Chemistry

AQA (7405)

Assessment Information:

All students will sit 3 external examinations at the end of year 13, which will cover content from both years of the A-Level. The exams are a mix of short and long written answers, calculations and multiple-choice questions.

Students will also be required to complete 12 Required Practicals over the 2 years. Skills will be assessed during these practicals through observations and questioning during the practical, and by the content of the written work in the student's lab book after the practical. Students must show consistent competency in these skills to obtain the practical accreditation on their Chemistry A-Level.

External examinations:

Paper 1	Paper 2	Paper 3
What's assessed • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12) • Inorganic chemistry (Section 3.2) • Relevant practical skills	**What's assessed** • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9) • Organic chemistry (Section 3.3) • Relevant practical skills	**What's assessed** • Any content • Any practical skills
How it's assessed • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 90 marks • 30% of A-level
Questions 105 marks of short and long answer questions	**Questions** 105 marks of short and long answer questions	**Questions** 40 marks of questions on practical techniques and data analysis 20 marks of questions testing across the specification 30 marks of multiple choice questions

Practical Skills Assessments:

Students must complete practicals demonstrating use of key apparatus and techniques. They are also required to show competency of the CPAC statements below throughout their practical work.

Competency	Practical mastery
1. Follows written procedures	a. Correctly follows written instructions to carry out experimental techniques or procedures.
2. Applies investigative approaches and methods when using instruments and equipment	a. Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting. b. Carries out techniques or procedures methodically, in sequence and in combination, identifying practical issues and making adjustments when necessary. c. Identifies and controls significant quantitative variables where applicable, and plans approaches to take account of variables that cannot readily be controlled. d. Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results.
3. Safely uses a range of practical equipment and materials	a. Identifies hazards and assesses risks associated with these hazards, making safety adjustments as necessary, when carrying out experimental techniques and procedures in the lab or field. b. Uses appropriate safety equipment and approaches to minimise risks with minimal prompting.
4. Makes and records observations	a. Makes accurate observations relevant to the experimental or investigative procedure. b. Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions.
5. Researches, references and reports	a. Uses appropriate software and/or tools to process data, carry out research and report findings. b. Cites sources of information demonstrating that research has taken place, supporting planning and conclusions.

Rationale

A Level Chemistry is taught according to the AQA scheme of work A. This means we follow a topic-by-topic approach and interleave sections where appropriate. The qualification is linear. Linear means that students will sit all the A-level exams at the end of their A-level course. The course is split into distinct topics which fall into organic, inorganic and physical chemistry. In the second year of the course, students will be expected to be able to draw on knowledge from both years of study and bring together their learning in a synoptic way. Practical skills are assessed throughout the year according to the CPAC guidance shared between exam boards.

Year 12:

Organic chemistry:

- Intro to organic
- Alkanes
- Halogenoalkanes
- Alkenes
- Alcohols
- Organic analysis

Inorganic chemistry:

- Periodicity
- Group 2, the alkaline earth metals
- Group 7, the halogens

Physical chemistry

- Atomic structure
- Amount of substance
- Bonding
- Energetics
- Chemical equilibria, Le Chatelier's principle and K_c

Year 13:

Organic Chemistry:

- Optical isomerism
- Aldehydes and ketones
- Carboxylic acids and derivatives
- Aromatic chemistry
- Amines
- Polymers
- Amino acids, proteins and DNA
- Organic synthesis
- Nuclear magnetic resonance spectroscopy
- chromatography

Inorganic Chemistry:

- properties of period 3 elements and their oxides
- transition metals
- reactions of ions in aqueous solution

Physical Chemistry:

- thermodynamics
- rate equations
- equilibrium constant K_p
- Electron potential and electrochemical cells
- Acids and bases.

Students will be required to learn definitions, equations and recall facts for each topic by heart and will be quizzed on them every lesson. Lessons will include a mixture of new content and practice of skills. Students will be expected to remember recall facts throughout their chemistry course and their knowledge of all content will be checked throughout the course.

Key Resources (textbooks/videos/websites)

Title	Location
A level textbook	You have been loaned one from school
Chemguide	https://www.chemguide.co.uk/
Physics and Maths Tutor (exam questions and revision notes for all A-Level sciences)	https://www.physicsandmathstutor.com/
S-Cool Revision	https://s-cool.co.uk/a-level/chemistry
Chemistry World	https://www.chemistryworld.com/
Seneca Podcasts	https://senecalearning.com/en-GB/blog/chemistry-a-level-podcasts-by-seneca/
Youtube: A Level practicals	https://www.youtube.com/c/AdvancedChemistrybyPrimroseKitten/videos
Youtube: A-Level Chemistry Revision	https://www.youtube.com/c/Freesciencelessons/playlists?view=50&sort=dd&shelf_id=8
Youtube: Snap Revise	https://www.youtube.com/playlist?list=PLkocNW0BSuEFvnpnhj8fKN-KFUOlnKiT0
Revisely: AI flashcards and AI quizzes	https://www.revisely.com/

Year 12

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 1	Atomic Structure	Describe the structure of atoms, and details of the subatomic particles. Define atoms and isotopes in terms of P, N and E.	Atomic structure GCSE Properties of PNE.	100% Sheet Atomic structure	http://www.rsc.org/chemsoc/timeline	Investigate how the model of the atom has changed over time. (AO1)
	Amount of Substance	Define and calculate relative mass of atoms, elements and compounds.	Atomic structure GCSE. PNE	100% Sheet Amounts of Substance	http://www.docbrown.info/	Research why C^{13} was chosen as the standard. (AO3)
Week 2	Atomic Structure	Explain how TOF-MS works and its uses. Describe the electron configuration of atoms and ions.	2,8,8 electron configuration (linked to spd orbitals) Ions	100% Sheet Atomic structure and Mass Spec Electron configuration practice.	http://www.rsc.org/learn-chemistry/resource/res00001332/the-atom-detectives?cmpid=CMP00002843 https://edu.rsc.org/resources/a-model-of-mass-spectrometry/2390.article	Investigate the use of mass spectroscopy in drug testing athletes. (AO3)
	Amount of Substance	Calculate using moles for solids and solutions.	Calculations GCSE. Definition of moles.	100% Sheet Amounts of Substance	https://docbrown.info/page13/page13c.htm	Research how Avogadro determined the value of his constant. (AO3)

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 3	Atomic Structure	Write equations for ionisation energies. Explain how ionisation energy data provides evidence for electron configuration.	2,8,8 electron configuration (linked to spd orbitals) Ions	100% Sheet Atomic structure and Mass Spec Exam question practice.	http://en.wikipedia.org/wiki/Molar_ionization_energies_of_the_elements	
	Amount of Substance	Perform calculations using the ideal gas equation.	Moles calculations	100% Sheet Amounts of Substance		Research how the behaviour of real gases deviates from ideal gas behaviour.
Week 4	Bonding	Understand ionic bonding Write formulas for ionic compounds. Understand covalent bonding. Draw molecules with lines and arrows showing covalent and co-ordinate bonds. Understand metallic bonding.	**GCSE Chemistry** - Structure and bonding - Periodic table **AS Chemistry** - Atoms	100% Sheet Bonding		Which of the following ionic compounds have the highest and lowest melting points: sodium chloride, potassium chloride; magnesium chloride – explain your reasoning?
	Amount of Substance	Calculate empirical and molecular formulae from data.	Empirical formula calculations GCSE.	100% Sheet Amounts of Substance	RSC resource on elemental microanalysis: http://www.nationalstemcentre.org.uk/elibrary/resource/9890/elemental-microanalysis	Complete further reading: elemental microanalysis.

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 5	Bonding	Work out the name and sketch and explain the shape of molecules and ions. Define electronegativity. Explain origins of polar covalent molecules. Deduce whether a bond is polar. Deduce whether a bond has a permanent dipole.	**GCSE Chemistry** - Structure and bonding - Periodic table **AS Chemistry** - Atoms	100% Sheet Bonding		
	Amount of Substance	Write balanced full and ionic equations.	Periodic table Atoms Ionic and covalent bonding	100% Sheet Amounts of Substance	https://www.s-cool.co.uk/gcse/chemistry/writing-formulae-and-balancing-equations/revise-it/writing-equations	Search for these past paper questions • January 2011 Unit 1 Question 3 • June 2010 Unit 1 Question 3 • January 2009 Unit 1 Question 5
Week 6	Bonding	Describe the 3 types of intermolecular force. How IM forces affect melting and boiling points. The impact of hydrogen bonding on water and ice.	**GCSE Chemistry** - Structure and bonding **AS Chemistry** - Atoms	100% Sheet Bonding		Rich Question – Why is there no hydrogen bonding between molecules of HCl gas even though Cl is more electronegative than N, yet NH_3 has hydrogen bonding?

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Amount of Substance	Use equations to calculate masses, percentage yields, atom economies, volumes of gases, concentrations and volumes of solutions. Titration	Balancing equations	100% Sheet Amounts of Substance	https://www.bbc.co.uk/bitesize/guides/z8fvvcw/revision/5	
Week 7	Bonding	Understand the structures of ionic, molecular, giant covalent and metallic substances. Describe and Sketch details of the structures of diamond, graphite, ice, iodine, magnesium and sodium chloride.	**GCSE Chemistry** - Structure and bonding **AS Chemistry** - Atoms	100% Sheet Bonding		
	Amount of substance	Use equations to calculate masses, percentage yields, atom economies, volumes of gases, concentrations and volumes of solutions. Titration	Balancing equations Moles Stoichiometry	100% Sheet Amounts of Substance	https://www.bbc.co.uk/bitesize/guides/z8fvvcw/revision/5	Search for these past paper questions • January 2011 Unit 1 Question 3 • June 2010 Unit 1 Question 3 • January 2009 Unit 1 Question 5

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 8	Introduction to Organic	Understand the different types of formulas used in organic chemistry. Understand what is meant by a homologous series. Draw and name organic molecules with chains and rings with up to six carbon atoms each.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes **AS Chemistry** - Empirical and molecular formulas	100% Sheet Intro-nomenclature		Naming hydrocarbons activity http://www.rsc.org/learn-chemistry/resource/res00000110/afl-naming-hydrocarbons
	Enthalpy	Know that reactions can be exothermic or endothermic. Know what an enthalpy change and is and about standard conditions. Define standard enthalpies of formation and combustion.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy	Some everyday examples of exothermic and endothermic reactions: http://antoine.frostburg.edu/chem/senese/101/thermo/faq/exothermic-endothermic-examples.shtml	
Week 9	PAZ					

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 10	Introduction to Organic	Understand the difference between structural and stereoisomerism. Understand the three types of structural isomerism: chain, position and functional group. Understand the cause of *E*–*Z* isomerism. Draw and name *E*–*Z* isomers using CIP priority rules.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes **AS Chemistry** - Empirical and molecular formulas	100% Sheet Intro-nomenclature and Intro – Spatial representation	A brief guide to the types of isomerism: https://www.compoundchem.com/2014/05/22/typesofisomerism/	Complete the following exam questions • June 2011 Unit 2 Question 6a and 6b • June 2003 Unit 3 Question 3a • June 2003 Unit 3 Question 4a
	Enthalpy	Understand and be able to use the equation $q = mc\Delta T$ to calculate molar enthalpy changes.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		Search for the following exam questions: January 2011 Unit 2 Question 9b and 9d June 2009 Unit 2 Question 3 June 2006 Unit 2 Question 1d
Week 11	Alkanes	Understand what alkanes are. Understand how fractional distillation can be used to separate the alkanes in crude oil.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes - Fractional distillation of crude oil **AS Chemistry** - Empirical and molecular formulae	100% Sheet Alkanes		RSC Videos and animations on fractional distillation of crude oil http://www.rsc.org/learn-chemistry/resource/res00000027/oil-refining#!cmpid=CMP00002022

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Enthalpy	**Required practical 2** Measurement of an enthalpy change.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		Research how accurate values are found for the energy content in food and fuels
Week 12	Alkanes	Understand why cracking is useful. Compare how thermal and catalytic cracking are completed and the types of compounds that are produced.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes - Fractional distillation of crude oil **AS Chemistry** - Empirical and molecular formulae	Construct a table to compare thermal and catalytic cracking in terms of conditions and products.	*Chemistry Review* article: Catalysis: heterogeneous catalysis (volume 23, edition 1)	RSC Videos and animations on cracking http://www.rsc.org/learn-chemistry/resource/res00000027/oil-refining#!cmpid=CMP00002022
	Enthalpy	Understand Hess's law. Use Hess's law to calculate enthalpy changes using enthalpies of formation and combustion.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		
Week 13	Alkanes	Know what is formed when alkanes are burned as fuels. Know/consider how pollution problems from burning alkanes can be reduced.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes - Fractional distillation of crude oil **AS Chemistry** - Empirical and molecular formulae	100% Sheets Alkanes and Pollution	Anecdote about a plane running out of fuel http://www.rsc.org/learn-chemistry/resource/res00000037/anecdotes-gimli-glider	Search for the following exam questions: • June 2010 Unit 1 Question 4 • June 2010 Unit 1 Question 5 • January 2004 Unit 3 Question 2

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Enthalpy	Understand Hess's law. Use Hess's law to calculate enthalpy changes using enthalpies of formation and combustion.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		Search for the following exam questions: • January 2013 Unit 2 Question 3a • January 2013 Unit 2 Question 4 • June 2012 Unit 2 Question 2a
Week 14	Alkanes	Equations and mechanism for reaction of alkanes with halogens.	**GCSE Chemistry** - Some simple organic chemistry, eg alkanes and alkenes - Fractional distillation of crude oil **AS Chemistry** - Empirical and molecular formulae	100% Sheets Halogenoalkanes	RSC resource of misconceptions about mechanisms: http://www.rsc.org/learn-chemistry/resource/res00001107/reaction-mechanisms	Complete the following exam questions: • June 2003 Unit 3 Question 2 • June 2012 Unit 2 Question 6a
	Enthalpy	**Required practical 2** Measurement of an enthalpy change.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		
Week 15	Halogenoalkanes	The polar nature of the C-halogen bond. Nucleophilic substitution reactions with OH^-, CN^- and NH_3. Relative rate of reaction of halogenoalkanes.	**AS Chemistry** - Nomenclature of organic compounds - Principles of curly arrow mechanisms	100% Sheets Halogenoalkanes	Nobel Prize 1995 http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1995/press.html	RSC AfL task on nucleophilic substitution http://www.rsc.org/learn-chemistry/resource/res00000115/afl-nucleophilic-substitution-reaction-mechanisms

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Enthalpy	Understand the term mean bond enthalpy. Use mean bond enthalpies to calculate approximate values for *ΔH* for reactions Understand why most bond enthalpies are mean values.	**GCSE Chemistry** - Exothermic and endothermic reactions.	100% sheet Enthalpy		Search for the following exam questions: • January 2013 Unit 2 Question 6 • January 2006 Unit 2 Question 1
Week 16	Halogenoalkanes	The concurrent substitution and elimination reactions of a halogenoalkane.	**AS Chemistry** - Nomenclature of organic compounds - Principles of curly arrow mechanisms	100% Sheets Halogenoalkanes	RSC mechanisms resource: http://www.rsc.org/learn-chemistry/resource/res00000638/curly-arrows-and-stereoselectivity-in-organic-reactions	Complete the following questions: • June 2013 Unit 2 Question 5 • January 2011 Unit 2 Question 8 • January 2010 Unit 2 Question 7
	Kinetics	Collision theory. Drawing Maxwell–Boltzmann distribution curves.	**GCSE Chemistry** - Reaction rates.	100% sheet Kinetics		Collision theory simulator: http://www.kscience.co.uk/animations/collision.htm Maxwell–Boltzmann curve simulator: http://www.docbrown.info/BBCbasic/kpts.htm

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 17	Halogenoalkanes	What ozone is and its role in the atmosphere. How Cl free radicals are formed in the atmosphere and how they destroy ozone. How research evidence led to the end of use of CFCs and alternatives found.	**AS Chemistry** - Nomenclature of organic compounds - Principles of curly arrow mechanisms	100% Sheets Halogenoalkanes	*Chemistry Review* article: Do ants destroy the ozone layer (Volume 20, edition 4) *Chemistry Review* article: Thomas Midgley (Volume 15, edition 2)	Rich question – CFCs are still used in some countries – how can we stop this?
	Kinetics	Understand how and why temperature affects the rate of chemical reactions. **Required practical 3** Investigation of how the rate of a reaction changes with temperature.	**GCSE Chemistry** - Reaction rates.	100% sheet Kinetics		Sodium thiosulfate practical: http://www.rsc.org/learn-chemistry/resource/res00000448/the-effect-of-temperature-on-reaction-rate
Week 18	PAZ					
Week 19	Alkenes	Draw alkenes Understand that the double bond is an area of high electron density.	**AS Chemistry** - *E–Z* isomerism (3.3.1). - Principles of curly arrow mechanisms (3.3.1). - Shapes of molecules (3.1.3).	100% sheet Alkenes		

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Kinetics	Understand how and why concentration and pressure affect the rate of chemical reactions.	**GCSE Chemistry** - Reaction rates.	100% sheet Kinetics		Find the following exam question. • June 2012 Unit 2 Question 1a, 1b, 1c and 1d
Week 20	Alkenes	To be able to identify, state conditions and reagents, and draw mechanisms for electrophilic addition reactions of alkenes with HBr, H_2SO_4 and Br_2	Structure of double bonds.	100% sheet Alkenes	RSC resource of misconceptions about mechanisms: http://www.rsc.org/learn-chemistry/resource/res00001107/reaction-mechanisms	Mechanism animations http://science.jbpub.com/organic/movies/ Find the following exam question. • June 2012 Unit 2 Question 7
	KINETICS	Understand how and why a catalyst affects the rate of chemical reactions.	**GCSE Chemistry** - Reaction rates.	100% sheet Kinetics		Research the use of catalysts in catalytic converters in cars

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 21	Alkenes	Describe what a polymer is Identify the repeating unit of an addition polymer given the monomer structure and vice versa Name polymers from the Name of the monomer Explain how polymers have developed over time Give some uses of PVC and how plasticisers can change its properties Explain why addition polymers are unreactive Explain the nature of the intermolecular forces between polyalkene molecules.	Uses of polymers GCSE	100% sheet Alkenes	Nuffield Practical Chemistry method to polymerise phenylethene http://www.nuffieldfoundation.org/practical-chemistry/addition-polymerisation	RSC Polymers resource http://www.rsc.org/learn-chemistry/resource/res00000846/polymers

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Equilibria, Le Chatelier and Kc	Understand how reversible reactions can reach a state of dynamic equilibrium. Understand Le Chatelier's principle. Understand why a compromise temperature and pressure may be used for a reversible reaction in an industrial process.	**GCSE Chemistry** - Reaction rates. - Exothermic and endothermic reactions. **AS Chemistry** - Energetics - Kinetics	100% sheet Equilibria	RSC Resource pack on equilibria http://www.rsc.org/learn-chemistry/resource/res00000843/equilibria	Find the following exam questions • June 2013 Unit 2 Question 10a • June 2013 Unit 2 Question 1a
Week 22	Alkenes	Write equations and mechanisms for reactions of alkenes with HBr, H_2SO_4 and HBr Explain the potential formation of major and minor products in these reactions.	**AS Chemistry** - Energetics - Bonding - Intro to organic	100% sheet Alkenes	RSC resource of misconceptions about mechanisms: http://www.rsc.org/learn-chemistry/resource/res00001107/reaction-mechanisms Mechanism animations http://science.jbpub.com/organic/movies/	Find the following exam questions. • June 2010 Unit 2 Question 6a
	Equilibria, Le Chatelier and Kc	Understand the effect of a catalyst on an equilibrium.	**GCSE Chemistry** - Reaction rates. - Exothermic and endothermic reactions. **AS Chemistry** - Energetics - Kinetics	100% sheet Equilibria		Research some compromise conditions in an industrial process, focusing on why they are used.

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 23	Alkenes – Addition Polymers	Describe what a polymer is. Identify the repeating unit of an addition polymer given the monomer structure and vice versa. Name polymers from the name of the monomer. Explain how polymers have developed over time. Give some uses of pvc and how plasticisers can change its properties. Explain why addition polymers are unreactive. Explain the nature of the intermolecular forces between polyalkene molecules.	Polymers early organic chem. Polymers GCSE Covalent bonding IM forces	100% sheet Alkenes	RSC Polymers resource http://www.rsc.org/learn-chemistry/resource/res00000846/polymers	Find the following exam questions. • June 2012 Unit 2 Question 7 • June 2010 Unit 2 Question 6a
	Equilibria, Le Chatelier and Kc	Write an expression for and calculate K_c including units. Predict the effect, if any, of changes in conditions on the value of K_c.	**GCSE Chemistry** - Reaction rates. - Exothermic and endothermic reactions. - Equilibria **AS Chemistry** - Energetics - Kinetics	100% sheet Equilibria		Find the following exam questions • June 2013 Unit 4 Question 2 (QS13.4.02) • January 2010 Unit 4 Question 1 (QW10.04.01)

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 24	Alcohols	Write equations and give conditions for the production of alcohols by hydration of alkenes Outline the mechanism for formation of ethanol from reaction of ethene with steam with an acid catalyst Write an equation, give and justify conditions for the production of ethanol by fermentation of glucose Compare the two methods of producing ethanol Explain the meaning of the term biofuel Evaluate the use of ethanol as a biofuel Show using equations how ethanol made by fermentation can be regarded as carbon neutral but that in reality it is not.	Alkenes	100% Sheets Alcohols	Biofuels website: http://www.biofuels.co.uk/ Press report about problems with biofuels: http://www.telegraph.co.uk/earth/energy/biofuels/10520736/The-great-biofuels-scandal.html	Find the following exam questions • January 2005 Unit 3 Question 5a, 5b and 5c (QW.05.3.05) • January 2002 Unit 3 Question 7 (QW02.3.07)
	REDOX	Oxidation and reduction in terms of electron transfer. Oxidation states.	**AS Chemistry** - Writing equations	100% sheet REDOX		

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 25	Alcohols	Classify alcohols as primary, secondary or tertiary. Identify products and write equations for oxidation reactions of alcohols.	Alkenes, specifically structures (primary, secondary or tertiary).	100% Sheets Alcohols	*Chemistry Review* article: Oxidation of alcohols (Volume 10, edition 4)	Investigate how a roadside breathalyser works (AO3 - Analyse, interpret and evaluate scientific information).
	REDOX	Writing redox half equations and full equations.	**AS Chemistry** - Writing equations	100% sheet REDOX		Find the following exam questions • June 2013 Unit 2 Question 4a • January 2012 Unit 2 Question 5a and 5b • June 2011 Unit 2 Question 5a
Week 26	Alcohols	Use chemical tests to distinguish aldehydes and ketones.	Identification of functional groups	100% Sheets Alcohols 100% Sheets Aldehydes and Ketones		Giant silver mirror http://www.nuffieldfoundation.org/practical-chemistry/giant-silver-mirror
	Periodicity	How elements are classified as s, p, d or f block elements. Trends in atomic radius, ionisation energy and melting point across Period 3.	**AS Chemistry** - Electron structure - Ionisation energy - Bonding	Exam Questions • January 2011 Unit 1 Question 5 • January 2009 Unit 1 Question 4 • June 2003 Unit 1 Question 1c		Rich question: Is helium an s or p block element?

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week27	Alcohols	Identify products of alcohol elimination reactions Write equations and mechanism for alcohol elimination reactions Understand how addition polymers can be made from alkenes made this way without using monomers derived from crude oil.	Mechanism rules	100% Sheets Alcohols Mechanism mind map		
	Group 2, the Alkaline Earth Metals	Trends in atomic radius, first ionisation energy and melting point. How elements Mg–Ba react with water.	**GCSE Chemistry** - Writing formulas of ionic compounds. **AS Chemistry** - Ionisation energy - Bonding	100% sheet Group 2	Newspaper story about changes to recipe of milk of magnesia in 2013: http://www.dailymail.co.uk/news/article-2352139/Milk-Magnesia-disappears-British-shelves-ingredients-fall-foul-EU-meddlers.html	research the uses of the following: • $Mg(OH)_2$ and $BaSO_4$ in medicine • $Ca(OH)_2$ in agriculture
Week 28	Alcohols	**Required practical 5** Distillation of a product from a reaction.	GCSE distillation core practical	Lab report	*Chemistry Review* article: Heating under reflux (Volume 20, edition 2) *Chemistry Review* article: Distillation (Volume 14, edition 3)	

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Group 2, the Alkaline Earth Metals	Solubility and some uses of Group 2 sulfates and hydroxides. Uses of Mg in the extraction of Ti and $CaO/CaCO_3$ in removing SO_2 from flue gases.	**GCSE Chemistry** - Writing formulas of ionic compounds. **AS Chemistry** - Ionisation energy - Bonding	100% sheet Group 2	Royal College of Radiologists leaflet on barium meals: https://www.rcr.ac.uk/docs/patients/worddocs/CRPLG_meal.doc	Complete the following exam questions • June 2012 Unit 2 Question 5 • June 2006 Unit 1 Question 5a • January 2005 Unit 1 Question 5b
Week 29	Organic Analysis	**Required practical 6** Tests for alcohol, aldehyde, alkene and carboxylic acid. Carry out test-tube reactions in the specification to distinguish alcohols, aldehydes, alkenes and carboxylic acids, and interpret the observations from these reactions.	AS organic topics – analysis of organics	100% sheet Organic Analysis	*Chemistry Review* article: Identifying an unknown compound (Volume 17, edition 3)	
	Group 7, the halogens	Trends in electronegativity and boiling point down Group 7. Trends in oxidising power of halogens and reducing power of halide ions. Use of acidified silver nitrate to identify halide ions.	**AS Chemistry** - Ionisation energy - Ionic equations - Electronegativity - Bonding - Oxidation states and redox equations	100% sheet Group 7	*Chemistry Review* article: Iodine in medicine (Volume 23, edition 1)	Complete the following exam questions • June 2002 Unit 2 Question 4 • June 2002 Unit 2 Question 3 • January 2002 Unit 2 Question 8

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 30	Organic Analysis	**Required practical 6** Tests for alcohol, aldehyde, alkene and carboxylic acid. Carry out test-tube reactions in the specification to distinguish alcohols, aldehydes, alkenes and carboxylic acids, and interpret the observations from these reactions.	AS organic topics – analysis of organics	100% sheet Organic Analysis	*Chemistry Review* article: Identifying an unknown compound (Volume 17, edition 3)	
	Group 7, the halogens	**Required practical 4** Carry out simple test-tube reactions in aqueous solution to identify cations (Group 2, NH_4^+) and anions (Group 7 (halide), OH^-, CO_3^{2-}, SO_4^{2-}).	**AS Chemistry** - Ionisation energy - Ionic equations - Electronegativity - Bonding - Oxidation states and redox equations	100% sheet Group 7	Use of silver halides in non-digital photography http://electronics.howstuffworks.com/film7.htm	
Week 31	Organic Analysis	Use high resolution mass spectrometry to find molecular formulae.	AS – atomic structure	100% sheet Organic Analysis – Mass Spec		Complete the following questions: • June 2012 Unit 2 Question 3c (QS12.2.03) • January 2010 Unit 2 Question 6e (QW10.2.06)

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
	Group 7, the halogens	Reactions of chlorine with water and use of chlorine in water treatment. Reaction of chlorine with sodium hydroxide and use of this reaction.	**AS Chemistry** - Ionisation energy - Ionic equations - Electronegativity - Bonding - Oxidation states and redox equations	100% sheet Group 7	Review by University of York of fluoridation of water http://www.york.ac.uk/inst/crd/fluores.htm	Complete the following questions: • January 2013 Unit 2 Question 10 • January 2010 Unit 2 Question 10a, 10b and 10c
Week 32	Organic Analysis	Use infrared absorptions to identify functional groups. Know how the "fingerprint" region can be used. The role of infrared absorption by molecule in global warming.	Bonding and structure. Mass spec.	100% sheet Organic Analysis - IR	*Chemistry Review* article: Infrared spectrometers (Volume 21, edition 2)	IR spectroscopy resources: http://www.chemsheets.co.uk/page3.html
Week 33 - 35	Question practice and recall practice. Closing gaps and individualised interventions.					

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 36 - 37	PAZ					

Year 13

	Topic Area(s)	Learning Objectives	Flashback RP Opportunities	Out of Lesson Assignments	Pre-Learning Reading	Independent Learning
Week 1	Thermodynamics	Define lattice enthalpy (formation and dissociation), enthalpy of formation, ionisation enthalpy, enthalpy of atomisation, bond enthalpy, electron affinity, enthalpy of solution, hydration enthalpy Draw and use Born–Haber cycles to find missing values of enthalpy changes Comment on the covalent character of an ionic compounds by comparing lattice enthalpies found using Born–Haber cycles with those calculated theoretically using the perfect ionic model	3.1.4 – Energetics	100 % Sheets	Textbook – AS energetics	Rich question – predict the relative magnitude of the lattice enthalpy of the following compounds: aluminium oxide, potassium oxide, sodium chloride, sodium oxide. Exam Questions: • June 2013 Unit 5 Question 1 (QS13.5.01) • June 2013 Unit 5 Question 2 (QS13.5.02) Rich question – for an ionic compound with covalent character, deduce whether the lattice enthalpy will have a greater or smaller magnitude than that calculated theoretically from the perfect ionic model.

Week 2	Thermodynamics	Describe entropy in terms of disorder Predict whether reactions have an increase or decrease in entropy Calculate the entropy change for a reaction Calculate the gibbs free-energy change for a reaction at a given temperature Determine whether a reaction is feasible at a given temperature Calculate the temperature at which a reaction becomes feasible Use entropy changes to explain why some endothermic reactions are feasible.	3.1.4 – Energetics	100 % Sheets		Exam Questions: • June 2013 Unit 5 Question 3 (QS13.5.03) • January 2012 Unit 5 Question 2 (QW12.5.02)

Week 3	Rates of Reaction	Define the terms order of reaction and rate constant Describe how changing concentration of a reagent affects the rate when the order with respect that reagent is 0, 1 or 2 Determine the values and units for rate constants given appropriate data Describe how rate constants change with temperature Perform calculations using the arrhenius equation Plot straight line graphs of ln k versus 1/t to determine the activation energy of a reaction.	**AS Chemistry** - 3.1.5 – Kinetics.	100 % Sheets	*Chemistry Review* article: Establishing a rate equation (Volume 14, edition 2)	

Week 4	Rates of Reaction	Explain that rate equations can only be determined by experiment Use concentration-time graphs to find rates (including initial rates) Use initial rate data to determine rate equations Use rate-concentration data/graphs to find orders of reaction with respect to a reagent Link rate equations to mechanism and determine rate determining steps. **Required practical 7** Measure the rate of a reaction by an initial rate method, and a continuous monitoring method.	**AS Chemistry** - 3.1.5 – Kinetics.	100 % Sheets	*Chemistry Review* article: Establishing a rate equation (Volume 14, edition 2) ILPAC Unit P5: Chemical Kinetics (free download from www.nationalstemcentre.org.uk) Avogadro web site on rate equations: http://www.avogadro.co.uk/kinetics/rate_equation.htm	Exam Questions: • June 2013 Unit 4 Question 1 (QS13.4.01) • January 2013 Unit 4 Question 1 (QW13.4.01) • January 2011 Unit 4 Question 1 (QW11.4.01)

Week 5	Optical Isomerism	Explain the cause of optical isomerism Identify molecules that exhibit optical isomerism/that are optically active. Draw pairs of optical isomers in 3d Describe how enantiomers affect plane polarised light Explain what a racemic mixture is, how they can be formed, and their effect on plane polarised light.	**AS Chemistry** - 3.3.1.3 – Isomerism. **A-level Chemistry** - 3.3.8 – Aldehydes and ketones	100 % Sheets	*Chemistry Review* article: Looking in the mirror (Volume 10, edition 3)	

	Aldehydes and Ketones	Write equations and know reagents and conditions to oxidise aldehydes to carboxylic acids Know how to distinguish aldehydes and ketones Write equations, know reagents and conditions and outline the mechanism to reduce aldehydes and ketones to alcohols with $nabh_4$ Write equations, know reagents and conditions and outline the mechanism for reaction of aldehydes and ketones with KCN and acid Understand why reaction of aldehydes and ketones with KCN followed by acid can form a racemic mixture Students understand the hazards of using KCN	**AS Chemistry** - 3.3.1.1 – Nomenclature - 3.3.1.2 – Reaction mechanisms - 3.3.5.2 – Oxidation of alcohols	100 % Sheets		Exam Question: • January 2010 Unit 4 Question 4 (QW10.4.04) **Research Opportunity** Why are KCN/HCN are highly toxic (AO3 - Analyse, interpret and evaluate scientific information).

Week 6	Carboxylic Acids and Their Derivatives	Draw the structure of and name carboxylic acids and esters Know how carboxylic acids react with carbonates Write equations for the reaction of carboxylic acids with alcohols to form esters Know some common uses of esters Write equations for the hydrolysis of esters in acidic or alkaline conditions Understand the structure of animals fats and vegetable oils Know how soap and biodiesel are made and write equations for these reactions for specified fats/oils.	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. - 3.3.5.2 – Oxidation of alcohols.	100 % Sheets	Molecule of the month: Esters in fruits http://www.chm.bris.ac.uk/motm/ethylacetate/ethylv.htm Press report about problems with biofuels: http://www.telegraph.co.uk/earth/energy/biofuels/10520736/The-great-biofuels-scandal.html	

Week 7	Carboxylic Acids and Their Derivatives	Draw the structure of and name acid anhydrides, acyl chlorides and amides Identify the products of and write equations for acylation reactions of water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides Outline the mechanism for the acylation reactions of acyl chlorides	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. - 3.3.5.2 – Oxidation of alcohols.	100 % Sheets		Exam Question: • January 2012 Unit 4 Question 10a (QW12.4.10)
Week 8	Carboxylic Acids and Their Derivatives	State advantages of using ethanoic anhydride rather than ethanoyl chloride in the production of aspirin Prepare and purity an organic solid and test its purity. **Required practical 10** Preparation of - a pure organic solid and test of its purity - a pure organic liquid.	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. - 3.3.5.2 – Oxidation of alcohols.	100 % Sheets	RSC resource on aspirin: http://www.rsc.org/learn-chemistry/resource/res00000056/aspirin Aspirin Pre-lab Screen Experiment: http://www.rsc.org/learn-chemistry/resource/res00001644/aspirin-screen-experiment	

Week 9	PAZ					
Week 10	Kp	Calculate equilibrium quantities, mole fractions and partial pressures for equilibrium mixtures Write an expression for k_p for a reaction and calculate the value of k_p with units Predict and justify how changes in temperature and pressure affect the position of an equilibrium, and how this may or may not affect the value of k_p Understand how a catalyst affects an equilibrium and the value of k_p.	**AS Chemistry** - 3.1.6 – Chemical equilibria, Le Châtelier's principle and K_c	100 % Sheets	Read and complete questions on topic 3.1.6 from text book.	Exam Questions: • January 2009 Unit 4 Question 3 (QW09.4.03) • June 2009 Unit 4 Question 2 (QS09.4.02)

Week 11	Acids and Bases	Define Brønsted–Lowry acids and bases Identify species as Brønsted–Lowry acids or bases in proton transfer reactions. Calculate ph of a strong acid from its concentration Calculate the concentration of a strong acid from its ph Calculate the ph of when a strong acid is diluted. Show that $K_w = [H^+][OH^-]$ Use K_w to find the ph of strong bases from its concentration, and vice versa Calculate the ph of water at different temperatures	**AS Chemistry** - 3.1.6 – Chemical equilibria, Le Châtelier's principle and K_c	100 % Sheets	Theory of acids history websites: http://www.bbc.co.uk/dna/ptop/plain/A708257 http://pubs.acs.org/subscribe/archive/tcaw/12/i03/pdf/303chronicles.pdf RSC acid-base simulator: http://www.rsc.org/learn-chemistry/resource/res00001457/acid-base-solutions-rsc-funded RSC pH simulator: http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-simulation-rsc-funded	Rich Task - Estimate the number of H^+ ions in a drop of water http://www.rsc.org/learn-chemistry/resource/res00000665/h-ions-in-water

Week 12	Acids and Bases	Write expressions for K_a for stated weak acids Perform calculations linking K_a to concentration and ph Convert K_a values to pk_a and vice versa Calculate the ph of water at different temperatures. Calculate ph of a mixture of a strong acid with a strong base Calculate the ph of a mixture of a weak acid with a strong base Sketch ph curves for titrations of strong/weak acids with strong/weak bases Choose a suitable indicator for acid-base titrations. **Required practical 9** Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base.	**AS Chemistry** - 3.1.6 – Chemical equilibria, Le Châtelier's principle and K_c	100 % Sheets	Creative problem solving in Chemistry – weak acids: http://www.rsc.org/learn-chemistry/resource/res00000677/a-weak-acid	Exam Questions: • January 2012 Unit 4 Question 4b (QW12.4.04) • June 2013 Unit 4 Question 3 (QS13.4.03) • June 2011 Unit 4 Question 1 (QS11.4.01)

Week 13	Acids and Bases	Describe what a buffer solution is and how it is made Explain qualitatively how acidic/basic buffer solutions work Know some uses of buffer solutions Calculate the ph of a buffer solution.	**AS Chemistry** - 3.1.6 – Chemical equilibria, Le Châtelier's principle and K_c	100 % Sheets		Exam Questions • January 2013 Unit 4 Question 2 (QW13.4.02) • January 2011 Unit 4 Question 2 (QW11.4.02)
Week 14	Aromatic Chemistry	Describe the structure of benzene and explain how delocalisation makes benzene more stable than the theoretical cyclohexa-1,3,5-triene Use thermochemical evidence from enthalpies of hydrogenation to account for this extra stability Explain why benzene undergoes substitution reactions in preference to addition reactions.	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. **3.3.10.1 Bonding**	100 % Sheets	*Chemistry Review* article: The structure of benzene (Volume 1, edition 1) *Chemistry Review* article: Who discovered the structure of benzene (Volume 5, edition 1)	

Week 15	Aromatic Chemistry	Write equations and outline mechanisms for nitration and Friedel-Crafts acylation reactions of aromatic compounds. (including equations for the formation of electrophiles) Understand the usefulness of nitration and Friedel-Crafts acylation reactions	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. **3.3.10.1 Bonding**	100 % Sheets	*Chemistry review* article: Probably the most important reactions in the world (Volume 15, edition 2)	Exam Questions • January 2012 Unit 4 Question 9a (QW12.4.09) • January 2011 Unit 4 Question 6 (QW11.4.06)

Week 16	Amines	Write equations and give conditions for the preparation of primary aliphatic amines from both halogenoalkanes and nitriles Write equations and give conditions for the production of aromatic amines and identify their use in making dyes. Place amines in order of base strength and explain this order. Identify the various amines and quaternary ammonium salts formed when ammonia and amines react with halogenoalkanes Give the mechanism for reactions of ammonia and amines with halogenoalkanes Recognise the use of quaternary ammonium salts Identify the products of and write equations for acylation reactions of ammonia and amines with acyl chlorides and acid anhydrides Outline the mechanism for the acylation reactions	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.1.2 – Reaction mechanisms. - 3.3.3.1 – Nucleophilic substitution.	100 % Sheets	*Chemistry Review* article: Two in one: the chemistry of shampoo and conditioner (Volume 22, edition 3)	

Week 17	Polymers	Identify the repeating unit and linkages in polyesters and polyamides given the monomer(s) Identify monomer(s) needed the make a condensation polymer given the repeating unit Know the repeating units in terylene, nylon 6,6 and Kevlar Know some uses of condensation polymers Explain the nature of the intermolecular forces between molecules of condensation polymers. Explain why polyalkenes cannot be hydrolysed and so are non-biodegradable Explain why polyesters and polyamides can be hydrolysed and so are biodegradable Evaluate the advantages and disadvantages of different methods of disposing of polymers.	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.4.3 – Addition polymers.	100 % Sheets	RSC resource on nylon: http://www.rsc.org/learn-chemistry/resource/res00000026/nylon The discovery of Nylon http://www.rsc.org/learn-chemistry/resource/res00000034/anecdotes-nylon Video on recycling plastics: http://www.rsc.org/learn-chemistry/resource/res00001347/recycling-plastics	Exam Questions: • January 2012 Unit 4 Question 8b (QW12.4.08) • June 2011 Unit 4 Question 4a (QS11.4.04)

	Amino Acids, Proteins, DNA and Chromatography	Draw the structure of given amino acids in acidic solution, alkaline solution and as zwitterions. Describe the primary, secondary and tertiary structure of proteins, including the importance of hydrogen bonds and s-s bonds Draw the structure of peptides formed from amino acids Know that peptide link can be hydrolysed producing amino acids Identify the amino acids given when a peptide is hydrolysed Know that amino acids can be separated and identified by thin-layer chromatography, including the use of r_f values. Describe the similarities and differences between thin-layer, column and gas chromatography Explain how chromatography works Use retention times and r_f values to identify substances Describe the use of mass spectroscopy to analyse	**AS Chemistry** - 3.1.3.7 – Forces between molecules. - 3.3.1.1 – Nomenclature. **A-level Chemistry** - 3.3.9 – Carboxylic acids. - 3.3.11 – Amines.	100 % Sheets	Structure of amino acids (rotatable) https://undergrad-ed.chemistry.ohio-state.edu/jmol-viewer/# RSC resource on basic biochemistry http://www.rsc.org/Education/Teachers/Resources/cfb/proteins.htm AQA Biochemistry Teachers' Notes (covers 3.3.13): http://www.aqa.org.uk/resources/science/as-and-a-level/chemistry-7404-7405/teach/teaching-notes	Exam Questions: • June 2013 Unit 4 Question 6 (QS13.4.06) • January 2012 Unit 4 Question 7 (QS12.4.07) • June 2011 Unit 4 Question 4c (QS11.4.04) • January 2011 Unit 4 Question 4f (QW11.4.04)

		substances separated by gas chromatography				
Week 18	PAZ					
Week 19						

Week 20	Amino Acids, Proteins, DNA and Chromatography	**Required practical 12** Separation of species by thin-layer chromatography Explain that enzymes are proteins which act through a stereospecific active site that binds to a substrate Explain how drugs, which can be designed with the aid of computers, can act to inhibit enzymes by blocking active sites, but that the correct enantiomer is required. Identify the components of DNA Explain how the two DNA strands interact with hydrogen bonds between base pairs. Describe how DNA replicates in simple terms Explain how the anti-cancer drug cisplatin prevents DNA replication Explain why some drugs can have adverse effects and appreciate the balance between benefits and adverse effects of any drug.	**AS Chemistry** - 3.1.3.7 – Forces between molecules. - 3.3.1.1 – Nomenclature. **A-level Chemistry** - 3.3.9 – Carboxylic acids. - 3.3.11 – Amines.	100 % Sheets	AQA Chromatography Teachers' Notes: http://filestore.aqa.org.uk/resources/chemistry/AQA-7405-TN-CHROMATOGRAPHY.PDF RCS video on TLC http://www.rsc.org/learn-chemistry/resource/res00001074/thin-layer-chromatography Modern Chemical Techniques RSC resource: http://www.rsc.org/learn-chemistry/resource/res00001301/chromatography Simple animation showing the structure of DNA: http://www.youtube.com/watch?v=qy8dk5iS1f0 Useful animations on biochemistry http://doctorprodigious.wordpress.com/hd-animations/	*Chemistry review* article: Why is DNA helical? (Volume 1, edition 1) *Chemistry Review* articles: How pure is your aspirin? (Volume 6, edition 3) What is chromatography? (Volume 8, edition 2)

Week 21	Electrochemical Cells	Understand that there is a potential difference between two half cells (electrodes) that are joined Use cell notation to represent cells Understand that potentials are measured relative to the standard hydrogen electrode Understand that the potential of an electrode is affected by conditions Know the standard conditions under which potentials are measured Know that electrode potential are listed in order in the electrochemical series Use the electrochemical series to predict the direction of simple redox reactions.	**AS Chemistry** - 3.1.7 – Oxidation, reduction and redox equations.	100 % Sheets	*Chemistry Review* articles: Understanding electrode potentials (Volume 12, edition 1) Electrode potentials (Volume 15, edition 3)	Exam Questions: • January 2013 Unit 5 Question 7 (QW13.5.07) • January 2012 Unit 5 Question 4 (QW12.5.04)
Week 22	Electrochemical Cells	**Required practical 8** Measuring the EMF of an electrochemical cell.	**AS Chemistry** - 3.1.7 – Oxidation, reduction and redox equations.	100 % Sheets		

Week 23	Electrochemical Cells	Calculate the EMF and cell reaction for a commercial cell given the half-equations Explain how some cells can be recharged Explain how a hydrogen fuel cell works Evaluate the benefits and risks associated with using non-rechargeable, rechargeable and fuel cells.	**AS Chemistry** - 3.1.7 – Oxidation, reduction and redox equations.	100 % Sheets		Exam Questions: • June 2013 Unit 5 Question 5 (QS13.5.05) • June 2012 Unit 5 Question 5 (QS12.5.05)
	Transition Metals	Write the electron structure of first row transition metals and their ions Describe what a transition metal is in terms of electron structure Describe the characteristic properties of transition metals Define the terms ligand, complex, co-ordinate bond and co-ordination number.	**AS Chemistry** - 3.1.1 – Atomic structure (electron structure). - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations).	100 % Sheets	*Chemistry Review* article: Vanadium (Volume 19, edition 4)	Exam Question: • January 2011 Unit 5 Question 4a and 4b (QW11.5.04)

Week 24	Transition Metals	Explain the difference between, and give examples of monodentate, bidentate and multidentate ligands Explain what happens in a ligand substitution (exchange) reaction and why there may be a change in co-ordination number Describe what haem is, how oxygen is carried in blood and why carbon monoxide is toxic Describe and explain the chelate effect in terms of enthalpy and entropy changes.	**AS Chemistry** - 3.1.1 – Atomic structure (electron structure). - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations).	100 % Sheets	Molecule of month article on EDTA http://www.chm.bris.ac.uk/motm/edta/edtah.htm - Practical Uses of EDTA RSC article on uses of EDTA http://www.rsc.org/chemistryworld/podcast/CIIEcompounds/transcripts/EDTA.asp	

Week 25	Transition Metals	Sketch examples of octahedral, tetrahedral, square planar and linear complexes Know how some complexes can show *cis-trans (e–z)* or optical isomerism Know the complexes in cisplatin and Tollen's reagent. Explain why transition metal complexes are coloured Describe factors that affect the colour of transition metal ions Describe how colorimetry can be used to find the concentration of coloured ions in solution.	**AS Chemistry** - 3.1.1 – Atomic structure (electron structure). - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations).	100 % Sheets	Shapes viewer (including inorganic complexes) https://undergrad-ed.chemistry.ohio-state.edu/jmol-viewer/# *Chemistry Review* article: Colorimetry (Volume 12, edition 3) RSC booklet on colorimetry from Gifted & Talented Chemistry: http://www.rsc.org/learn-chemistry/resource/res00000847/spectroscopy	Exam Question: • January 2011 Unit 5 Question 4a, 4b and 4c (QW11.5.04) • June 2013 Unit 5 Question 6 (QS13.5.06) • January 2012 Unit 5 Question 7a and 7b (QW12.5.07)

Week 26	Transition Metals	Describe and explain what happens when vanadate(V) ions are reduced by zinc in acidic solution Understand how the redox potential of a transition metal ion is affected by changes in ph and ligand Describe and explain the use of $Ag(NH_3)_2^+$ in Tollen's reagent to distinguish between aldehydes and ketones Perform titrations and associated calculations for redox reactions of MnO_4^- with Fe^{2+} and $C_2O_4^{2-}$ in acidic solution.	**AS Chemistry** - 3.1.1 – Atomic structure (electron structure). - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations).	100 % Sheets		Exam Questions: • June 2006 Unit 5 Question 1 (QW06.5.01) • June 2005 Unit 5 Question 5 (QS05.5.05)

Week27	Transition Metals	Describe what a heterogeneous catalyst is and the role of active sites and the support medium Explain, with the aid of equations, how v_2o_5, acts as a catalyst in the contact process Describe the use of fe in the haber process Explain how heterogeneous catalysts can become poisoned Describe what a homogeneous catalyst is and how reactions proceed through an intermediate species Describe, with the aid of equations, how fe^{2+} catalyses the reaction between i^- and $s_2o_8^{2-}$ Describe, with the aid of equations, how mn^{2+} catalyses the reaction between $C_2O_4^{2-}$ and MnO_4^-	**AS Chemistry** - 3.1.1 – Atomic structure (electron structure). - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations).	100 % Sheets	*Chemistry Review* article: Catalysts: getting chemistry going (Volume 20, edition 3) *Chemistry Review* article: Catalysts: heterogeneous catalysis (Volume 23, edition 1) *Chemistry Review* article: Catalysts: homogeneous catalysis (Volume 23, edition 3)	Exam Questions: • January 2013 Unit 5 Question 6 (QW13.5.06) • January 2012 Unit 5 Question 6 (QW12.5.06)

Week 28	Ions in Aqueous Solutions	Understand that metal ions exist as metal-aqua ions in aqueous solution The hydrolysis of metal-aqua ions in aqueous solution giving acidic solutions Explain why $[m(h_2o)_6]^{3+}$ ions are more acidic than $[m(h_2o)_6]^{2+}$ ions Describe and explain reactions of $[m(h_2o)_6]^{2+}$ (m = cu, fe) and $[m(h_2o)_6]^{3+}$ (m = al, fe) with the bases oh^-, nh_3, co_3^{2-} Describe if and how metal hydroxides (cu(ii), fe(ii), al(iii), fe(iii)) react with h^+ and oh^-, and so whether these metal hydroxides are basic or amphoteric. **Required practical 11** Carry out simple test-tube reactions to identify transition metal ions in aqueous solution.	**AS Chemistry** - 3.1.7 – Oxidation, reduction and redox reactions (oxidation states, oxidation, reduction, redox equations). **A-level Chemistry** - 3.2.5 – Transition metals.	100 % Sheets	AQA Reactions of metal ions in aqueous solution resource: http://filestore.aqa.org.uk/resources/chemistry/AQA-7405-REACTIONS-OF-METAL-IONS.PDF	Exam Question: • January 2013 Unit 5 Question 8 (QW13.5.08)

Week 29	Period 3 and Their Oxides	describe and write equations for reactions of Na and Mg with water Describe and write equations for reactions of Na, Mg, Al, Si, P and S with oxygen Describe and explain the trend in melting points of period 3 oxides Write equations for the reactions of period 3 oxides with water and describe the ph of the solutions formed Describe the structure and bonding of period 3 oxides, and link this to how they react with water.	**AS Chemistry** - 3.1.3 – Bonding. - 3.2.1 – Periodicity.	100 % Sheets	Youtube video on Period 3 oxides: https://www.youtube.com/watch?v=D0pNAFjyE6o Youtube video of reaction of phosphorus with oxygen: https://www.youtube.com/watch?v=U6_-EUcswSc&src_vid=mjkuSm__G7s&feature=iv&annotation_id=annotation_323593	Exam Questions • June 2013 Unit 5 Question 4a, 4b and 4c (QS13.5.04) • January 2013 Unit 5 Question 4a, 4b, 4c and 4d (QW13.5.04) • January 2012 Unit 5 Question 3 (QW12.5.03)
Week 30	NMR	Understand the use of TMS and the δ scale for chemical shift Understand the use of deuterated solvents or CCl_4 Use the n+1 rule to deduce spin-spin splitting patterns of adjacent, non-equivalent protons in aliphatic compounds	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.6 – Organic analysis.	100 % Sheets	RSC Spectral School: http://www.rsc.org/learn-chemistry/collections/spectroscopy?uol_r=3ae0be55 RSC Spectroscopy resource: http://www.rsc.org/learn-chemistry/resource/res00000847/spectroscopy	

Week 31	NMR	Deduce the structure of compounds using ^{1}H NMR to deduce structures including the number, position, relative intensity and splitting of signals Deduce the structure of compounds using ^{13}C NMR to deduce structures including the number and position of signals.	**AS Chemistry** - 3.3.1.1 – Nomenclature. - 3.3.6 – Organic analysis.	100 % Sheets	Database of spectra for organic compounds http://sdbs.db.aist.go.jp/sdbs/cgi-bin/cre_index.cgi	Exam Questions: • June 2013 Unit 4 Question 7 (QS13.4.07) • January 2013 Unit 4 Question 5 (QS13.4.05) • June 2012 Unit 4 Question 8 (QS12.4.08)
Week 32	Organic Synthesis	Devise synthetic routes, with up to four steps, to make specific organic compounds using the reactions in the specification Explain why processes are designed to avoid solvents, non-hazardous starting materials and have steps with high atom economy.	**AS Chemistry** - All organic chemistry topics.	100 % Sheets	RSC synthesis resource http://www.rsc.org/learn-chemistry/resource/res00000003/synthesis-explorer *Chemistry review* articles: New tricks for stacking bricks: modern approaches to organic synthesis (Volume 12, edition 3) Salbutamol: saving your breath (Volume 18, edition 4)	

Week 33	Review and exam prep
Week 34	EXAM – Paper 1
Week 35	EXAM – Paper 2
Week 36	EXAM – Paper 3