THE CROSSLEY HEATH SIXTH FORM

Student Name:

A-Level Chemistry

Welcome!

Hello, and welcome to Crossley Heath chemistry. We are very much looking forward to seeing you in September as you embark on your next steps as part of The Crossley Heath School's sixth form. We are eager to be part of your learning journey that will see you enhance both your chemistry knowledge and transferable skills as we help prepare you for the future. If you need any help or advice along the way, our supportive team will be available to guide you every step of the way.

See you in September!

Mrs E Ryan
(Department Leader for Chemistry)

Dr J Norcliffe
(Teacher of Chemistry)

Dr H Stevens
(Teacher of Chemistry)

This bridging work is designed to help you consolidate the GCSE knowledge needed in A level Chemistry. During the first lesson of the course, you will bring this completed booklet and have a discussion with your teacher about how you found it. You will then mark your booklet and use it to identify any further work needed at the start of your A level chemistry journey. You may need paper as some of the answers may not fit in the booklet

Exam Board and Specification: OCR A-Level Chemistry A (H432)

Link to Specification: https://www.ocr.org.uk/images/171720-specification-accredited-a-level-gce-chemistry-a-h432.pdf

THE CROSSLEY HEATH SIXTH FORM

Bridging work

The Fundamentals!

A level chemistry relies on a lot of the fundamental GCSE ideas. If any of the things on the list are something you struggled with or don't remember, you need to prioritise raising your understanding of it. This booklet focuses on the key skills and knowledge needed early at A level

What you need to have a really good understanding of from GCSE

Covalent bonding

Ionic bonding

Metallic bonding

Writing formulae

Balancing equations

Moles

Reacting masses calculations

Gas volume calculations

% yield and atom economy

Titrations

Molecular, structural and displayed formula

Drawing alkanes and combustion (up to 4 C's)

Drawing alkenes and their GCSE reactions (up to 4 C's)

Drawing alcohols (up to 4 C's)

What you can do to boost your understanding if necessary

Fuse School videos on YouTube have lots of excellent GCSE videos

Borrow a GCSE textbooks from the department

Come to the Chemistry drop in session to ask for help

Email your teacher for help

Go on physics and maths tutor and look at the GCSE past paper questions on that particular topic

Watch MaChem Guy YouTube videos called 'Prep for A level Chemistry'

Maths skills

Rearranging equations to make something else the subject

Drawing graphs, lines of best fit and tangents

Converting units

Standard form

Decimal places, significant figures and rounding

Content	Current confidence (1-5) very confident to not at all
Covalent bonding	
Ionic bonding	
Metallic bonding	
Ionic formulae	
Balancing Equations	
Moles	
Reacting masses	
Gas volumes	
% yield + Atom economy	
Titrations	
Types of formulae	
Alkanes	
Alkenes	
Alcohols	

The Periodic Table of the Elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	18
1 **H** hydrogen 1.0	2											13	14	15	16	17	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 27.0	14 **Si** silicon 28.1	15 **P** phosphorus 31.0	16 **S** sulfur 32.1	17 **Cl** chlorine 35.5	18 **Ar** argon 39.9
19 **K** potassium 39.1	20 **Ca** calcium 40.1	21 **Sc** scandium 45.0	22 **Ti** titanium 47.9	23 **V** vanadium 50.9	24 **Cr** chromium 52.0	25 **Mn** manganese 54.9	26 **Fe** iron 55.8	27 **Co** cobalt 58.9	28 **Ni** nickel 58.7	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	39 **Y** yttrium 88.9	40 **Zr** zirconium 91.2	41 **Nb** niobium 92.9	42 **Mo** molybdenum 95.9	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	● 57–71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	● 89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **Lv** livermorium		

Key
atomic number
Symbol
name
relative atomic mass

●	57 **La** lanthanum 138.9	58 **Ce** cerium 140.1	59 **Pr** praseodymium 140.9	60 **Nd** neodymium 144.2	61 **Pm** promethium 144.9	62 **Sm** samarium 150.4	63 **Eu** europium 152.0	64 **Gd** gadolinium 157.2	65 **Tb** terbium 158.9	66 **Dy** dysprosium 162.5	67 **Ho** holmium 164.9	68 **Er** erbium 167.3	69 **Tm** thulium 168.9	70 **Yb** ytterbium 173.0	71 **Lu** lutetium 175.0
●	89 **Ac** actinium	90 **Th** thorium 232.0	91 **Pa** protactinium	92 **U** uranium 238.1	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium

Section 1: Charges on Ions and writing forumlae (2 hours 30 minutes)

Task 1:

Watch the following video on writing ionic formulae. Whilst watching, write a **short summary** of the video below: https://www.youtube.com/watch?v=tV8Cv2x0SD0

Task 2:

Read the guidance we wrote for this section on the next pages and use your notes and ours to complete the questions

How to work out the charge on ions

STEP 1: work out the ions in your compound from the name
e.g. sodium chloride has a sodium ion (metal) and chloride ion (non-metal)

at your periodic table to work out the charge on the ions in the compound

Metals (left, group 1-3)

- charge is positive
- same value as the group

Non-metals (right, groups 5-7

- charge is negative
- value = 8 - group number

STEP 2: work out the charges on those ions. USE THE PERIODIC TABLE.

sodium ion (metal) so positive charge and in GROUP 1 so 1^+

chloride ion (non-metal) so negative charge and GROUP 7 so 8-7 = 1^-

The ions may be ones you need to remember (see above) because the charge can't be worked out from the periodic table e.g. hydroxide OH^-

Ions you need to memorise

- OH^- hydroxide
- H^+ hydrogen
- NO_3^- nitrate
- SO_4^{2-} sulfate
- CO_3^{2-} carbonate
- NH_4^+ ammonium

FURTHER EXAMPLE:

calcium hydroxide

calcium ion (metal) so positive charge and in GROUP 2 so 2^+, Ca^{2+}

hydroxide ion: is non-metal so has a negative charge and is one you have to remember: OH^-

QUIZ

How to work out the charge on ions

Have a go at the following questions and check your answers (upside down below) to make sure you understand

1. What are the formulae (with charge shown) of the following metal ions?
    a. Magnesium
    b. Potassium
    c. Aluminium
    d. Calcium
    e. Rubidium

2. What are the formulae (with charge shown) of the following non-metal ions?
    a. Chloride (chlorine)
    b. Oxide (oxygen)
    c. Nitride (nitrogen)
    d. Sulphide (sulphur)
    e. Bromide (bromine)
3. Without looking at the help sheet write down the formula of the following compound ions
    a. Hydroxide
    b. Nitrate
    c. sulfate
    d. ammonium
    e. carbonate

How to work out the formulae of ionic compounds

YOU CAN DO IT

STEP 1: work out the ions in your compound from the name
e.g. sodium chloride has a sodium ion (metal) and chloride ion (non-metal)

sodium is in group 1 so 1^+

chloride (from chlorine) is in group 7 so 1^-

The ions could be ones you need to memorise as they cannot be worked out from the periodic table (see box on right)

Ions you need to memorise

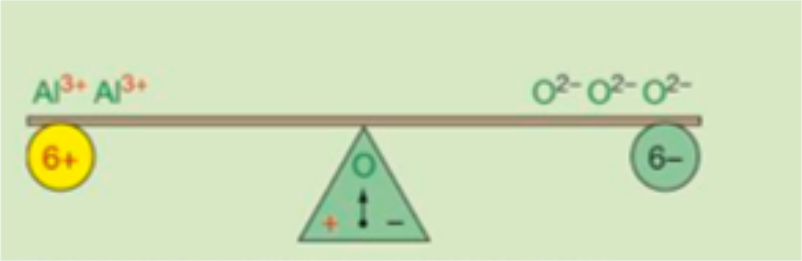
- OH^- hydroxide
- H^+ hydrogen
- NO_3^- nitrate
- SO_4^{2-} sulfate
- CO_3^{2-} carbonate
- NH_4^+ ammonium

STEP 2: work out the simplest whole number ratio of ions that will give not overall charge (number of positive charges = number of negative charges)

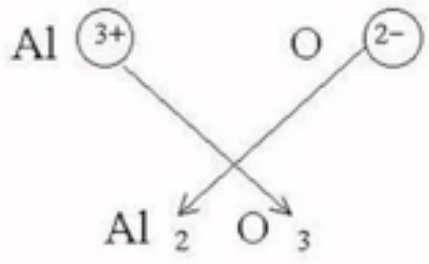
e.g. for magnesium chloride, Mg^{2+} and Cl^- ions will be in a (Mg) 1:2 (Cl) ratio

Formula is $MgCl_2$

$2 \times Al^{3+}$ ions cancel out $3 \times O^{2-}$ so formula of aluminium chloride is Al_2O_3



Number of charges can be 'CROSSED OVER' to give the ratio



FURTHER EXAMPLE:

calcium hydroxide

calcium ion (metal) so positive charge and in GROUP 2 so 2^+, Ca^{2+}

hydroxide ion: is non-metal so has a negative charge and is one you have to remember: OH^-

Ratio is (Ca) 1:2 (OH) as $2 \times 1^-$ of OH required to cancel out 2^+ of Ca

Formula is $Ca(OH)_2$

Use brackets around compound ion if 2 or more in formula

QUIZ

How to work out the formulae of ionic compounds

Have a go at the following questions and check your answers (upside down below) to make sure you understand

1. What are the formulae of the compounds formed from the following elements?
    a. Magnesium and chlorine
    b. Potassium and oxygen
    c. Aluminium and bromine
    d. Calcium and fluorine
    e. Rubidium and nitrogen

2. What are the formulae of the following compounds?
    a. Sodium chloride
    b. Calcium oxide
    c. Magnesium nitride
    d. Rubidium sulfide
    e. Aluminium bromide
3. What are the formulae of the following compounds that contain compound ions?
    a. Magnesium hydroxide
    b. Sodium nitrate
    c. Potassium sulfate
    d. Ammonium hydroxide
    e. Calcium carbonate

THE CROSSLEY HEATH SIXTH FORM

Section 2: Bonding (2 hours 30 minutes)

Task 1:

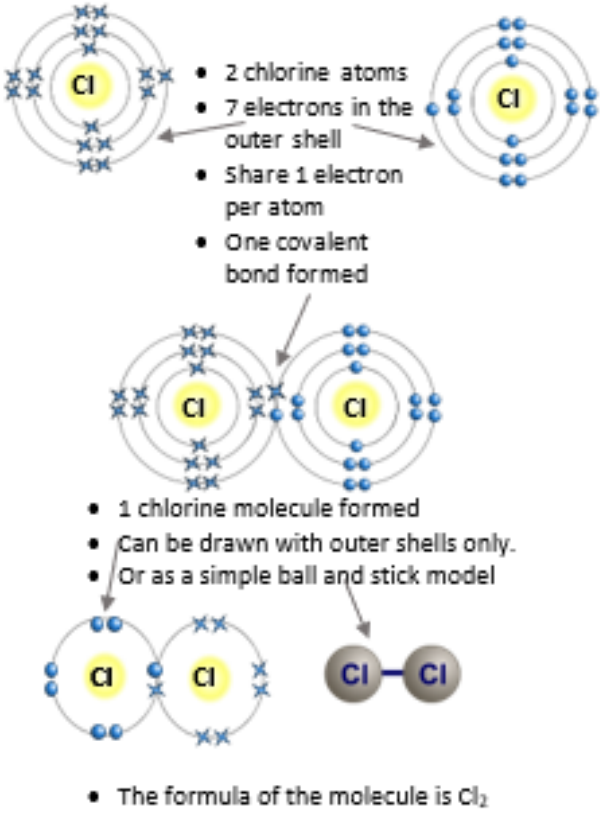
Watch the following video of the different types of bonding. Whilst watching, write **the answers to the video questions** below and mark them yourself:
https://www.youtube.com/watch?v=vUbUoyR6Log

Task 2:

Read the guidance we wrote for this section on the next pages and use your notes and ours to complete the questions

Covalent bonding and the formulae of simple molecules

1. A simple molecular element:



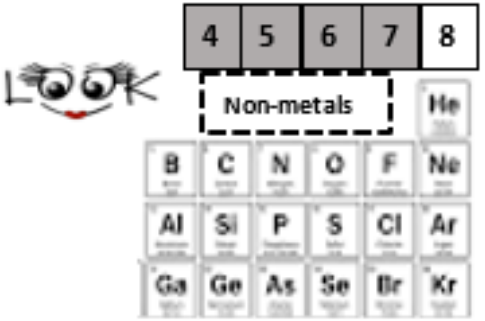
- The formula of the molecule is Cl_2

Multiple bonds

Single bond = 1 pair of shared electrons
Double bond = 2 pairs of shared electrons
Triple bond = 3 pairs of shared electrons

KEY IDEA

Simple covalent molecules are formed when atoms of non-metal elements bond together by sharing electrons with the exception of Carbon (diamond and graphite) and silicon dioxide which form giant covalent lattices)



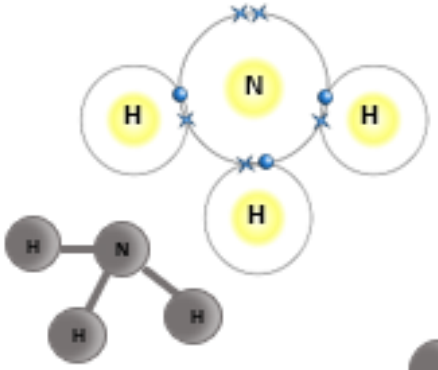
How to work out the formula for a simple molecular compound:

1. **Work out how many electrons are needed to complete the outer shell for each atom in the compound.**
2. **Write these as a ratio then reverse the values and simplify. This will then give you the number of each type of atom in the formula**

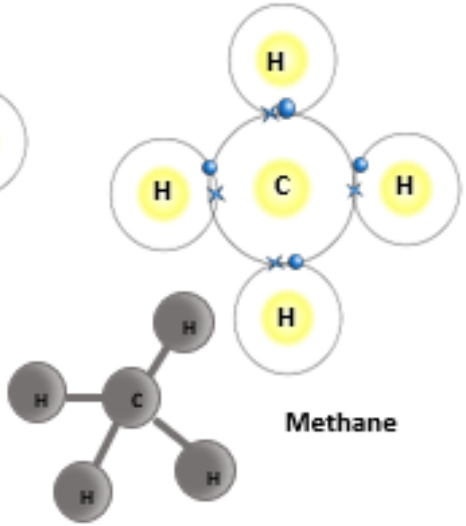
Element	N	H
Outer shell e-	5	1
Number e- needed	3	1
Ratio of atoms	1	3
Formula	NH_3	

Element	C	H
Outer shell e-	4	1
Number e- needed	4	1
Ratio of atoms	1	4
Formula	CH_4	

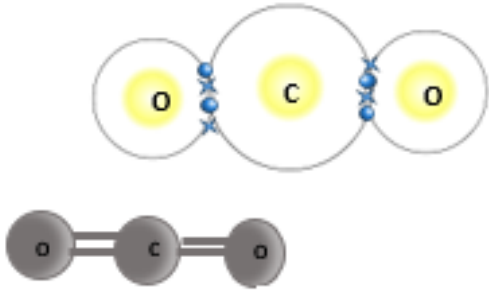
Element	C	O
Outer shell e-	4	6
Number e- needed	4	2
Ratio of atoms	2	4
Simplified ratio	1	2
Formula	CO_2	



Ammonia



Methane



Carbon dioxide

Covalent bonding and the formulae of simple molecules

Have a go at the following questions and check your answers (upside down below) to make sure you understand

1. Work out the formula of the simple molecules formed between the following elements?
    a. Chlorine and hydrogen
    b. Carbon and fluorine
    c. Oxygen and hydrogen
    d. Hydrogen and bromine

2. How many covalent bonds would be formed between two atoms on the following elements (diatomic molecules)?
    a. Chloride
    b. Oxygen
    c. Nitrogen
    d. Hydrogen
    e. Iodine
3. Draw dot and cross diagrams of the molecules in questions 1 & 2

Explaining properties of ionic compounds

Bonding	ionic (between metals and non-metals)
↓ Structures	↓ giant ionic
Melting point	high
Conduct electricity?	not when solid, but they do when molten or dissolved in water (when ions are mobile)
Example	sodium chloride 

High melting points:

All ions are held with the GIANT structure by STRONG ionic bonds

To melt these substances these bonds have to be broken so the ions can move around each other in the liquid.

A high energy input is required to break these bonds.

Conduction of electricity:

Charge must be able to flow so the ions will need to be able to move.

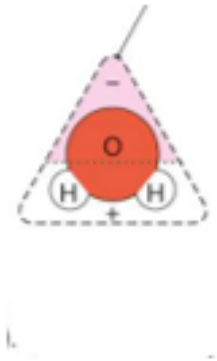
NOT when solid as all ions are held with the GIANT structure by STRONG ionic bonds so they CANNOT MOVE.

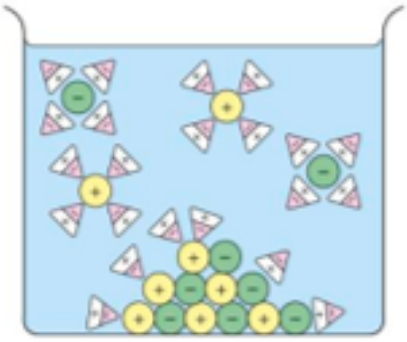
If these substances are melted or dissolved in water (many are soluble) then the ions are mobile so the substance can conduct.

Other properties:

Soluble in water (many): water molecules are slightly positively charge at the hydrogen end and negatively charged at the oxygen end so they for bonds of attraction to the ions in the compound.

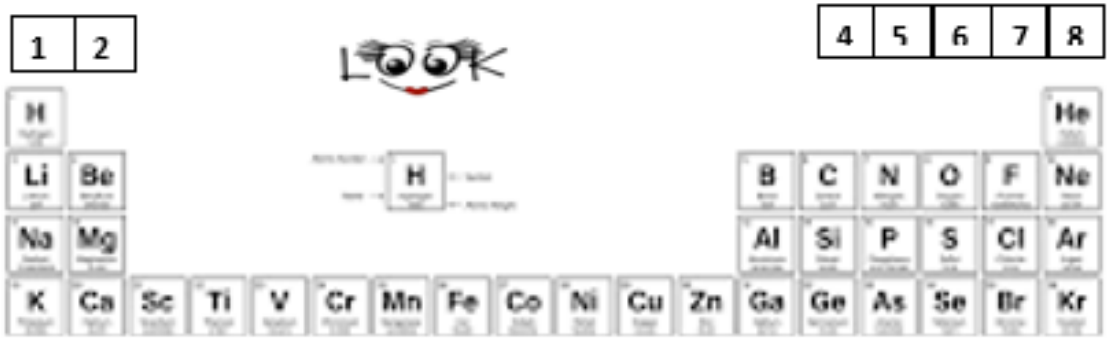
Crystalline: regular arrangement of ions in the giant structure leads to regularly shaped crystals





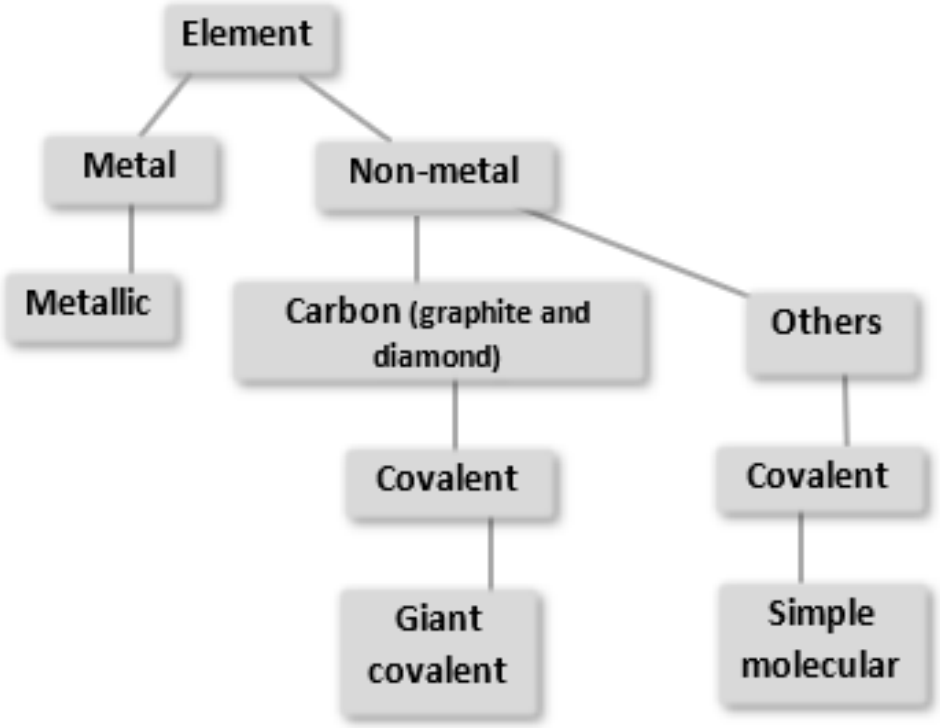
How to predict the type of bonding and structure of a substance

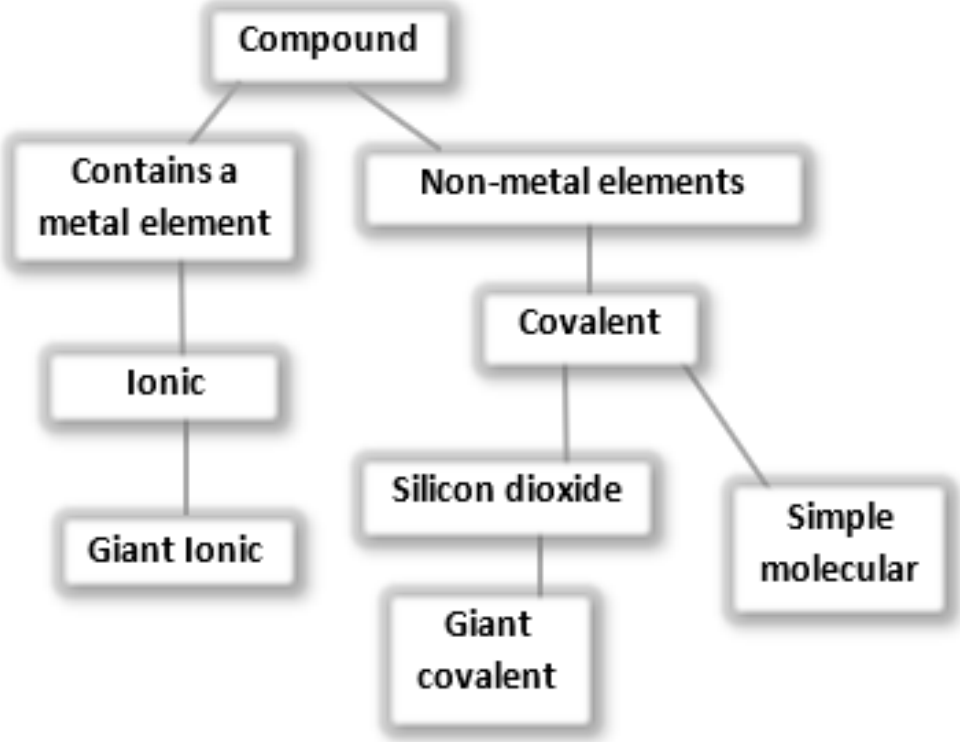
STEP 1: Decide if your substance is an element (named on periodic table) or a compound. Then follow the corresponding flow chart.



Metals: groups 1-3 and transition metals e.g. Sc → Zn

Non-metals: groups 4-8





QUIZ

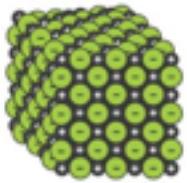
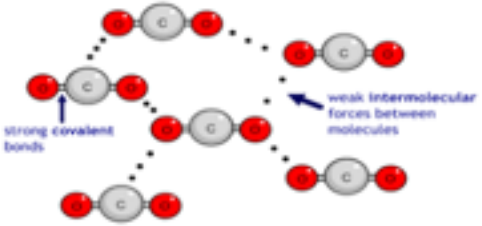
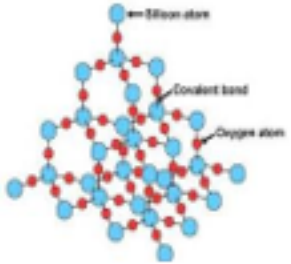
How to predict the type of bonding and structure of a substance

Have a go at the following questions and check your answers (upside down below) to make sure you understand

1. What type of bonding would between atoms in the following elements?
    a. Magnesium
    b. chlorine
    c. carbon (diamond)
    d. sulphur
    e. Rubidium

2. What type of bonding would be present in the following compounds?
    a. Sodium chloride
    b. Calcium oxide
    c. Nitrogen dioxide
    d. Carbon disulfide
    e. Aluminium bromide
3. Using the formulae state the type of chemical structure of the following substances:
    a. NaOH
    b. CH_4
    c. SO_2
    d. Cu
    e. $CaCl_2$

Explaining properties

Property	Ionic	Simple (covalent)	Giant (covalent)	Metallic
				
Melting /boiling point	High: Strong ionic bonds must be overcome so requires a high energy input.	Low: Weak forces of attraction between molecules can be overcome with a small energy input (the strong covalent bonds between atoms within the molecules do not need to be broken)	High: Strong covalent bonds must be overcome so requires a high energy input.	High: Strong metallic bonds must be overcome so requires a high energy input.
Electrical/ heat conductor	Yes, when molten or in solution (NOT when solid) : Melting or dissolving allows ions to move so a current to flow when a potential difference is applied.	No: No overall charge on molecules (so no ions) as all electrons are shared between the atoms. There are no delocalised electrons either!	No – diamond, silicon dioxide: All electrons are fixed into covalent bonds Yes – graphite: only 3 electrons per carbon atom are fixed in covalent bonds the 4th is delocalised so can move	Yes, delocalised electrons of the metallic structure can move/flow

QUIZ

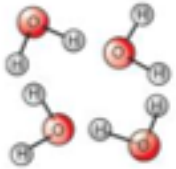
Explaining properties

Have a go at the following questions and check your answers (upside down below) to make sure you understand

1. Explain why carbon (graphite) is a solid at room temperature and pressure whereas carbon dioxide is a gas.
2. Explain why the conductivity of sodium chloride increases dramatically at **801 °C**.
3. Why are metals very good conductors?
4. Explain why the two allotropes of carbon have very different electrical conductivities.

Predicting chemical structure and properties

Make sure you understand and can recall the basics in this table:

Bonding	ionic (between metals and non-metals)	covalent (between non-metals)		metallic (between metals)
Structures	giant ionic	giant covalent	simple molecular	giant metallic
Melting point	high	high	low	high
Conduct electricity?	not when solid, but they do when molten or dissolved in water (when ions are mobile)	no	no	yes (has mobile electrons)
Example	sodium chloride 	diamond 	water 	zinc 

Elements ONLY

All metal elements are bonded in this way.

Elements or Compounds

Elements: Most non-metals (groups 5-7) e.g. O_2, N_2, Cl_2

Compounds: between non-metals. Other examples include: NH_3, HCl, CO_2

Compounds ONLY

As always between a metal and a non-metal so must be different types of atom.

Elements or Compounds (3 examples to memorise)

Element: carbon (both Allotropes 1. diamond and 2. graphite)

Compound: 3. silicon dioxide (sand) SiO_2

NOTE: graphite can conduct electricity and you'll need to explain why!

QUIZ

Predicting chemical structure and properties

Have a go at the following questions and check your answers (upside down below) to make sure you understand.

1) For the following pairs of substances state which has the higher melting point:

   a) Sodium chloride or hydrogen chloride
   b) Sulfur or iron.
   c) Diamond or iodine
   d) Carbon monoxide or aluminium oxide.

2) For each of the following compounds state whether it has a giant or a simple structure
   a) Diamond
   b) Copper
   c) Silicon dioxide
   d) Carbon dioxide
   e) Chlorine

3) For the substances in 2 state the type of structure.

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Section 3: Chemical Calculations (3 hours)

Task 1:

Watch the following videos on reacting masses and limiting reactants. Whilst watching, write **the answers to the video questions** below and on the next page. Use the video to mark your answers

Reacting masses video and space for answers

https://www.youtube.com/watch?v=I3WVO3TEqAY

Limiting reactant video and space for answers: https://www.youtube.com/watch?v=CVN6M7Pe0M0

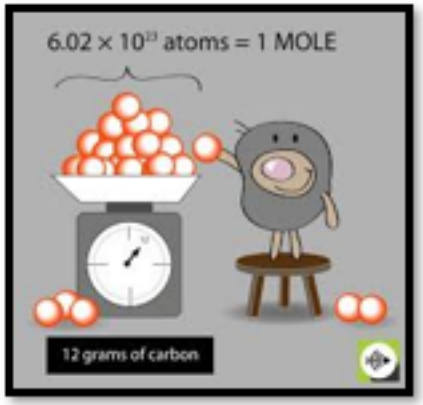
Task 2:

Read the guidance we wrote for this section on the next pages and use your notes and ours to complete the questions

How many moles?

KEY IDEAS

The mole is simply a number of particles.
The particles can be atoms, ions or molecules.
In one mole there a lot of particles (6.02 x 10^{23}!)
The mass of a mole of any substance is in grams so number of particles is huge as the particles are tiny



Elements

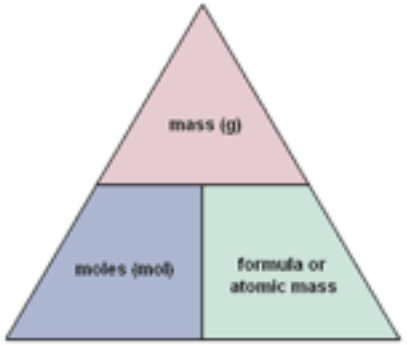
- Each element has a mass number displayed on the periodic table.
- This is the mass of 1 mole of atoms of that element in grams: 1 mole of helium, He, has a mass of 4 g.
- Some elements (group 7 and hydrogen, nitrogen and oxygen) exist as **diatomic molecules** (2 atoms) e.g. Cl_2 for chlorine or O_2 for oxygen.
- For these diatomic elements a mass of one mole is usually the mass of 1 mole of molecules (M_r) which are twice as heavy as one

Compounds

- For **simple molecular compounds** we need the mass of 1 mole of molecules e.g. H_2O
- For **giant ionic or giant covalent** compounds we need the mass of 1 mole of formula units e.g. NaCl for sodium chloride
- So for compounds we add up the mass numbers of all the atoms to get the formula mass, M_r.
- One mole of water molecules has a mass of 18g as the $M_r = 1 + 1 + 16 = 18$
- One mole of sodium chloride has a mass of 58.5 g as the $M_r = 23 + 35.5$

Formula for mole/mass calculations

Number of moles = mass of substance in grams ÷ formula mass



The formula mass can be substituted for simply and atomic mass if the substance is an element (not diatomic)

QUIZ

How many moles?

Have a go at the following questions and check your answers (upside down below) to make sure you understand.

1) State/work out the mass of 1 mole of the following elements (g)
   a) Magnesium
   b) Hydrogen
   c) Iron
   d) Bromine
   e) Argon

2) State/work out the mass of 1 mole of the following compounds (g)
   a) Hydrogen chloride, HCl
   b) Sodium oxide, Na_2O
   c) Water
   d) Carbon tetrafluoride, CF_4
   e) Sulfuric acid, H_2SO_4
   f) Calcium bromide, $CaBr_2$

3) How many moles are in the following amounts of substance?
   a) 200g of calcium carbonate ($CaCO_3$)
   b) 8g of oxygen (O_2)
   c) 22g of carbon dioxide (CO_2)
   d) 400g of sodium hydroxide (NaOH)

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Reacting Masses Practice

Calcium carbonate breaks down on heating to produce calcium oxide and carbon dioxide gas.

$$CaCO_3 \rightarrow CaO + CO_2$$

A student heats 15 g of calcium carbonate strongly in a crucible.

Relative atomic masses (A_r): Ca = 40, C = 12, O = 16.

a Calculate the number of moles in 15 g of calcium carbonate.

b Use your answer to part **a** to determine the number of moles of calcium oxide that will be produced.

c Calculate the mass of calcium oxide produced by this reaction.

A student is preparing a sample of sodium nitrate, $NaNO_3$.

She mixes 17 g of sodium oxide with an excess of nitric acid. The equation for the reaction is:

$$Na_2O + 2HNO_3 \rightarrow 2NaNO_3 + H_2O$$

Relative atomic masses (A_r): Na = 23, O = 16, N = 14, H = 1.

a Calculate the number of moles in 17 g of sodium oxide.

b Calculate the maximum mass of sodium nitrate that can be produced in this reaction.

Aluminium and iron oxide (Fe_2O_3) react together to produce aluminium oxide (Al_2O_3). The equation for the reaction is:

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$$

Calculate the mass of iron that is produced by reacting 20 g of iron oxide with an excess of aluminium.

Relative atomic masses (A_r): Al = 27, O = 16, Fe = 56.

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Limiting Reactant Calculation

Questions

1. A 50.6 g sample of $Mg(OH)_2$ is reacted with 45.0 g of HCl according to the reaction:

$$Mg(OH)_2 + 2\ HCl \rightarrow MgCl_2 + 2\ H_2O$$

a) How many moles of $Mg(OH)_2$ are there in 50.6g?

b) How many moles of HCl are there in 45g?

c) How many moles of $Mg(OH)_2$ would react with that amount of moles of HCl?

d) Which is the limiting reagent?

e) How many moles of $MgCl_2$ will be produced from this reaction? (Hint: look at the equation)

f) How many grams of $MgCl_2$ will be produced from this reaction?

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2. In an experiment, 3.25 grams of NH_3 are allowed to react with 3.5 grams of O_2.

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

a) How many moles of NH_3 are there in 3.25g?

b) How many moles of O_2 are there in 3.5g?

c) How many moles of NH_3 would react with that amount of moles of O_2?

d) Which is the limiting reagent?

e) How many moles of NO will be produced from this reaction?

f) How many grams of NO will be produced from this reaction?

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Section 4: Balancing Equations (1 hour)

Task 1:

Watch the following video on balancing equations. Whilst watching, write **the answers to the video questions** below. Use the video to mark your answers
https://www.youtube.com/watch?v=kwD7raDxm_A

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Balance the following equations for types of reactions you studied at GCSE

1. $H_2 + Br_2 \rightarrow HBr$
2. $H_2 + O_2 \rightarrow H_2O$
3. $Mg + HCl \rightarrow MgCl_2 + H_2$
4. $Na + H_2SO_4 \rightarrow Na_2SO_4 + H_2$
5. $Zn + O_2 \rightarrow ZnO$
6. $MgCO_3 + HCl \rightarrow MgCl_2 + H_2O + CO_2$
7. $C + O_2 \rightarrow CO$
8. $MgO + HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$
9. $FeCl_3 + NaOH \rightarrow Fe(OH)_3 + NaCl$
10. $CuSO_4 + NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$