Mapping grid showing how the AQA AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Unit 1. Foundation Chemistry

Topic	Boardworks AS Chemistry presentation title
3.1.1 Atomic structure: Fundamental particles; protons, neutrons and electrons; mass number and isotopes; electron arrangement.	• Atomic Structure • Electron Arrangement • Analytical Chemistry
3.1.2 Amount of substance: Relative atomic mass and relative molecular mass; the mole and the Avogadro constant (L); the ideal gas equation; empirical and molecular formulae; balanced equations and associated calculations.	• Moles and Formulae • Chemical Calculations
3.1.3 Bonding: Nature of ionic, covalent and metallic bonds; bond polarity; forces acting between molecules; states of matter; shapes of simple molecules and ions.	• Bonding and Intermolecular Forces • Structure and Shape
3.1.4 Periodicity: Classification of elements in s, p and d blocks; properties of the elements of Period 3 to illustrate periodic trends.	• Electron Arrangement • Trends in Period 3
3.1.5 Introduction to organic chemistry: Nomenclature; isomerism.	• Introducing Organic Chemistry • Alkanes • Halogenoalkanes • Alkenes
3.1.6 Alkanes: Fractional distillation of crude oil; modification of alkanes by cracking; combustion of alkanes.	• Alkanes • Green Chemistry

Unit 2. Chemistry in Action

Topic	Boardworks AS Chemistry presentation title
3.2.1 Energetics: Enthalpy change (ΔH); calorimetry; simple applications of Hess's Law; bond enthalpies.	• Energetics
3.2.2 Kinetics: Collision theory; Maxwell–Boltzmann distribution; effect of temperature on reaction rate; effect of concentration; catalysts.	• Kinetics
3.2.3 Equilibria: The dynamic nature of equilibria; qualitative effects of changes of pressure, temperature and concentration on a system in equilibrium; importance of equilibria in industrial processes.	• Equilibria • Green Chemistry
3.2.4 Redox reactions: Oxidation and reduction; oxidation states; redox equations.	• Redox Reactions
3.2.5 Group 7, the halogens: Trends in physical properties; trends in the oxidizing abilities of the halogens; trends in the reducing abilities of the halide ions; identification of halide ions using silver nitrate; uses of chlorine and chlorate(I).	• Halogens
3.2.6 Group 2, the alkaline earth metals: Trends in physical properties; trends in chemical properties.	• Trends in Group 2
3.2.7 Extraction of metals: Principles of metal extraction; environmental aspects of metal extraction.	• Redox Reactions
3.2.8 Haloalkanes: Synthesis of chloroalkanes; nucleophilic substitution; elimination.	• Halogenoalkanes • Green Chemistry
3.2.9 Alkenes: Alkenes: structure, bonding and reactivity; addition reactions; polymerisation of alkenes.	• Alkenes • Alcohols
3.2.10 Alcohols: Ethanol production; classification and reactions; elimination.	• Alcohols • Green Chemistry
3.2.11 Analytical techniques: Mass spectrometry; infra-red spectroscopy	• Analytical Chemistry

Mapping grid showing how the Edexcel AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Unit 1. The core principles of chemistry

Formulae, equations and amount of substance	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding of the terms atom, element, ion, molecule, compound, empirical and molecular formulae.	• Moles and Formulae • Atomic Structure • Electron Arrangement
b. Write balanced equations (full and ionic) for simple reactions, including the use of state symbols.	• Chemical Calculations
c. Demonstrate an understanding of the terms relative atomic mass, amount of substance, molar mass and parts per million (ppm), eg gases in the atmosphere, exhausts, water pollution.	• Moles and Formulae
d. Calculate the amount of substance in a solution of known concentration (excluding titration calculations at this stage), eg use data from the concentrations of the various species in blood samples to perform calculations in $mol\,dm^{-3}$.	• Chemical Calculations
e. Use chemical equations to calculate reacting masses and vice versa using the concepts of amount of substance and molar mass.	• Chemical Calculations
f. Use chemical equations to calculate volumes of gases and vice versa using the concepts of amount of substance and molar volume of gases, eg calculation of the mass or volume of CO_2 produced by combustion of a hydrocarbon (given a molar volume for the gas).	• Moles and Formulae
g. Use chemical equations and experimental results to deduce percentage yields and atom economies in laboratory and industrial processes and understand why they are important.	• Chemical Calculations
i. Analyse and evaluate the results obtained from finding a formula or confirming an equation by experiment, eg the reaction of lithium with water and deducing the equation from the amounts in moles of lithium and hydrogen.	
j. Make a salt and calculate the percentage yield of product, eg preparation of a double salt (ammonium iron(II) sulfate from iron, ammonia and sulfuric acid).	• Chemical Calculations

k. Carry out and interpret the results of simple test tube reactions, such as displacements, reactions of acids, precipitations, to relate the observations to the state symbols used in equations and to practise writing full and ionic equations.	

Energetics	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding of the term enthalpy change, ΔH.	• Energetics
b. Construct simple enthalpy level diagrams showing the enthalpy change.	• Energetics
c. Recall the sign of ΔH for exothermic and endothermic reactions, eg illustrated by the use of exo- and endothermic reactions in hot and cold packs.	• Energetics
d. Recall the definition of standard enthalpy changes of reaction, formation, combustion, neutralization and atomization and use experimental data to calculate energy transferred in a reaction and hence the enthalpy change of the reaction. This will be limited to experiments where substances are mixed in an insulated container, and combustion experiments.	• Energetics
e. Recall Hess's law and apply it to calculating enthalpy changes of reaction from data provided, selected from a table of data or obtained from experiments and understand why standard data is necessary to carry out calculations of this type.	• Energetics

f. Evaluate the results obtained from experiments using the expression: *energy transferred in joules = mass × specific heat capacity × temperature change* and comment on sources of error and assumptions made in the experiments. The following types of experiments should be performed: i) Experiments in which substances are mixed in an insulated container and the temperature rise measured. ii) Simple enthalpy of combustion experiments using, eg a series of alcohols in a spirit burner. iii) Plan and carry out an experiment where the enthalpy change cannot be measured directly, eg the enthalpy change for the decomposition of calcium carbonate and calcium oxide with hydrochloric acid.	• Energetics
g. Demonstrate an understanding of the terms bond enthalpy and mean bond enthalpy, and use bond enthalpies in Hess cycle calculations and recognize their limitations. Understand that bond enthalpy data gives some indication about which bond will break first in a reaction, how easy or difficult it is and therefore how rapidly a reaction will take place at room temperature.	• Energetics

Atomic structure and the periodic table	Boardworks AS Chemistry presentation title
a. Recall the definitions of relative atomic mass, relative isotopic mass and relative molecular mass and understand that they are measured relative to 1/12th the mass of a ^{12}C atom.	• Moles and Formulae
b. Demonstrate an understanding of the basic principles of a mass spectrometer and interpret data from a mass spectrometer to: i) Deduce the isotopic composition of a sample of an element, eg polonium. ii) Deduce the relative atomic mass of an element. iii) Measure the relative molecular mass of a compound.	• Atomic Structure • Analytical Chemistry
c. Describe some uses of mass spectrometers, eg in radioactive dating, in space research, in sport to detect use of anabolic steroids, in the pharmaceutical industry to provide an identifier for compounds synthesized for possible identification as drugs.	• Atomic Structure • Analytical Chemistry

d. Recall and understand the definition of ionization energies of gaseous atoms and that they are endothermic processes.	• Electron Arrangement
e. Recall that ideas about atomic structure developed from: i) An understanding that successive ionization energies provide evidence for the existence of quantum shells and the group to which the element belongs. ii) An understanding that the first ionization energy of successive elements provides evidence for electron sub-shells.	• Electron Arrangement
f. Describe the shapes of electron density plots (or maps) for s and p orbitals.	• Electron Arrangement
g. Predict the electronic structure and configuration of atoms of the elements from hydrogen to krypton inclusive using 1s…notation and electron-in-boxes notation (recall electrons populate orbits singly before pairing up).	• Electron Arrangement
h. Demonstrate an understanding that electronic structure determines the chemical properties of an element.	• Bonding and Intermolecular Forces • Structure and Shape • Trends in Period 3 • Trends in Group 2 • Halogens
i. Recall that the periodic table is divided into blocks, such as s, p and d.	• Electron Arrangement
j. Represent data, in a graphical form, for elements 1 to 36 and use this to explain the meaning of the term 'periodic property'.	• Trends in Period 3
k. Explain trends in the following properties of the elements from periods 2 and 3 of the periodic table: i) Melting temperature of the elements based on given data using the structure and the bonding between the atoms or molecules of the element. ii) Ionization energy based on given data or recall of the shape of the plots of ionization energy versus atomic number using ideas of electronic structure and the way that electron energy levels vary across the period.	• Trends in Period 3

Mapping grid showing how the Edexcel AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Bonding: 1. Ionic bonding 2. Covalent bonding 3. Metallic bonding	Boardworks AS Chemistry presentation title
1a. Recall and interpret evidence for the existence of ions, limited to physical properties of ionic compounds, electron density maps and the migration of ions, eg electrolysis of aqueous copper chromate(VI).	
1b. Describe the formation of ions in terms of electron loss or gain.	• Bonding and Intermolecular Forces
1c. Draw electron configuration diagrams of cations and anions using dots or crosses to represent electrons.	• Bonding and Intermolecular Forces
1d. Describe ionic crystals as giant lattices of ions.	• Bonding and Intermolecular Forces
1e. Describe ionic bonding as the result of strong net electrostatic attractions between ions.	• Bonding and Intermolecular Forces
1f. Recall trends in ionic radii down a group and for a set of isoelectronic ions, eg N^{3-} to Al^{3+}.	• Trends in Group 2
1g. Recall the stages involved in the formation of a solid ionic crystal from its elements and that this leads to a measure value for the lattice energy (students will not be expected to draw the full Born-Haber cycles).	
1h. Test the ionic model for ionic bonding of a particular compound by comparison of lattice energies obtained from the experimental values used in Born-Haber cycles, with provided values calculated from electrostatic theory.	
1i. Explain the meaning of the term polarization as applied to ions.	
1j. Demonstrate an understanding that the polarizing power of a cation depends on its radius and charge, and the polarizability of an anion depends on its size.	
1k. Demonstrate an understanding that polarization of anions by cations leads to some covalency in an ionic bond, based on evidence from the Born-Haber cycle.	• Bonding and Intermolecular Forces

1l. Use values calculated for standard heats of formation based on Born-Haber cycles to explain why particular ionic compounds exist, eg the relative stability of $MgCl_2$ over MgCl or $MgCl_3$ and NaCl over $NaCl_2$.	
2a. Demonstrate an understanding that covalent bonding is strong and arises from the electrostatic attraction between the nucleus and the electrons which are between the nuclei, based on the evidence: i) The physical properties of giant atomic structures. ii) Electron density maps for simple molecules.	• Bonding and Intermolecular Forces • Structure and Shape
2b. Draw electron configuration diagrams for simple covalently bonded molecules, including those with multiple bonds and dative covalent bonds, using dots or crosses to represent electrons.	• Bonding and Intermolecular Forces
3a. Demonstrate an understanding that metals consist of giant lattices of metal ions in a sea of delocalized electrons.	• Bonding and Intermolecular Forces
3b. Describe metallic bonding as the strong attraction between metal ions and the sea of delocalized electrons.	• Bonding and Intermolecular Forces
3c. Use the models in 3a. and 3b. to interpret simple properties of metals, eg conductivity and melting temperatures.	• Structure and Shape

Introductory organic chemistry: 1. Introduction 2. Alkanes 3. Alkenes	Boardworks AS Chemistry presentation title
1a. Demonstrate an understanding that there are series of organic compounds characterized by a general formula and one or more functional groups.	• Introducing Organic Chemistry

1b. Apply the rules of IUPAC nomenclature to compounds relevant to this specification and draw these compounds, as they are encountered in the specification, using structural, displayed and skeletal formulae.	• Introducing Organic Chemistry • Alkanes • Halogenoalkanes • Alkenes • Alcohols
1c. Appreciate the difference between hazard and risk.	
1d. Demonstrate an understanding of the hazards associated with organic compounds and why it is important to carry out risk assessments when dealing with potentially hazardous materials. Suggest ways by which risks can be reduced and reactions can be carried out safely by: i) Working on a smaller scale. ii) Taking specific precautions or using alternative techniques depending on the substances involved. iii) Carrying out the reaction using an alternative method that involves less hazardous substances.	• Green Chemistry
2a. State the general formula of alkanes and understand that they are saturated hydrocarbons which contain single bonds only.	• Alkanes
2b. Explain the existence of structural isomers using alkanes (up to C_5) as examples.	• Introducing Organic Chemistry • Alkanes
2c. Know that alkanes are used as fuels and obtained from fractional distillation, cracking and reformation of crude oil.	• Alkanes
2d. Discuss the reasons for developing alternative fuels in terms of sustainability and reducing emissions, including the emission of CO_2 and its relationship to climate change.	• Green Chemistry • Alkanes
2e. Describe the reactions of alkanes in terms of combustion and substitution by chlorine showing the mechanism of free radical substitution in terms of initiation, propagation and termination, and using curly half-arrows in the mechanism to show the formation of free radicals in the initiation step using a single dot to represent the unpaired electron.	• Alkanes • Halogenoalkanes
3a. State the general formula of alkenes and understand that they are unsaturated hydrocarbons with a carbon-carbon double bond which consists of a σ and a π bond.	• Alkenes

3b. Explain E-Z isomerism (geometric/cis-trans isomerism) in terms of restricted rotation around a C=C double bond and the nature of the substituents on the carbon atoms.	• Introducing Organic Chemistry • Alkenes
3c. Demonstrate an understanding of the E-Z naming system and why it is necessary to use this when the *cis*- and *trans*- naming system breaks down.	• Introducing Organic Chemistry
3d. Describe the addition reactions of alkenes, limited to: i) The addition of hydrogen with a nickel catalyst to form an alkane. ii) The addition of halogens to produce di-substituted halogenoalkanes. iii) The addition of hydrogen halides to produce mono-substituted halogenoalkanes iv) Oxidation of the double bond by potassium manganate(VII) to produce a diol.	• Alkenes
3e. Describe the mechanism (including diagrams), giving evidence where possible, of: i) The electrophilic addition of bromine and hydrogen bromide to ethene. ii) The electrophilic addition of hydrogen bromide to propene.	• Alkenes
3f. Describe the test for C=C using bromine water and understand that the product is the addition of OH and Br.	• Alkenes
3g. Describe the addition polymerization of alkenes and identify the repeat unit given the monomer, and vice versa.	• Alkenes
3h. Interpret given information about the uses of energy and resources over the lifecycle of polymer products to show how the use of renewable resources, recycling and energy recovery can contribute to the more sustainable use of materials.	

Unit 2. Application of core principles of chemistry

Shapes of molecules and ions	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding of the use of electron-pair repulsion theory to interpret and predict the shapes of simple molecules and ions.	• Structure and Shape
b. Recall and explain the shapes of $BeCl_2$, $BeCl_3$, CH_4, NH_3, NH_4^+, H_2O, CO_2, gaseous PCl_5 and SF_6 and the simple organic molecules listed in Units 1 and 2.	• Structure and Shape
c. Apply the electron-pair repulsion theory to predict the shapes of molecules and ions analogous to those in b.	• Structure and Shape
d. Demonstrate an understanding of the terms bond length and bond angle and predict approximate bond angles in simple molecules and ions.	• Structure and Shape
e. Discuss the different structures formed by carbon atoms, including graphite, diamond, fullerenes and carbon nanotubes, and the applications of these, eg the potential to use nanotubes as vehicles to carry drugs into cells.	• Structure and Shape

Intermediate bonding and bond polarity	Boardworks AS Chemistry presentation title
a. Explain the meaning of the term electronegativity as applies to atoms in a covalent bond.	• Bonding and Intermolecular Forces
b. Recall that ionic and covalent bonding are the extremes of a continuum of bonding type and explain this in terms of electronegativity differences leading to bond polarity in bonds and molecules, and to ionic bonding if the electronegativity is large enough.	• Bonding and Intermolecular Forces
c. Distinguish between polar bonds and polar molecules and be able to predict whether or not a given molecule is likely to be polar.	• Bonding and Intermolecular Forces

d. Carry out experiments to determine the effect of an electrostatic force on jets of liquids and use the results to determine whether the molecules are polar or non-polar.	

Intermolecular forces	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding of the nature of intermolecular forces resulting from interactions between permanent dipoles, instantaneous dipoles and induced dipoles (London forces) and from the formation of hydrogen bonds.	• Bonding and Intermolecular Forces
b. Relate the physical properties of materials to the types of intermolecular force present, eg: i) The trends in boiling and melting temperatures of alkanes with increasing chain length. ii) The effect of branching in the carbon chain on the boiling and melting temperatures of alkanes. iii) The relatively low volatility (higher boiling temperatures) of alcohols compares to alkanes with a similar number of electrons. iv) The trends in boiling temperatures of the hydrogen halides HF to HI.	• Bonding and Intermolecular Forces • Alkanes • Alcohols • Halogens • Trends in Period 3
c. Carry out experiments to study the solubility of simple molecules in different solvents.	
d. Interpret given information about solvents and solubility to explain the choice of solvents in given contexts, discussing the factors that determine the solubility, including: i) The solubility of ionic compounds in water in terms of the hydration of the ions. ii) The water solubility of simple alcohols in terms of hydrogen bonding. iii) The insolubility of compounds that cannot form hydrogen bonds with water molecules, eg polar molecules such as halogenoalkanes. iv) The solubility in non-aqueous solvents of compounds which have similar intermolecular forces to those in the solvent.	

Mapping grid showing how the Edexcel AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Redox	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding of: i) Oxidation number – the rules for assigning oxidation numbers. ii) Oxidation and reduction as electron transfer. iii) Oxidation and reduction in terms of oxidation number changes. iv) How oxidation number is a useful concept in terms of the classification of reactions as redox and as disproportionation.	• Redox Reactions • Halogens
b. Write ionic half-equations and use them to construct full ionic equations.	• Redox Reactions

The periodic table – groups 2 and 7: 1. Properties down group 2 2. Inorganic chemistry of group 7	Boardworks AS Chemistry presentation title
1a. Explain the trend in the first ionization energy down group 2.	• Trends in Group 2
1b. Recall the reaction of the elements in group 2 with oxygen, chlorine and water.	• Trends in Group 2
1c. Recall the reactions of the oxides of group 2 elements with water and dilute acid, and their hydroxides with dilute acid.	• Trends in Group 2
1d. Recall the trends in solubility of the hydroxides and sulfates of group 2 elements.	• Trends in Group 2
1e. Recall the trends in thermal stability of the nitrates and carbonates of the elements in groups 1 and 2 and explain these in terms of size and charge of the cations involved.	• Trends in Group 2
1f. Recall the characteristic flame colours formed by group 1 and 2 compounds and explain their origin in terms of electron transitions.	• Trends in Group 2

1g. Describe and carry out the following: i) Experiments to study the thermal decomposition of group 1 and 2 nitrates and carbonates. ii) Flame tests on compounds of group 1 and 2. iii) Simple acid-base titrations using a range of indicators, acids and alkalis, to calculate solution concentrations in $g\,dm^{-3}$ and $mol\,dm^{-3}$, eg measuring the residual alkali present after skinning fruit with potassium hydroxide.	• Chemical Calculations • Trends in Group 2
1h. Demonstrate an understanding of how to minimize the sources of measurement uncertainty in volumetric analysis and estimate the overall uncertainty of the calculated result.	
2a. Recall the characteristic physical properties of the elements limited to the appearance of solutions of the elements in water and hydrocarbon solvents.	
2b. Describe and carry out the following chemical reactions of halogens: i) Oxidation reactions with metal and non-metallic elements and ions such as iron(II) and iron(III) ions in solution. ii) Disproportionation reactions with cold and hot alkali, eg hot potassium hydroxide with iodine to produce potassium iodate(V).	• Halogens
2c. Carry out an iodine/thiosulfate titration, including calculation of the results and evaluation of the procedures involved, eg determination of the purity of potassium iodate(V) by liberation of iodine and titration with standard sodium thiosulfate solution.	
2d. Describe and carry out the following reactions: i) Potassium halides with concentrated sulfuric acid, halogens and silver nitrate solution. ii) Silver halides with sunlight and their solubilities in aqueous ammonia solution. iii) Hydrogen halides with ammonia and with water (to produce acids).	• Halogens
2e. Make predictions about fluorine and astatine and their compounds based on the trends in the physical and chemical properties of halogens.	• Halogens

Kinetics	Boardworks AS Chemistry presentation title
a. Recall the factors that influence the rate of chemical reaction, including concentration, temperature, pressure, surface area and catalysts.	• Kinetics
b. Explain the changes in rate based on a qualitative understanding of collision theory.	• Kinetics
c. Use, in a qualitative way, the Maxwell-Boltzmann model of the distribution of molecular energies to relate changes of concentration and temperature to the alteration in the rate of a reaction.	• Kinetics
d. Demonstrate an understanding of the concept of activation energy and its qualitative relationship to the effect of temperature changes on the rate of reaction.	• Kinetics
e. Demonstrate an understanding of the role of catalysts in providing alternative reaction routes of lower activation energy and draw the reaction profile of a catalysed reaction including the energy level of the intermediate formed with the catalyst.	• Kinetics
f. Carry out simple experiments to demonstrate the factors that influence the rate of chemical reactions, eg the decomposition of hydrogen peroxide.	

Chemical equilibria	Boardworks AS Chemistry presentation title
a. Demonstrate an understanding that chemical equilibria are dynamic.	• Equilibria
b. Deduce the qualitative effects of changes of temperature, pressure and concentration on the position of equilibrium, eg extraction of methane from methane hydrate.	• Equilibria
c. Interpret the results of simple experiments to demonstrate the effect of a change of temperature, pressure and concentration on a system at equilibrium, eg i) iodine(I) chloride reacting with chlorine to form iodine(III) chloride , or ii) $N_2O_4 \rightleftharpoons 2NO_2$	• Equilibria

Mapping grid showing how the Edexcel AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Organic chemistry: 1. Alcohols 2. Halogenoalkanes	Boardworks AS Chemistry presentation title
1a. Give examples of, and recognize, molecules that contain the alcohol functional group.	• Introducing Organic Chemistry • Alcohols
1b. Demonstrate an understanding of the nomenclature and corresponding structural, displayed and skeletal formulae of alcohols, and classify them as primary, secondary or tertiary.	• Introducing Organic Chemistry • Alcohols
1c. Describe the following chemistry of alcohols: i) Combustion ii) Reaction with sodium iii) Substitution reactions to form halogenoalkanes, including reaction with PCl_5 and its use as a qualitative test for the presence of the –OH group. iv) Oxidation using potassium dichromate(VI) in dilute sulfuric acid on primary alcohols to produce aldehydes and carboxylic acids and on secondary alcohols to produce ketones.	• Alcohols
1d. Demonstrate an understanding of, and practise, the preparation of an organic liquid (reflux and distillation), eg oxidation of alcohols.	• Alcohols
2a. Demonstrate an understanding of the nomenclature and corresponding structural, displayed and skeletal formulae for halogenoalkanes, including the distinction between primary, secondary and tertiary structures.	• Introducing Organic Chemistry • Halogenoalkanes
2b. Interpret given data and observations comparing the reactions and reactivity of primary, secondary and tertiary compounds.	• Halogenoalkanes
2c. Carry out the preparation of a halogenoalkane from an alcohol and explain why a metal halide and concentrated sulfuric acid should not be used when making a bromoalkane or an iodoalkane.	

2d. Describe the typical behaviour of halogenoalkanes. This will be limited to treatment with: i) Aqueous alkali, eg $KOH_{(aq)}$ ii) Alcoholic potassium hydroxide iii) Water containing dissolved silver nitrate iv) Alcoholic ammonia	• Halogenoalkanes
2e. Carry out the reactions described in 2d. i, ii, and iii.	
2f. Discuss the uses of halogenoalkanes, eg as fire retardants and modern refrigerants.	

Mechanisms	Boardworks AS Chemistry presentation title
a. Classify reactions (including those in Unit 1) as addition, elimination, substitution, oxidation, reduction, hydrolysis or polymerization.	• Halogenoalkanes • Alkenes • Alcohols
b. Demonstrate an understanding of the concept of a reaction mechanism and that bond breaking can be homolytic of heterolytic and that the resulting species are either free radicals, electrophiles or nucleophiles.	
c. Give definitions of the terms free radical, electrophile and nucleophile.	• Halogenoalkanes • Alkenes
d. Demonstrate an understanding of why it is helpful to classify reagents.	
e. Demonstrate an understanding of the link between bond polarity and the type of reaction mechanism a compound will undergo.	• Halogenoalkanes
f. Describe the mechanisms of the substitution reactions of halogenoalkanes and recall those in 1.7.2e and 1.7.3e.	• Halogenoalkanes
g. Demonstrate an understanding of how oxygen, O_2, and ozone, O_3, absorb UV radiation and explain the part played by emission of oxides of nitrogen, from aircraft, in the depletion of the ozone layer, including the free radical mechanism for the reaction and the fact that oxides act as catalysts.	• Green Chemistry • Halogenoalkanes

Mass spectra and IR	Boardworks AS Chemistry presentation title
a. Interpret fragment ion peaks in the mass spectra of simple organic compounds, eg the difference between propanal and propanone.	• Analytical Chemistry
b. Use infrared spectra, or data from infrared spectra, to deduce functional groups present in organic compounds and predict infrared absorptions, given wavenumber data, due to familiar functional groups. This will be limited to: i) C-H stretching absorptions in alkanes, alkenes and aldehydes. ii) O-H stretching absorption in alcohols and carboxylic acids. iii) N-H stretching absorption in amines. iv) C=O stretching absorption in aldehydes and ketones. v) C-X stretching absorption in halogenoalkanes. vi) As an analytical tool to show the change in functional groups during the oxidation of an alcohol to a carbonyl.	• Analytical Chemistry
c. Demonstrate an understanding that only molecules which change their polarity as they vibrate can absorb infrared radiation.	• Analytical Chemistry
d. Demonstrate an understanding that H_2O, CO_2, CH_4 and NO molecules absorb IR radiation and are greenhouse gases, whilst O_2 and N_2 are not.	• Analytical Chemistry • Green Chemistry

Green Chemistry	Boardworks AS Chemistry presentation title

a. Demonstrate an understanding that the processes in the chemical industry are being reinvented to make them more sustainable ('greener') by: i) Changing to renewable resources ii) Finding alternatives to very hazardous chemicals iii) Discovering catalysts for reactions with higher atom economies, eg the development of methods used to produce ethanoic acid based on catalysts of cobalt, rhodium and iridium. iv) Making more efficient use of energy, eg the use of microwave energy to heat reactions in the pharmaceutical industry. v) Reducing waste and preventing pollution of the environment.	• Green Chemistry • Redox Reactions
b. Discuss the relative effects of different greenhouse gases as absorbers of IR and hence on global warming.	• Green Chemistry • Analytical Chemistry
c. Discuss the difference between anthropogenic and natural climate change over hundreds of thousands of years.	• Green Chemistry
d. Demonstrate understanding of the terms 'carbon neutrality' and 'carbon footprint'.	• Green Chemistry • Equilibria
e. Apply the concept of carbon neutrality to different fuels, such as petrol, bio-ethanol and hydrogen.	• Green Chemistry
f. Discuss and explain, including mechanisms for the reactions the science community's reasons for recommending that CFCs are no longer used due to their damaging effect on the ozone layer.	• Green Chemistry • Halogenoalkanes

Mapping grid showing how the OCR AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Unit 1. Atoms, bonds and groups

Topic 1.1 Atoms and reactions	Boardworks AS Chemistry presentation title
1.1.1 Atoms: Atomic structure; relative masses.	• Atomic Structure • Moles and Formulae
1.1.2 Moles and equations: The mole; empirical and molecular formulae; chemical equations; calculation of reacting masses, mole concentrations and volumes of gases.	• Moles and Formulae • Chemical Calculations
1.1.3 Acids: Acids and bases; salts.	
1.1.4 Redox: Oxidation number; redox reactions.	• Redox Reactions
Topic 1.2 Electrons, bonding and structure	**Boardworks AS Chemistry presentation title**
1.2.1 Electron structure: Ionization energies; electrons: electronic energy levels, shells, sub-shells, atomic orbitals, electron configuration.	• Electron Arrangement
1.2.2 Bonding and structure: Ionic bonding; Covalent bonding and dative covalent (coordinate) bonding; the shapes of simple molecules and ions; electronegativity and bond polarity; intermolecular forces; metallic bonding; bonding and physical properties.	• Bonding and Intermolecular Forces • Structure and Shape
Topic 1.3 The periodic table	**Boardworks AS Chemistry presentation title**
1.3.1 Periodicity: The structure of the Periodic Table in terms of groups and periods; periodicity of physical properties of elements.	• Trends in Period 3 • Trends in Group 2
1.3.2 Group 2: Redox reactions of Group 2 metals; reactions of Group 2 compounds.	• Trends in Group 2

1.3.3 Group 7: Characteristic physical properties; redox reactions and trends in reactivity of Group 7 elements and their compounds; characteristic reactions of halide ions.	• Halogens

Mapping grid showing how the OCR AS Level Chemistry specification (for first teaching in 2008) is covered by Boardworks AS Chemistry

Unit 2. Chains, energy and resources

Topic 2.1 Basic concepts and hydrocarbons	Boardworks AS Chemistry presentation title
2.1.1 Basic concepts: Representing formulae of organic compounds; functional groups and the naming of organic compounds; isomerism; reaction mechanisms; percentage yields and atom economy.	• Moles and Formulae • Introducing Organic Chemistry • Alkanes • Chemical Calculations • Green Chemistry
2.1.2 Alkanes: Hydrocarbons from crude oil; hydrocarbons as fuels; substitution reactions of alkanes.	• Alkanes • Halogenoalkanes • Green Chemistry
2.1.3 Alkenes: Properties of alkenes; addition reactions of alkenes; polymers from alkenes; industrial importance of alkenes.	• Alkenes • Alcohols • Green Chemistry
Topic 2.2 Alcohols, halogenoalkanes and analysis	**Boardworks AS Chemistry presentation title**
2.2.1 Alcohols: Properties and preparation of ethanol; reactions of alcohols.	• Alcohols • Equilibria
2.2.2 Halogenoalkanes: Substitution reactions of halogenoalkanes; uses of halogenoalkanes.	• Halogenoalkanes • Green Chemistry
2.2.3 Modern analytical techniques: Infrared spectroscopy; mass spectrometry.	• Analytical Chemistry
Topic 2.3 Energy	**Boardworks AS Chemistry presentation title**
2.3.1 Enthalpy Changes: Enthalpy changes: ΔH of reaction, formation and combustion; bond enthalpies; Hess' law and enthalpy cycles.	• Energetics
2.3.2 Rates and Equilibrium: Simple collision theory; catalysts; the Boltzmann distribution; dynamic equilibrium and le Chatelier's principle.	• Kinetics • Equilibria

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Topic 2.4 Resources	Boardworks AS Chemistry presentation title
2.4.1 Chemistry of the air: The 'Greenhouse Effect'; the ozone layer; controlling air pollution.	• Green Chemistry • Analytical Chemistry • Halogenoalkanes • Alkanes
2.4.2 Green chemistry: Sustainability.	• Green Chemistry