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Year 11 into 12 – Chemistry Summer work

July 2024

GCSE to A-Level Key ideas

Introduction:

A-Level Chemistry is extremely well valued by both employers and universities. It is, however, a challenging course. We want you to be ready to face these challenges and to do so you must have a good understanding of some key ideas that you studied at GCSE.
The purpose of this booklet is to inform you of the required skills for the A-Level Chemistry course and inform you of resources available to you to help you prepare.

How to prepare:

You are advised to purchase your own copy of the required textbook to bring to lessons.
You need an A4 (lever arch) folder with at least 6 folder dividers

During the first couple of weeks of the course you will take a diagnostic test to assess your suitability for this course.

To prepare for this:

1. Use the checklist to RAG rate your current understanding of GCSE Chemistry for each of the topics identified below:

- The structure of the atom
- Formation of ions (including oxidation and reduction)
- Intermolecular forces
- Bonding and properties (ionic, covalent and metallic)
- Chemical equations (writing and balancing)
- Group 2 and Group 7 elements (trends and reactions)
- Acids and bases.

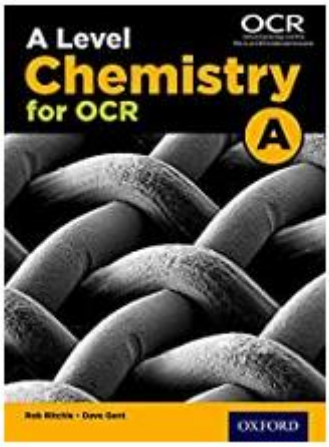
2. Produce consolidation mind maps / information pages / notes for any areas identified red or amber for each of the topics.

You can use the following resources to help you:

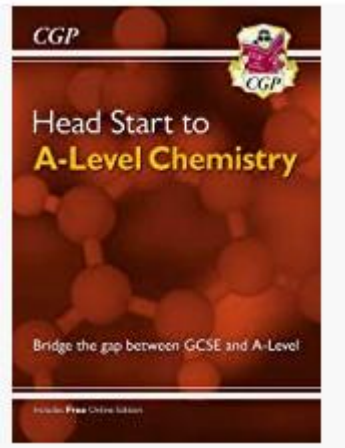
1. AQA GCSE Chemistry Revision Notes 2018 | Save My Exams
2. AQA GCSE (9-1) Chemistry Revision - PMT (physicsandmathstutor.com)
3. GCSE revision guides
4. Head start to GCSE Chemistry textbook (ISBN 9781782949138)

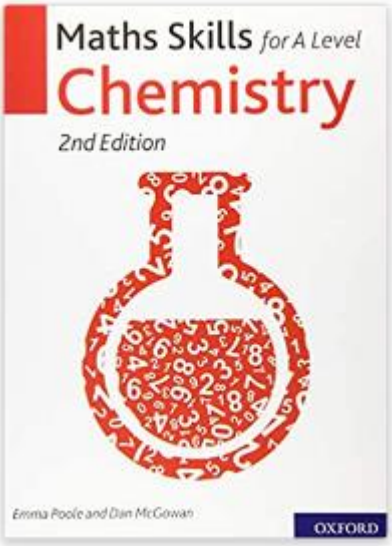
Required resources

You will need to purchase a copy of this textbook and bring it with you to your lessons.



Optional resources





AQA Chemistry (8462) from 2016 Topics C4.1 Atomic structure and the periodic table				
Topic	**Student Checklist**	**R**	**A**	**G**
4.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes	State that everything is made of atoms and recall what they are			
	Describe what elements and compounds are			
	State that elements and compounds are represented by symbols; and use chemical symbols and formulae to represent elements and compounds			
	Write word equations and balanced symbol equations for chemical reactions, including using appropriate state symbols			
	HT ONLY: Write balanced half equations and ionic equations			
	Describe what a mixture is			
	Name and describe the physical processes used to separate mixtures and suggest suitable separation techniques			
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)			
	Describe the difference between the plum pudding model of the atom and the nuclear model of the atom			
	State the relative charge of protons, neutrons and electrons and describe the overall charge of an atom			
	State the relative masses of protons, neutrons and electrons and describe the distribution of mass in an atom			
	Calculate the number of protons, neutrons and electrons in an atom when given its atomic number and mass number			
	Describe isotopes as atoms of the same element with different numbers of neutrons			
	Define the term relative atomic mass and why it takes into account the abundance of isotopes of the element			
	Calculate the relative atomic mass of an element given the percentage abundance of its isotopes			
	Describe how electrons fill energy levels in atoms, and represent the electron structure of elements using diagrams and numbers			
4.1.2 The periodic table	Recall how the elements in the periodic table are arranged			
	Describe how elements with similar properties are placed in the periodic table			
	Explain why elements in the same group have similar properties and how to use the periodic table to predict the reactivity of elements			
	Describe the early attempts to classify elements			
	Explain the creation and attributes of Mendeleev's periodic table			
	Identify metals and non-metals on the periodic table, compare and contrast their properties			
	Explain how the atomic structure of metals and non-metals relates to their position in the periodic table			
	Describe nobel gases (group 0) and explain their lack of reactivity			
	Describe the properties of noble gases, including boiling points, predict trends down the group and describe how their properties depend on the outer shell of electrons			
	Describe the reactivity and properties of group 1 alkali metals with reference to their electron arrangement and predict their reactions			
	Describe the properties of group 7 halogens and how their properties relate to their electron arrangement, including trends in molecular mass, melting and boiling points and reactivity			
	Describe the reactions of group 7 halogens with metals and non-metals			

AQA Chemistry (8462) from 2016 Topics C4.3 Quantitative chemistry				
Topic	**Student Checklist**	**R**	**A**	**G**
4.3.1 Chemical measurements, conservation of mass and the quantitative interpretation	State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass			
	Explain the use of the multipliers in equations in normal script before a formula and in subscript within a formula			
	Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula			
	Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation			
	Explain observed changes of mass during chemical reactions in non-enclosed systems using the particle model when given the balanced symbol equation			
	Explain why whenever a measurement is made there is always some uncertainty about the result obtained			
4.3.2 Use of amount of substance in relation to masses of pure substances	**HT ONLY: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant**			
	HT ONLY: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance			
	HT ONLY: Calculate the masses of reactants and products when given a balanced symbol equation			
	HT ONLY: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)			
	HT ONLY: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams			
	Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution			
	HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution			
4.3.3 Yield and atom economy of chemical reactions	*Chem ONLY: Explain why it is not always possible to obtain the calculated or expected amount of a product*			
	Chem ONLY: Calculate the theoretical amount of a product and percentage yield of a product using the formula ***% yield = mass of product made/max theoretical mass of product x 100***			
	Chem & HT ONLY: Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction			
	Chem ONLY: Describe atom economy as a measure of the amount of reactants that end up as useful products			
	Chem ONLY: Calculate the percentage atom economy of a reaction to form a desired product using the equation ***% atom economy =RfM of desired product/sum of RfM of all reactants x 100***			
	Chem & HT ONLY: Explain why a particular reaction pathway is chosen to produce a specified product, given appropriate data			
4.3.4 Using concentrations of solutions in mol/dm^3	***Chem & HT ONLY: Calculate the amount of solute (in moles or grams) in a solution from its concentration in mol/dm^3***			
	Chem & HT ONLY: Calculate the concentration of a solution when it reacts completely with another solution of a known concentration			
	Chem & HT ONLY: Describe how to carry out titrations of strong acids and strong alkalis and calculate quantities in titrations involving concentrations in mol/dm^3 and g/dm^3			
	Chem & HT ONLY: Explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution			
	Chem & HT ONLY: Explain what the volume of one mole of any gas at room temperature is			
	Chem & HT ONLY: Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass			

AQA Chemistry (8462) from 2016 Topics C4.4 Chemical changes				
Topic	**Student Checklist**	**R**	**A**	**G**
4.4.1 Reactivity of metals	Describe how metals react with oxygen and state the compound they form, define oxidation and reduction			
	Describe the arrangement of metals in the reactivity series, including carbon and hydrogen, and use the reactivity series to predict the outcome of displacement reactions			
	Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids			
	Relate the reactivity of metals to its tendency to form positive ions and be able to deduce an order of reactivity of metals based on experimental results			
	Recall what native metals are and explain how metals can be extracted from the compounds in which they are found in nature by reduction with carbon			
	Evaluate specific metal extraction processes when given appropriate information and identify which species are oxidised or reduced			
4.4.2 Reactions of acids	**HT ONLY: Describe oxidation and reduction in terms of loss and gain of electrons**			
	HT ONLY: Write ionic equations for displacement reactions, and identify which species are oxidised and reduced from a symbol or half equation			
	HT ONLY: Explain in terms of gain or loss of electrons that the reactions between acids and some metals are redox reactions, and identify which species are oxidised and which are reduced (Mg, Zn, Fe + HCl & H_2SO_4)			
	Explain that acids can be neutralised by alkalis, bases and metal carbonates and list the products of each of these reactions			
	Predict the salt produced in a neutralisation reaction based on the acid used and the positive ions in the base, alkali or carbonate and use the formulae of common ions to deduce the formulae of the salt			
	Describe how soluble salts can be made from acids and how pure, dry samples of salts can be obtained			
	Required practical 1: *preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution*			
	Recall what the pH scale measures and describe the scale used to identify acidic, neutral or alkaline solutions			
	Define the terms acid and alkali in terms of production of hydrogen ions or hydroxide ions (in solution), define the term base			
	Describe the use of universal indicator to measure the approximate pH of a solution and use the pH scale to identify acidic or alkaline solutions			
	Chem ONLY: Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids to find the reacting volumes accurately			
	Chem & HT ONLY: Calculate the chemical quantities in titrations involving concentrations in mol/dm³ and in g/dm³			
	HT ONLY: Use and explain the terms dilute and concentrated (in terms of amount of substance) and weak and strong (in terms of the degree of ionisation) in relation to acids			
	HT ONLY: Explain how the concentration of an aqueous solution and the strength of an acid affects the pH of the solution and how pH is related to the hydrogen ion concentration of a solution			
	Describe how ionic compounds can conduct electricity when dissolved in water and describe these solutions as electrolytes			
4.4.3 Electrolysis	Describe the process of electrolysis			
	Describe the electrolysis of molten ionic compounds and predict the products at each electrode of the electrolysis of binary ionic compounds			
	Explain how metals are extracted from molten compounds using electrolysis and use the reactivity series to explain why some metals are extracted with electrolysis instead of carbon			
	Describe the electrolysis of aqueous solutions and predict the products of the electrolysis of aqueous solutions containing single ionic compounds			
	Required practical 3: *investigate what happens when aqueous solutions are electrolysed using inert electrodes*			
	HT ONLY: Describe the reactions at the electrodes during electrolysis as oxidation and reduction reactions and write balanced half equations for these reactions			

AQA Chemistry (8462) from 2016 Topics C4.5 Energy changes				
Topic	**Student Checklist**	**R**	**A**	**G**
4.5.1 Exothermic and endothermic reactions	Describe how energy is transferred to or from the surroundings during a chemical reaction			
	Explain exothermic and endothermic reactions on the basis of the temperature change of the surroundings and give examples of everyday uses			
	Required practical 4*: investigate the variables that affect temperature changes in reacting solutions*			
	Describe what the collision theory is and define the term activation energy			
	Interpret and draw reaction profiles of exothermic and endothermic reactions, inc identifying the relative energies of reactants and products, activation energy and overall energy change			
	HT ONLY: Explain the energy changes in breaking and making bonds and calculate the overall energy change using bond energies			

AQA Chemistry (8462) from 2016 Topics C4.6 The rate and extent of chemical change				
Topic	**Student Checklist**	**R**	**A**	**G**
4.6.1 Rate of reaction	Calculate the rate of a chemical reaction over time, using either the quantity of reactant used or the quantity of product formed, measured in g/s, cm^3/s or mol/s			
	Draw and interpret graphs showing the quantity of product formed or reactant used up against time and use the tangent to the graph as a measure of the rate of reaction			
	HT ONLY: Calculate the gradient of a tangent to the curve on the graph of the quantity of product formed or reactant used against time and use this as a measure of the rate of reaction			
	Describe how different factors affect the rate of a chemical reaction, including the concentration, pressure, surface area, temperature and presence of catalysts			
	Required practical 5: *investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced, change in colour or turbidity*			
	Use collision theory to explain changes in the rate of reaction, including discussing activation energy			
	Describe the role of a catalyst in a chemical reaction and state that enzymes are catalysts in biological systems			
	Draw and interpret reaction profiles for catalysed reactions			
4.6.2 Reversible reactions and dynamic equilibrium	Explain what a reversible reaction is, including how the direction can be changed and represent it using symbols: A + B ⇌ C + D			
	Explain that, for reversible reactions, if a reaction is endothermic in one direction, it is exothermic in the other direction			
	Describe the State of dynamic equilibrium of a reaction as the point when the forward and reverse reactions occur at exactly the same rate			
	HT ONLY: Explain that the position of equilibrium depends on the conditions of the reaction and the equilibrium will change to counteract any changes to conditions			
	HT ONLY: Explain and predict the effect of a change in concentration of reactants or products, temperature, or pressure of gases on the equilibrium position of a reaction			

AQA Chemistry (8462) from 2016 Topics C4.7 Organic chemistry				
Topic	**Student Checklist**	**R**	**A**	**G**
	Describe trends in the properties of hydrocarbons, including boiling point, viscosity and flammability and explain how their properties influence how they are used as fuels			
	Describe and write balanced chemical equations for the complete combustion of hydrocarbon fuels			

AQA Chemistry (8462) from 2016 Topics C4.8 Chemical analysis				
Topic	**Student Checklist**	**R**	**A**	**G**
4.8.1 Purity, formulations and chromatograph & 4.8.2 ID of gases	Define a pure substance and identify pure substances and mixtures from data about melting and boiling points			
	Describe chromatography, including the terms stationary phase and mobile phase and identify pure substances using paper chromatography			
	Explain what the Rf value of a compound represents, how the Rf value differs in different solvents and interpret and determine Rf values from chromatograms			
	Required practical 6: *investigate how paper chromatography can be used to separate and tell the difference between coloured substances (inc calculation of Rf values)*			
	Explain how to test for the presence of hydrogen, oxygen, carbon dioxide and chlorine			

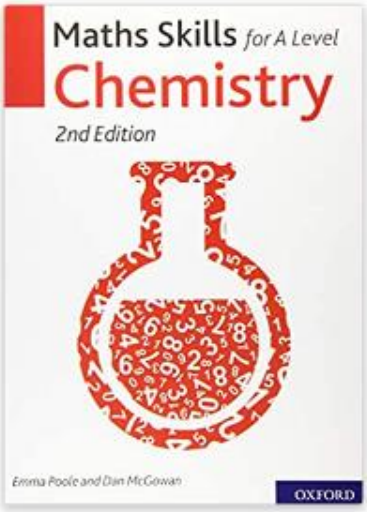
AQA Chemistry (8462) from 2016 Topics C4.9 Chemistry of the atmosphere				
Topic	**Student Checklist**	**R**	**A**	**G**
4.9.2 Carbon dioxide and methane as greenhouse gases	Name some greenhouse gases and describe how they cause an increase in Earth's temperature			
	List some human activities that produce greenhouse gases			
	Evaluate arguments for and against the idea that human activities cause a rise in temperature that results in global climate change			
	State some potential side effects of global climate change, including discussing scale, risk and environmental implications			
4.9.3 Common atmospheric pollutants and their	Describe the combustion of fuels as a major source of atmospheric pollutants and name the different gases that are released when a fuel is burned			
	Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used			
	Describe and explain the problems caused by increased amounts of these pollutants in the air			

Maths for Chemistry Specification

Outlined are the Maths skills for A level Chemistry. Some of these you are expected to know from GCSE Maths and Chemistry. The others you will learn during the A level course.

Task: The areas shaded in grey are the ones you will learn at A level.

1. Please go through and RAG rate the Skills in the boxes which have been left white. (These are the ones from GCSE Maths)



If you feel that you may struggle with some of the maths skills required for A-level Chemistry and would feel more confident by improving areas of your GCSE maths knowledge, then we would recommend this textbook. We have directed you towards the relevant pages for each skill in the Math's for A-level Chemistry document below:

Maths Skill	Example	R / A / G	Activity (page / Qs)
Arithmetic and Numerical Computation			
Recognise and make use of appropriate units in calculations	Students may be tested on their ability to: • convert between units, e.g. cm^3 to dm^3 as part of volumetric calculations • give units for an equilibrium constant or a rate constant • understand that different units are used in similar topic areas, so that conversions may be necessary, e.g. entropy in J mol^{-1} K^{-1} and enthalpy changes in kJ mol^{-1}.		Read page 48 -49 Worked example page 49 Complete Q3 page 49
Recognise and use expressions in decimal and ordinary form	Students will be tested on their ability to: • Use the appropriate number of decimal places in calculations e.g. for pH • Carry out calculations using numbers in standard and ordinary form, e.g. use of Avogadro's number • Understand standard for when applied to areas such as (but not limited to) Kw • Convert numbers in standard form and ordinary form • Understand that significant figures need retaining when making conversions between standard and ordinary form.		Read page 10 -11 Complete Q1, 2,3 5 and 6
Use ratios, fractions and percentages	Students may be tested on their ability to: • calculate percentage yields • calculate the atom economy of a reaction		Read page 62-63 Complete Q 1,2 and 3

	• construct and/or balance equations using ratios.		
Estimate results	Students may be tested on their ability to: • Evaluate the effect of changing experimental parameters on measurable values, e.g how the value of K would change with temperature given different specified conditions		Read page 96 -97 Complete Q1,2 and 3
Use calculators to find power, exponential and logarithmic functions	Students may be tested on their ability to: • Carry out calculations using Avogadro's constant • Carry out pH calculations • Make appropriate mathematical approximations in buffer calculations		
Handling Data			
Use an appropriate number of significant figures	Students may be tested on their ability to: • report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures • understand that calculated results can only be reported to the limits of the least accurate measurement.		Read page 34- 35 Complete Q 1 -3
Find the arithmetic mean	Students may be tested on their ability to: Calculate weighted means e.g calculation of an atomic mass based on isotopic abundances Select appropriate titration data (i.e identification of outliers) in order to calculate mean titres		Read page 68 -69 Complete Q 1-4
Identify uncertainties in measurements and use	Students may be tested on their ability to:		

a simple techniques to determine uncertainty when data are combined	• Determine uncertainty when two biuret readings are used to calculate a titre value		
Algebra			
Understand and use the symbols: =, <, <<, >>, >, ∝, .	No exemplification required.		
Change the subject of an equation	Students may be tested on their ability to: • Carry out structured and un-structured mole calculations. calculate a rate constant from k and a rate equation		Read page 24 -25 Complete Q1-4
Substitute numerical values into algebraic equations using appropriate units and physical quantities	Students may be tested on their ability to: • Carry out structured and un-structured mole calculations • Calculate the value of an equilib-rium constant Kc • Carry out rate calculations		Read page 86-87 Complete Q 1 and 2
Solve algebraic equations	Students may be tested on their ability to: • Carry out Hess's Law calculations • Calculate a rate constant K from a rate equation		
Use logarithms in relation to quantities that range over several orders of magnitude	Students may be tested on their ability to: • Carry out pH and Pk calculations.		
Graphs			
Translate information between graphical, numerical and algebraic forms	Students may be tested on their ability to: • interpret and analyse spectra • determine the order of a reac-tion from a graph • derive a rate expression from a graph.		Read page 82-83 Complete Q1 – 3
Plot two variables from experimental or other data	Students may be tested on their ability to:		Read page 82-83 Complete Q1-3

	• interpret and analyse spectra • determine the order of a reaction from a graph • derive a rate expression from a graph.		Complete **Stretch** question
Determine the slope and the intercept of a linear graph	Students may be tested on their ability to: • calculate the rate constant of a zero-order reaction by determination of the gradient of a concentration–time graph.		Read page 82-83 Complete Q1-3
Calculate rate of change from a graph showing a linear relationship	Students may be tested on their ability to: • Calculate the rate constant for a zero-order reaction by determination of the gradient of a concentration – time graph		Read page 82 – 83 Complete Q1-3
Draw and use the slope of a tangent to a curve as a measure of rate of change	Students may be tested on their ability to: • determine the order of a reaction using the initial rates method.		Read page 82-83 Complete Q 1-3
Geometry and Trigonometry			
Use angles and shapes in regular 2D and 3D structures	Students may be tested on their ability to; • draw different forms of isomers • Identify chiral centres from a 2D and 3D representation		
Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects	Students may be tested on their ability to: • Draw different forms of isomers • Identify chiral centres from a 2D and 3D representation		
Understand the symmetry of 2D and 3D shapes	Students may be tested on their ability to: Describe the types of stereoisomerism shown by molecules / complexes Identify chiral centres form a 2D or 3D representation		

How can I revise in an effective way?

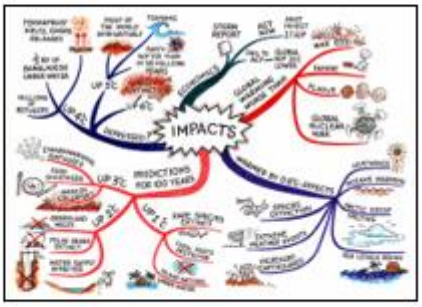
WARNING! There is no quick and easy way to revise effectively for your exam.

...There are, however, several **logical, interesting, effective** ways to revise and recap your **knowledge and understanding** - and therefore making it easier to apply in your GCSE examinations...

Create a revision timetable

Practice, Practice, Practice

Join with classmates

Making flash cards.	Making a mind map.
Create a set of cards with either key words on one side their definitions on the other or questions on one side with answers on the other. These can include equations / labelled diagrams etc? This is a great way of recalling the most important words / information in a topic – and will help you to use the words correctly in an exam 	Really useful for **linking ideas together**, concept maps allow you to **elaborate on your points** more than mind maps. Different colours could indicate social, environmental and economic factors. Add diagrams, make physical links use and symbols to make the concept map more interesting and visual. 
Completing relevant questions in your science workbooks.	Using an Internet resource like GCSE Pod / Seneca learning*/ BBC Bitesize (you will need some proof of this though – screen shots are fine)
Use the corresponding pages from your revision guide and answer the questions in your workbooks: 	Log on to any of the below resources and complete their quizzes / activities: www.gcsepod.com www.senecalearning.com www.bbc.co.uk/bitesize/subjects/zrkw2hv (choose AQA)