Chesterton Sixth Form

EASTERN LEARNING ALLIANCE

Year 12 Chemistry transition work

A Level Chemistry Transition Practice booklet

This document has been designed to aid you in your transition from Year 11 to Year 12. It will help you prepare for starting the A level Chemistry course by recapping some of the key concepts from GCSE that will be important for understanding the first module of the course as well as covering content that is unique to GCSE Chemistry. For students who studied combined science at GCSE, large parts of this content will be new.

To do:

1. Read through each section and make your own study notes
2. Attempt the practice questions at the end of each section
3. When you have worked through all sections of this practice booklet, attempt the exam booklet under exam conditions

Practice booklet contents:

Section	Page number	Topic
1	3	Balancing Equations
2	4	Ionic formulae
3	6	Transition metals
4	7	Moles and reacting masses
5	8	Empirical formula
6	9	Atom economy and yield
7	10	Concentrations and volumes
8	11	Titrations
9	12	Cells and batteries
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11	15	Polymerisation
12	16	Qualitative tests for ions
13	17	Haber process and fertilisers

Student name: ____

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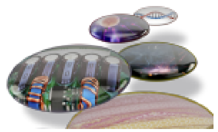
Periodic Table of the Elements

OCR
Oxford Cambridge and RSA

Key
atomic number
Symbol
name
relative atomic mass

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
1 **H** hydrogen 1.0																	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											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		

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



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Section 1: Balancing equations

AQA GCSE Chemistry /Combined Science topic: C1 – C10

Triple-only content? No

You will have practices balancing equations at GCSE. For A level chemistry you will come across many more equations, but you should find balancing soon becomes second natures. By the end of the course you should be able to write equations for all the reactions you have studied and for some unfamiliar reactions

When balancing an equation, you can only change the “big number”. The “small numbers” are part of the chemical formula of the molecule and must not be changed under any circumstances – if you change the “small numbers” you change the identity of the chemical (e.g. H_2O = water, H_2O_2 = hydrogen peroxide)

At A level, you will find the “big numbers” are given a different name – the stoichiometry. The stoichiometry is the molar ratios of each substance in a chemical equation. Remember it is only these numbers you can change when balancing.

For more help on balancing equations, try the following game: https://phet.colorado.edu/sims/html/balancing-chemical-equations/latest/balancing-chemical-equations_en.html

Practice Questions:

Balance the following equations

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

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Section 2: Ionic formulae

AQA GCSE Chemistry /Combined Science topic: C2

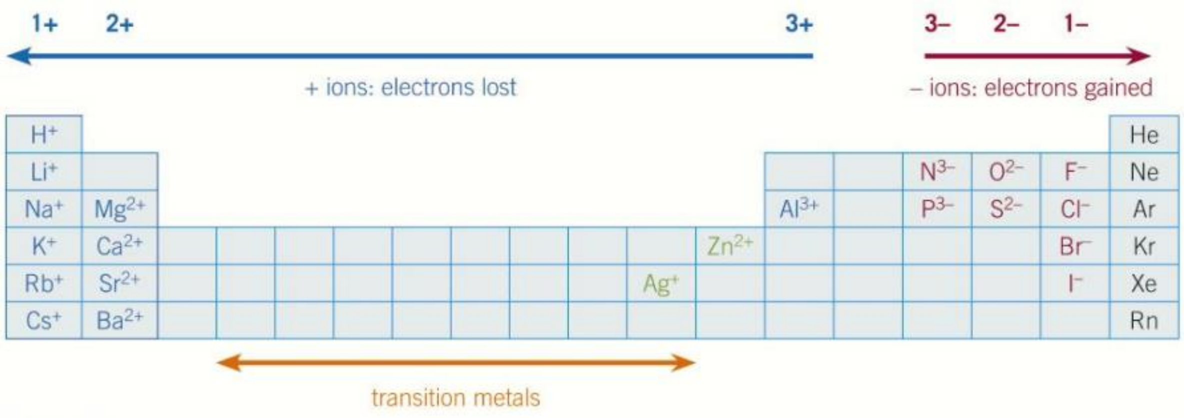
Triple-only content? No

The formula of an ionic compound depends on the charges on the ions present in the substance.

From GCSE you should remember that many atoms lose or gain electrons to achieve the same electron structure as the nearest noble gas (from He – Rn).

- Atoms of metals appear on the left of the periodic table and lose electrons to form cations (positive ions)
- Atoms of non-metals appear on the right of the periodic table and gain electrons to form anions (negative ions)

For many elements you can use the element's position in the periodic table to work out the likely charge on the ion



Some metals, mostly transition metals, can form ions with different charges. The ionic charge is then shown with a roman numeral in the name of the ion

e.g. Iron forms two ions: iron (II), Fe^{2+}, and iron (III), Fe^{3+}

Some ions are polyatomic – they contain multiple atoms bonded together but exist as a single ion

1+	1–	2–
ammonium NH_4^+	hydroxide OH^-	carbonate CO_3^{2-}
	nitrate NO_3^-	sulfate SO_4^{2-}

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To calculate the formula of an ionic compound, you must ensure the overall charge of the compound is 0.

Worked example: Ionic formulae

Compound name	Ions present	Balance charges	Formula
zinc chloride	Zn^{2+} and Cl^-	1 Zn^{2+} ions balances **2** Cl^- ions	$ZnCl_2$
aluminium sulfate	Al^{3+} and SO_4^{2-}	**2** Al^{3+} ions balance **3** SO_4^{2-} ions	$Al_2(SO_4)_3$

The charges must balance, but it's just a matter of multiplication tables.

1 Zn^{2+} ($1 \times 2+ = 2+$) is balanced by 2 Cl^- ($2 \times 1- = 2-$)

2 Al^{3+} ($2 \times 3+ = 6+$) is balanced by 3 SO_4^{2-} ($3 \times 2- = 6-$)

Practice questions:

Work out the formula of the following ionic compounds

1. Aluminium chloride
2. Magnesium sulfate
3. Sodium oxide
4. Iron (III) chloride
5. Ammonium sulfate
6. Copper (II) nitrate
7. Lithium nitride
8. Calcium oxide

Exam practice link: Question two

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Section 3: Transition metals

AQA GCSE Chemistry /Combined Science topic: C1

Triple-only content? Yes

Transition metals are found in the central part of the periodic table ('d block'). While they share many physical properties with other metals, typically they have:

- Higher melting points
- Higher densities
- Greater strength
- Greater hardness

Unlike Group 1 and Group 2 metals, transition metals react slowly (or not at all) with oxygen and water. However, many still react with halogens.

Transition metals may form ions of different charges. For example, iron commonly forms Fe^{2+} and Fe^{3+} ions. Due to this chemical property, they can often act as good catalysts (as they can both accept and donate electrons).

Transition metals often form colourful compounds and ions. For example, this video shows the colours of different vanadium ions: https://www.youtube.com/watch?v=sFAGQLokym4

Practice questions:

1. Compare the properties of potassium and copper.
2. Suggest whether manganese or magnesium oxide would be a better catalyst for the decomposition of hydrogen peroxide. Justify your answer.
3. Write a balanced symbol equation (include state symbols) for the reaction of iron and chlorine, forming iron (iii) chloride.

Exam practice link: Question one

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Section 4: Moles and reacting masses

AQA GCSE Chemistry /Combined Science topic: C3

Triple-only content? No

Chemists use a quantity called a mole to count the number of particles in substance. The number of particles in one mole can be calculated using Avogadro's constant (N_A)

One mole of a substance = 6.02×10^{23} particles of a substance

This number may seem arbitrary however it is directly inked to the mass of carbon-12, the standard for the measurement of relative atomic mass. 12 g of carbon 12 contains 6.02×10^{23} carbon atoms

Molar mass is a convenient way of linking moles with mass for any chemical substance. This molar mass gives the mass in grams in each mole of the substance

$$moles\ (mol) = \frac{mass\ (g)}{molar\ mass\ (g\ mol^{-1})}$$

You can use the mass of a reactant in a reaction and the stoichiometric relationship between reactants and products to predict the maximum theoretical yield of a product. This assumes 100% of your limiting reactant is converted into product. There are a number of ways of performing this calculation. Watch the following video to see an example of how it's done: https://www.youtube.com/watch?v=5zOpoeN0dV0

Practice questions:

1. Calculate the number of moles in 2.4 g of chlorine gas (Cl_2)
2. Calculate the number of molecules in 2.4 g of chlorine gas (Cl_2)
3. Calculate the mass of Al_2O_3 produced when 8.0 g of Al reacts with an excess of O_2

   $$4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$$
4. Calculate the mass of H_2O produced when 2.4. g of H_2 reacts with an excess of O_2

   $$2\ H_2 + O_2 \rightarrow 2\ H_2O$$
5. Write a balanced equation for the reaction of sodium with chlorine to produce sodium chloride
6. Calculate the mass of sodium chloride produced when 0.7 g of sodium reacts with an excess of chlorine

Exam practice link: Question two

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Section 5: Empirical formula

AQA GCSE Chemistry /Combined Science topic: C3

Triple-only content? No

The empirical formula is the simplest whole number ratios of atoms of each element in a compound. It is important for substances that do not exist as molecules, such as metals, giant covalent structures and ionic compounds.

Empirical formula can be calculate from molar ratios, reacting masses or percentage compositions. To see how its done, watch this video here: https://www.youtube.com/watch?v=k_GTEtK01Wg

Worked example: Empirical formula from mass

In an experiment, 1.203 g of calcium combines with 2.13 g of chlorine to form a compound [A_r: Ca, 40.1; Cl, 35.5].

Step 1: Convert mass into moles of atoms using $n = \frac{m}{M}$

$$n(\text{Ca}) = \frac{1.203}{40.1} = 0.030\,\text{mol} \qquad n(\text{Cl}) = \frac{2.13}{35.5} = 0.060\,\text{mol}$$

Step 2: To find the smallest whole-number ratio, divide by the smallest whole number.

$$n(\text{Ca}) : n(\text{Cl}) = \frac{0.030}{0.030} : \frac{0.060}{0.030} = 1:2$$

Step 3: Write the empirical formula: $CaCl_2$

Practice Questions:

1. In an experiment 7.29 g of magnesium reacts with 4.80 g of oxygen to form a compound. Calculate the empirical formula
2. A molecule is 52.2% carbon, 13.0% hydrogen, 34.8% oxygen. Calculate the empirical formula
3. A molecule is 82.2% nitrogen, 17.8% hydrogen. Calculate the empirical formula

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Section 6: Atom economy and percentage yield

AQA GCSE Chemistry /Combined Science topic: C3

Triple-only content? Yes

Atom economy is a measure of the amount of starting materials that end up as useful products in a chemical reaction.

To equation for atom economy is: $atom\ economy = \frac{Mr\ of\ desired\ product}{Total\ Mr\ of\ reactants}\ x\ 100$

Theoretical yield is the maximum possible mass of product that can be made in a reaction. You can calculate this if you know the mass of the limiting reactant, and the molar ratio between this reactant and the product from a balanced chemical equation.

However, the theoretical yield is impossible to obtain in practice. Alternative reactions may occur. The reaction may not go to completion. Some product may be lost during transfer or filtering.

The percentage yield shows what percentage of the theoretical yield was actually obtained in a reaction.

The equation for percentage yield is: $percentage\ yield = \frac{mass\ of\ product}{theoretical\ yield}\ x\ 100$

Read about how both atom economy and percentage yield are important factors to consider when designing a synthetic pathway here: https://www.bbc.co.uk/bitesize/guides/z8wkh39/revision/3

Practice questions:

1. Calculate the atom economy of the production of magnesium chloride from magnesium and hydrochloric acid.
2. 46 g of sodium was reacted with excess fluorine gas. 64 g of sodium fluoride was obtained from this reaction. Calculate the percentage yield.

Exam practice link: Question three

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Section 7: Concentration and volume

AQA GCSE Chemistry /Combined Science topic: C3

Triple-only content? Yes

Concentration can be measured in both gdm^{-3} and $moldm^{-3}$. You can convert between these quantities using these equations:

$$moles = \frac{mass}{Mr}$$

$$moles = concentration \ x \ volume$$

Avogadro's law states that equal volumes of different gases contain the same number of molecules at the same temperature and pressure. You can use this information along with the molar ratios from balanced chemical equations to calculate the volume of gas involved in a reaction.

The molar volume is the volume of one mole of any gas at room temperature and pressure (RTP): 24 dm^3 (24,000 cm^3). If you know the moles of gas present, multiplying this by the molar volume will give the volume occupied by this gas.

Practice questions:

1. 5 g of calcium sulfate was dissolved completely in 200 cm^3 of water. Calculate the concentration of the solution in $moldm^3$.
2. 20 cm^3 of 0.1 $moldm^{-3}$ sulfuric acid reacted completely with 30 cm^3 of sodium hydroxide solution: $2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$
   Calculate the concentration of the sodium hydroxide solution.
3. 250 cm^3 of hydrogen gas reacted completely with fluorine gas. What volume of hydrogen fluoride gas was produced?
4. What is the volume occupied by 0.2 mol of neon at RTP?
5. What mass of carbon dioxide occupies 22 dm^3 at RTP?

Exam practice link: Question four

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Section 8: Titrations

AQA GCSE Chemistry /Combined Science topic: C3 + C4

Triple-only content? Yes

A titration is a reaction between a known ratio of two solutions. This allows the concentration of one of the solutions to be determined, if the concentration of the other solution and the volumes of both solutions are known.

Read about how to conduct a titration experiment here:
https://www.bbc.co.uk/bitesize/guides/zx98pbk/revision/1#:~:text=Carrying%20out%20a%20titration%20to%20find%20out%20volumes%20of%20acid%20and%20alkali%20solutions%20that%20react

Practice questions:

1. Which piece of equipment should be used to accurately measure a fixed volume of solution?
2. Which piece of equipment should be used to accurately measure variable volumes of solution?
3. Why would universal indicator be unsuitable to use for a titration?
4. What is meant by the phrase ‘concordant titre’?
5. Describe how the mean titre should be calculated.
6. 0.5 $moldm^{-3}$ hydrochloric acid was reacted with 20 cm^3 of nitric acid in a titration. Three titres of hydrochloric acid were obtained: 24.80 cm^3, 24.85 cm^3, and 24.60 cm^3.
    a. Calculate the mean titre of hydrochloric acid.
    b. Write a balanced symbol equation for the reaction.
    c. Use your answers to 6a) and 6b) to calculate the concentration of the nitric acid.

Exam practice link: Question five and nine

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Section 9: Cells and batteries

AQA GCSE Chemistry /Combined Science topic: C5

Triple-only content? Yes

A simple cell can be made by connecting two different metals with an electrolyte. A voltage will be produced until one reactant is used up. The greater the difference in reactivity between the two metals, the greater the voltage produced.

Fuel cells produce a voltage continuously, as long as they are supplied with fuel and oxygen. In contrast to combustion, in fuel cells the fuel is oxidised electrochemically (not burned), and electrical energy is released (not thermal energy).

In hydrogen fuel cells, liquid water is the only product.

At the cathode, the following reaction occurs: $2H_2 + 4HO^- \rightarrow 4H_2O + 4e^-$

At the anode, the following reaction occurs: $O_2 + 2H_2O + 4e^- \rightarrow 4HO^-$

Read more about how hydrogen fuel cells work here: https://www.savemyexams.co.uk/gcse/chemistry/aqa/18/revision-notes/5-energy-changes/5-2-chemical-cells--fuel-cells/5-2-2-fuel-cells/

Practice questions:

1. Suggest which combination of the following metals would produce the highest cell voltage: magnesium, iron, potassium, copper, zinc
2. Which species is reduced or oxidised at each electrode in hydrogen fuel cells?
3. Suggest a suitable material for the electrodes in a hydrogen fuel cell.
4. Write the overall equation for the reaction that occurs in hydrogen fuel cells.

Exam practice link: Question five

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Section 10: Organic functional groups

AQA GCSE Chemistry /Combined Science topic: C7

Triple-only content? Yes

Functional groups are groups of atoms that determine the main chemical properties of a compound.

The functional group of alkenes is the c=c double bond.

Alkenes typically undergo incomplete combustion in oxygen.

They undergo addition reactions with diatomic halogen molecules to form halogenoalkanes.

An example of this type of reaction is shown here:

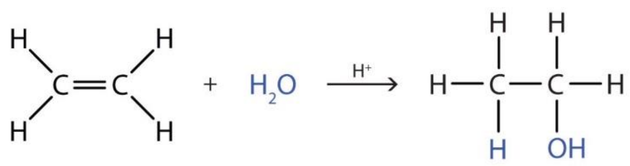
Ethene Chlorine Dichloroethane

This reaction shown with aqueous bromine can be used to test for the presence of alkenes. Bromine water remains orange-brown when mixed with alkanes, but becomes colourless when mixed with alkenes as the above reaction occurs.

Alkenes undergo addition reactions with diatomic hydrogen (called hydrogenation) to form alkanes. This reaction requires a catalyst.

Alkenes undergo addition reactions with steam (called hydration) to form alcohols. This reaction requires a high temperature (~300°C) and a catalyst.

An example of a hydration reaction is shown here:



Ethylene Water Ethanol

Alcohols are compounds with the functional group –OH (hydroxyl).

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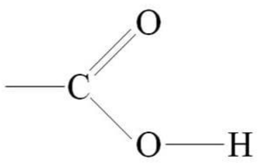
Alcohols are named in a similar way to alkanes and alkenes, depending on the number of carbons in their main chain. All alcohols have names ending in 'ol'. For example, an alcohol with three carbons would be called propanol, and an alcohol with four carbons would be called butanol.

All alcohols undergo complete combustion. Many alcohols also undergo reactions with sodium. Read more about the details of this reaction and its uses here:
https://www.chemguide.co.uk/organicprops/alcohols/sodium.html

Carboxylic acids contain the carboxyl functional group –COOH:

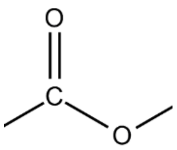


These display the typical properties of weak acids (eg reactions with metals and bases).

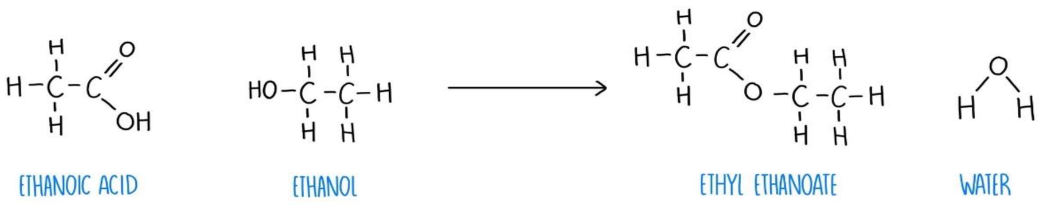
Carboxylic acids are named based on the number of carbons in their main chain, and their names end in 'anoic acid'. For example, ethanoic acid contains two carbons.

Carboxylic acids and alcohols can react together to for esters. This reaction, called esterification, requires a catalyst and also produces water.

Esters contain the functional group -COO- :



An example of an esterification reaction is shown here:



Practice questions:

1. Draw the displayed formulae of ethene and butane.
2. Ethene reacts with fluorine gas. Draw the displayed formula of the product.
3. Name the alkane that would be formed from the hydrogenation of propene.
4. Draw the displayed formula of the alcohol that would be formed from the hydration of butene.
5. Write a balanced symbol equation for the complete combustion of butanol.
6. Draw the structural formula of propanoic acid.
7. Draw the products of the esterification reaction between ethanol and butanoic acid.

Exam practice link: Question six

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Section 11: Polymers

AQA GCSE Chemistry /Combined Science topic: C2 + C7

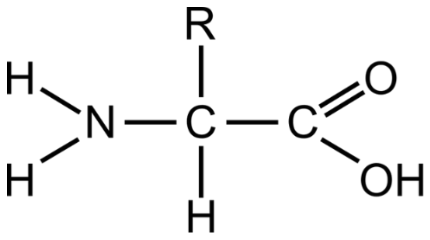
Triple-only content? Yes

Polymers are made of many small repeating units called monomers. For example, many ethene molecules (monomers) can form a long chain called poly(ethene), which is a polymer.

Read about how to draw the repeating units of addition polymers here (four examples):
http://www.passmyexams.co.uk/GCSE/chemistry/addition-polymerisation.html

DNA, carbohydrates (eg starch), and proteins are all examples of polymers found in living organisms. The monomers of proteins are amino acids. Amino acids contain the functional groups $–NH_2$ (amino group) and –COOH (carboxyl group).

The general structure of an amino acid is shown below:



In this structure, R is not the symbol of an element! It means that this part of the molecule, called a side chain, can vary in structure. In some amino acids, the R group is small (eg in glycine it is a hydrogen atom). In others it is much larger (eg in tryptophan it is C_9H_8N).

Amino acids can undergo condensation polymerisation. Read about how this reaction works here:
https://www.bbc.co.uk/bitesize/guides/z3v4xfr/revision/8

You may notice that the peptide bond formed between amino acids looks similar to an ester link. In fact, alcohols and carboxylic acids can form condensation polymers too!

Practice questions:

1. Draw the repeating unit of poly(ethene)
2. Draw the repeating unit of poly(difluroethene): CH_2F_2
3. Draw the general structure of an amino acid, and label the amino and carboxyl fundtional groups.
4. Draw the repeating unit of poly(glycine)

Exam practice link: Question seven

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Section 12: Qualitative tests for ions

AQA GCSE Chemistry /Combined Science topic: C8

Triple-only content? Yes

Some metal ions can be identified by the colour of the flame when they are burned. Read about the flame test colours for some common metal ions here: https://www.bbc.co.uk/bitesize/guides/zxtvw6f/revision/1#:~:text=The%20table%20shows,Green

Metal ions that form insoluble hydroxides can be tested for by reaction with dilute sodium hydroxide solution. Read about the precipitate colours for some common metals here, and how to distinguish between metals that produce white precipitates, here: https://www.bbc.co.uk/bitesize/guides/zxtvw6f/revision/2#:~:text=The%20table%20shows%20the,calcium%20and%20magnesium%20ions.

A test for carbonate ions is reaction with dilute acid. Carbon dioxide bubbles are given off. The identity of this gas can be confirmed with limewater.

A test for sulfate ions is reaction with aqueous barium chloride. The positive result of this test is the formation of white barium sulfate precipitate. The solution should first be acidified with dilute acid, to remove any carbonate ions that would give a false positive result. This acid should not be sulfuric acid, as this would also give a false positive result!

The test for halide ions is reaction with aqueous silver nitrate. Chloride ions form a white precipitate, bromide ions form a cream precipitate, and iodide anions form a yellow precipitate. The solution should first be acidified with dilute nitric acid to remove any carbonate or hydroxide ions that would also form insoluble silver salts and obscure the results. As with the sulfate test, hydrochloric acid should not be used for this purpose, as it would give a false positive result.

Instrumental methods have a number of benefits over traditional qualitative tests. Read about these here: https://www.bbc.co.uk/bitesize/guides/zxtvw6f/revision/5

Practice questions:

1. A salt solution burns with a green flame. Predict the colour of its hydroxide precipitate.
2. A salt solution forms a green precipitate upon reaction with sodium hydroxide, and a cream precipitate upon reaction with silver nitrate. What is its molecular formula?

Exam practice link: Question eight

Chesterton Sixth Form

EASTERN LEARNING ALLIANCE

Year 12 Chemistry transition work

Section 13: The Haber process

AQA GCSE Chemistry /Combined Science topic: C6 + C10

Triple-only content? Yes

Ammonia can be manufactured in a reversible reaction between hydrogen and nitrogen called the Haber process. This requires an iron catalyst, and is typically performed at 200 atmospheres of pressure and between 350-450°C. The reaction mixture can be periodically cooled to remove ammonia, and the unreacted gases can be recycled for future reactions.

Ammonia can be used in the synthesis of ammonium and nitrate salts, which are a vital component of fertilisers as they provide a soluble source of nitrogen for plants. Phosphate and potassium ions are also vital components of most fertilisers, providing soluble sources of phosphorous and potassium respectively. Fertilisers containing all of these three elements are known as NPK fertilisers.

A key component of many NPK fertilisers is the salt ammonium sulfate. This can be produced by reacting aqueous ammonia and sulfuric acid. Sulfuric acid can be produced by reacting sulfur with oxygen in multiple stages, then reacting sulfur trioxide with water.

Practice questions:

1. Write a balanced symbol equation for the Haber process.
2. Explain, with reference to Le Chatelier's principle, why the reaction conditions of the Haber process are a compromise between rate and yield.
3. Write a balanced symbol equation for the production of ammonium sulfate.

Exam practice link: Question ten