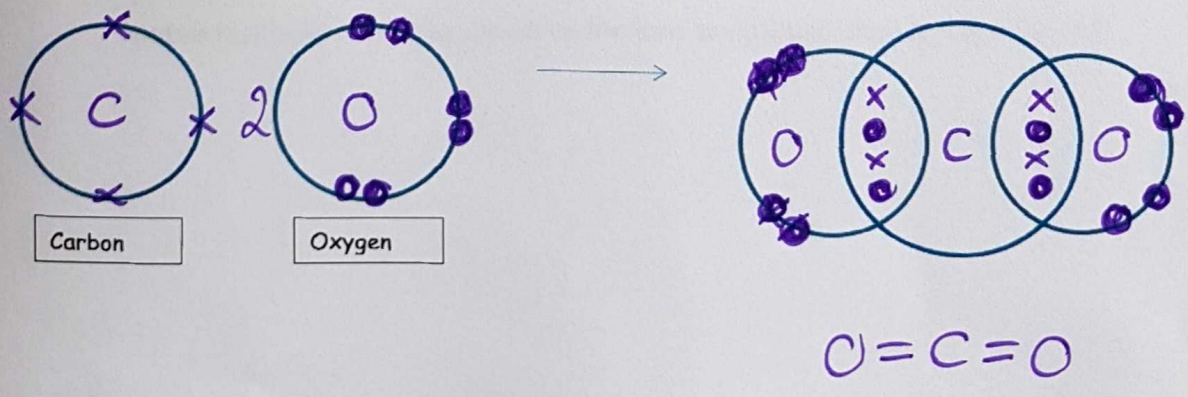
Hydrogen Chloride - HCl



Water – H_2O



Carbon Dioxide – CO_2

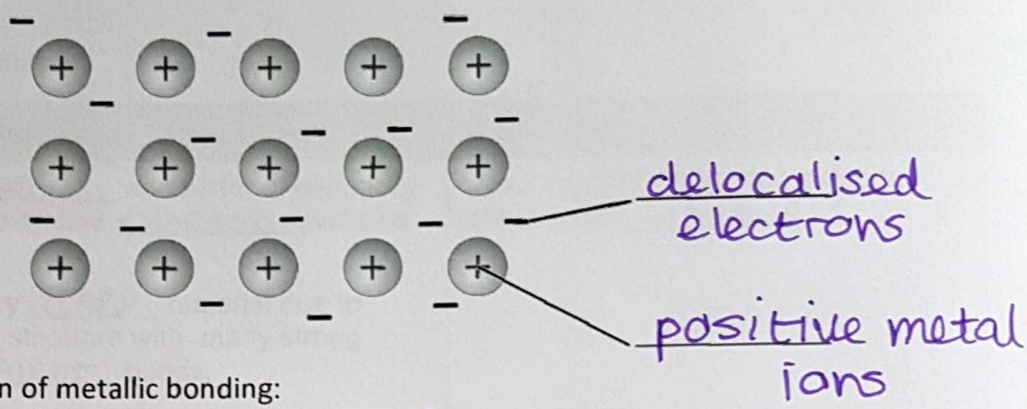


Metallic bonding

https://www.bbc.co.uk/bitesize/guides/zgmpgdm/revision/1 **Look at page 1.**

Questions

The diagram below shows the particles in a metal. Label the particles.



Complete the definition of metallic bonding:

The electrostatic attraction between positive metal ions and a delocalised 'sea' of electrons.

For each of the following sentences, state whether it is true or false.

	True	False
All **non-metals** are gases.		F
All **metals** are magnetic.	T	
Most metals are shiny when polished.	T	
Metals can be bent and hammered into shape.	T	
Non-metals do not conduct electricity, except for graphite.	T	
Metals have high melting points because strong covalent bonds have to be broken to melt them.		F
Metals are **malleable** because the electrons can slide over each other.		F
Metals conduct electricity because ions are free to move through the structure.		F
Metals have high densities because the ions are packed closely together.	T	

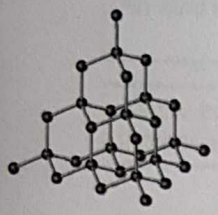
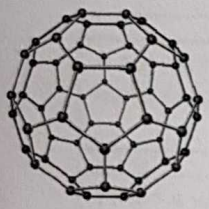
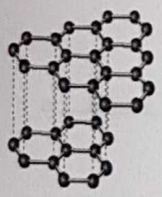
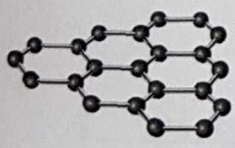
Giant structures with covalent bonding

https://www.bbc.co.uk/bitesize/guides/z9vrjty/revision/1

Look at all 3 pages

Questions

Complete the following table:

Material	Properties	Uses
DIAMOND 	POOR conductor of electricity as no mobile CHARGED particles. A very HARD material due to giant structure with many strong COVALENT bonds.	Used in CUTTING tools due to exceptional HARDNESS
FULLERENE 	POOR conductor of electricity as no mobile CHARGED particles LOW melting point as weak intermolecular forces. Slippery and SOFT	Used to cage molecules in DRUG delivery systems. Used in lubricants because it is SLIPPERY
GRAPHITE 	GOOD conductor of electricity because DELOCALISED electrons act as charge carriers. SLIPPERY and soft due to weak intermolecular forces between layers	Used as a dry LUBRICANT because it is slippery. Used to make ELECTRODES for electrolysis because it is a GOOD conductor of electricity.
GRAPHENE 	Conducts electricity well due to free ELECTRONS Exceptional strength Very FLEXIBLE	Future uses in electrical DEVICES and nanomaterials.

Reactions of acids with bases, carbonates and metals

https://www.youtube.com/watch?v=wmhOttroIrw

https://www.youtube.com/watch?v=4pIHhXfGZIE

https://www.youtube.com/watch?v=QISsle_jSQ8

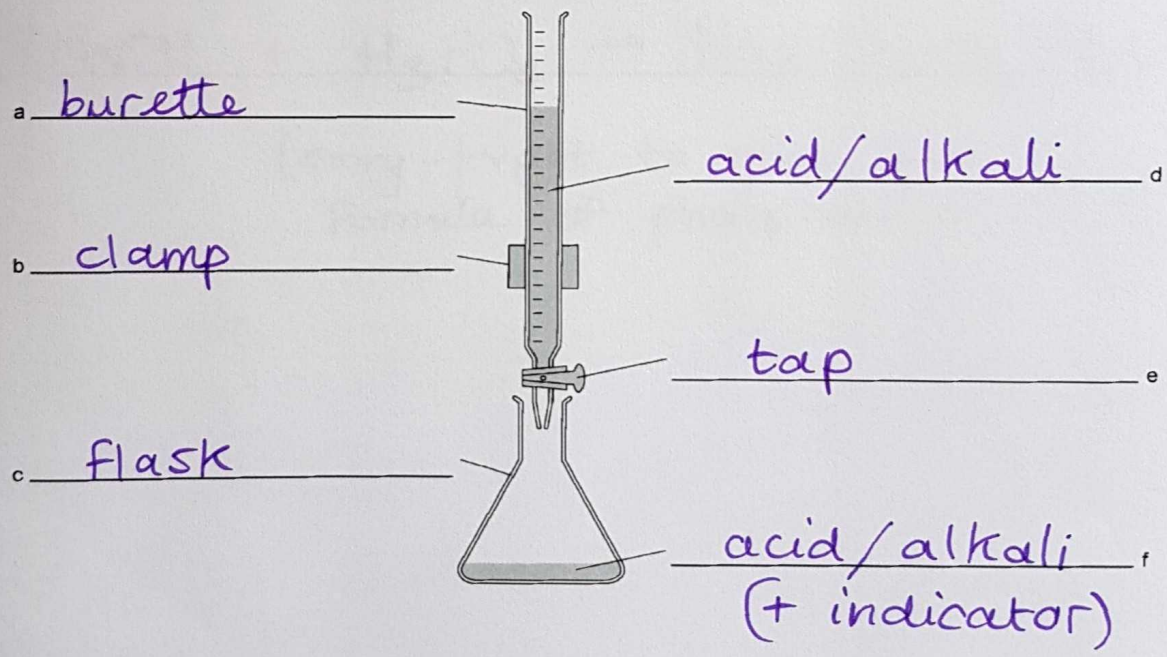
Watch these 3 videos to revise the properties and reactions of acids

Questions

Draw lines to join up the boxes and make correct sentences about solutions.

An acid solution always ...	... does not dissociate completely into ions.
As the concentration of H+ ions increases, it ...	... contains excess hydrogen ions.
When a strong acid dissolves it ...	... a dilute acid.
A concentrated acid contains more solute in the solution than ...	... lowers the pH.
When a weak acid dissolves it ...	... completely dissociates into ions.

Label the diagram below with the names of the apparatus used in titration.



Complete the equation below to show what happens during neutralisation.

$H^+(aq) + OH^-(aq) \rightarrow$ H_2O (l)

$NaCl$	$CaSO_4$	Na_2SO_4	$CaCl_2$	$NaNO_3$	Na_3PO_4	$Ca(NO_3)_2$	$Ca_3(PO_4)_2$

For each of the following word equations, write a balanced symbol equation beneath it.

The formulae for each substance is given in the table above.

a sodium hydroxide + nitric acid → sodium nitrate + water

$$NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$$

b calcium hydroxide + sulfuric acid → calcium sulfate + water

$$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$$

c sodium hydroxide + sulfuric acid → sodium sulfate + water

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

d calcium hydroxide + hydrochloric acid → calcium chloride + water

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$$

e calcium hydroxide + nitric acid → calcium nitrate + water

$$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$$

f sodium hydroxide + phosphoric acid → sodium phosphate + water

$$3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$$

(sorry - forgot to give you formula of phosphoric acid)

Relative Formula Mass Calculations

https://www.bbc.co.uk/bitesize/guides/z2ty97h/revision/1

The relative formula mass of a substance is the sum of the relative atomic mass of all the atoms present in the formula of the substance.

Formula	No of atoms of each element	Mass of each element	Relative Formula Mass
CO_2	1 x carbon 2 x oxygen	1 x 12 = 12 2 x 16 = 32	12 + 32 = 44
NH_3	1 x nitrogen 3 x hydrogen	1 × 14 = 14 3 × 1 = 3	14 + 3 = 17
Li_2O	2 x lithium 1 x oxygen	2 × 3 = 6 1 × 16 = 16	6 + 16 = 22
C_2H_6	2 x carbon 6 x hydrogen	2 × 12 = 24 6 × 1 = 6	24 + 6 = 30
$NaNO_3$	1 x sodium 1 x nitrogen 3 x oxygen	1 × 23 = 23 1 × 14 = 14 3 × 16 = 48	23 + 14 + 48 = 85
K_2SO_4	2 x potassium 1 x sulfur 4 x oxygen	2 × 39 = 78 1 × 32 = 32 4 × 16 = 64	78 + 32 + 64 = 174
$Ca(NO_3)_2$	1 x calcium 2 x nitrogen 6 x oxygen	1 × 40 = 40 2 × 14 = 28 6 × 16 = 96	40 + 28 + 96 = 164
$Al_2(SO_4)_3$	2 x aluminium 3 x sulfur 12 x oxygen	2 × 27 = 54 3 × 32 = 96 12 × 16 = 192	54 + 96 + 192 = 342
$(NH_4)_2CO_3$	2 x nitrogen 8 x hydrogen 1 x carbon 3 x oxygen	2 × 14 = 28 8 × 1 = 8 1 × 12 = 12 3 × 16 = 48	28 + 8 + 12 + 48 = 96

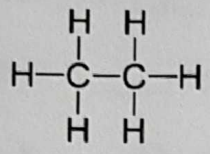
Empirical Formula Calculations

https://www.bbc.co.uk/bitesize/guides/z2ty97h/revision/2

Questions

The empirical Formula of a compound is the simplest whole number ratio of atoms of each element in the compound

e.g. ethane



molecular formula: C_2H_6

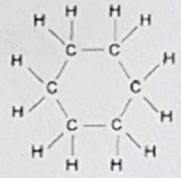
empirical formula: CH_3

Write the **empirical formula** of each of the following substances.

a H_2O_2 HO

b C_4H_8 CH_2

g



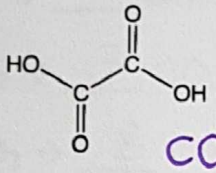
CH_2

c C_5H_{12} C_5H_{12}

d $C_4H_8O_2$ C_2H_4O

e $C_6H_{12}O_6$ C_3H_2O

f



CO_2H

Calculate the empirical formula of each of the following substances with the following compositions.

a) 3.60 g of magnesium and 10.65 g of chlorine

	Mg	Cl
m	3·6	10·65
n	$\frac{3·6}{24}$	$\frac{10·65}{35·5}$
	$\frac{0·15}{0·15}$	$\frac{0·30}{0·3}$
	1 :	2

$MgCl_2$

b) 9.1 g of lithium and 10.4 g of oxygen

	Li	O
m	9·1	10·4
n	$\frac{9·1}{7}$	$\frac{10·4}{16}$
	$\frac{1·3}{0·65}$	$\frac{0·65}{0·65}$
	2 :	1

Li_2O

A compound contains 70% iron and 30% oxygen. Calculate the empirical formula of this compound.

	Fe	O
m	70	30
n	$\frac{70}{56}$	$\frac{30}{16}$
	$\frac{1·25}{1·25}$	$\frac{1·875}{1·25}$
	1 :	1·5 — (×2)

Fe_2O_3

Balancing Symbol Equations

Balance the equations below:

1) ___ N_2 + 3 H_2 → 2 NH_3

2) 2 $KClO_3$ → 2 KCl + 3 O_2

3) 2 NaCl + ___ F_2 → 2 NaF + ___ Cl_2

4) 2 H_2 + ___ O_2 → 2 H_2O

5) ___ $Pb(OH)_2$ + 2 HCl → 2 H_2O + ___ $PbCl_2$

6) 2 $AlBr_3$ + 3 K_2SO_4 → 6 KBr + ___ $Al_2(SO_4)_3$

7) ___ CH_4 + 2 O_2 → ___ CO_2 + 2 H_2O

8) ___ C_3H_8 + 5 O_2 → 3 CO_2 + 4 H_2O

9) ___ C_8H_{18} + 12.5 O_2 → 8 CO_2 + 9 H_2O

10) ___ $FeCl_3$ + 3 NaOH → ___ $Fe(OH)_3$ + 3 NaCl

11) 4 P + 5 O_2 → 2 P_2O_5

12) 2 Na + 2 H_2O → 2 NaOH + ___ H_2

OR $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$