Pearson
Edexcel

INTERNATIONAL GCSE

CHEMISTRY

4CH1

Mapping from Cambridge International Examinations to Pearson Edexcel (0620 to 4CH1)

Qualification at a Glance

<table>
<tr><th>Cambridge International</th><th>Pearson Edexcel</th></tr>
<tr><td>

Availability
Two Tiers: Core and Extended
Number of Papers: Three Papers at Core and Three at Extended

Content Summary:
The particulate nature of matter
Experimental techniques
Atoms, elements and compounds
Stoichiometry
Electricity and chemistry
Chemical energetics
Chemical reactions
Acid, bases and salts
The Periodic Table
Metals
Air and water
Sulfur
Carbonates
Organic Chemistry

Paper 1C: 45 minutes, 30% of the qualification, Multiple-Choice Questions
Paper 3C: 1 hour 15, 50% of the qualification, Short-answer and structured questions
Or
Paper 2E: 45 minutes, 30% of the qualification, Multiple-Choice Questions
Paper 4E: 1 hour 15, 50% of the qualification, Short-answer and structured questions

All candidates also have to take Component 5 or 6.
Paper 5C: 1 hour 15, 20% of the qualification, **Practical Test:** questions based on experimental skills
Paper 6E: 1 hour, 20% of the qualification, **Alternative to Practical:** questions based on experimental skills

</td><td>

Availability: January and June
Number of Papers: Two Papers

Content Summary:
Principles of Chemistry
Inorganic Chemistry
Physical Chemistry
Organic Chemistry

Paper 1: 2 hours, 61.1% of the qualification
Paper 2: 1 hour 15, 38.9% of the qualification

Calculator may be used in the examinations.

<table>
<tr><td>AO1</td><td>Knowledge and understanding of chemistry</td><td>38–42%</td></tr>
<tr><td>AO2</td><td>Application of knowledge and understanding, analysis and evaluation of chemistry</td><td>38–42%</td></tr>
<tr><td>AO3</td><td>Experimental skills, analysis and evaluation of data and methods in chemistry</td><td>19–21%</td></tr>
</table>

<table>
<tr><th rowspan="2">Unit</th><th colspan="3">Assessment Objective</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th></tr>
<tr><td>Paper 1</td><td>23.2–25.7%</td><td>23.2–25.7%</td><td>11.6–12.8%</td></tr>
<tr><td>Paper 2</td><td>14.8–16.3%</td><td>14.8–16.3%</td><td>7.4–8.2%</td></tr>
<tr><td>Total</td><td>38–42%</td><td>38–42%</td><td>19–21%</td></tr>
</table>

</td></tr>
</table>

Core: Targeted at C-G candidates
Extended: Targeted at A*-C candidates

AO1	Knowledge and understanding	50 %
AO2	Handling information and problem solving	30 %
AO3	Experimental skills and investigations	20 %

Unit	**Assessment Objective**		
	AO1	**AO2**	**AO3**
Paper 1 and 2	25 %	15 %	0 %
Paper 3 and 4	25 %	15 %	0 %
Paper 5 and 6	0 %	0 %	20 %
Total	50 %	30 %	20 %

Cambridge IGCSE Chemistry Mapped Against Edexcel International GCSE

1. Detailed Comparison of Specifications

This is broken down by Cambridge specification heading

1 The particulate nature of matter

Cambridge	Edexcel	Notes
1.1 The particulate nature of matter		
State the distinguishing properties of solids, liquids and gases	1.1 understand the three states of matter in terms of the arrangement, movement and energy of the particles	Treatment of these topics is similar.
Describe the structure of solids, liquids and gases in terms of particle separation, arrangement and types of motion		
Describe changes of state in terms of melting, boiling, evaporation, freezing, condensation and sublimation	1.2 understand the interconversions between the three states of matter in terms of: · the names of the interconversions · how they are achieved · the changes in arrangement, movement and energy of the particles.	Treatment of these topics is similar.
Explain changes of state in terms of the kinetic theory		
Describe qualitatively the pressure and temperature of a gas in terms of the motion of its particles		A description of pressure not required for Edexcel, but students should understand that particles move faster at higher temperature.
Show an understanding of the random motion of particles in a suspension (sometimes known as Brownian motion) as evidence for the kinetic particle (atoms, molecules or ions) model of matter		Not required for Edexcel.
Describe and explain Brownian motion in terms of random molecular bombardment		
State evidence for Brownian motion		
Describe and explain diffusion	1.3 understand how the results of experiments involving the dilution of coloured solutions and diffusion of gases can be explained	Treatment of these topics is similar.
Describe and explain dependence of rate of diffusion on molecular mass		

2 Experimental techniques

Cambridge	Edexcel	Notes
2.1 Measurement		
Name appropriate apparatus for the measurement of time, temperature, mass and volume, including burettes, pipettes and measuring cylinders		Not mentioned specifically on Edexcell syllabus but students would be expected to use all these pieces of apparatus and refer to them in exam questions.
2.2 Purity		
2.2.1 Criteria of purity		
Demonstrate knowledge and understanding of paper chromatography	1.10 describe these experimental techniques for the separation of mixtures: … paper chromatography.	Treatment of these topics is similar.
Interpret simple chromatograms	1.11 understand how a chromatogram provides information about the composition of a mixture	
	1.13 *practical: investigate paper chromatography using inks/food colourings*	Required practical for Edexcel.
Interpret simple chromatograms, including the use of R_f values	1.12 understand how to use the calculation of R_f values to identify the components of a mixture	
Outline how chromatography techniques can be applied to colourless substances by exposing chromatograms to substances called locating agents. (Knowledge of *specific* locating agents is not required.)		The idea of locating agents not required.
Identify substances and assess their purity from melting point and boiling point information	1.9 understand that a pure substance has a fixed melting and boiling point, but that a mixture may melt or boil over a range of temperatures	Treatment of these topics is similar.
Understand the importance of purity in substances in everyday life, e.g. foodstuffs and drugs		No specific references required – emphasis is on understanding – teachers free to choose how they illustrate.
2.2.2 Methods of purification		
Describe and explain methods of purification		Treatment of these topics is similar.

by the use of a suitable solvent, filtration, crystallisation and distillation (including use of a fractionating column). (Refer to the fractional distillation of petroleum in section 14.2 and products of fermentation in section 14.6.)	1.10 describe these experimental techniques for the separation of mixtures: · simple distillation · fractional distillation · filtration · crystallisation	
Suggest suitable purification techniques, given information about the substances involved		
	1.4 know what is meant by the terms: · solvent · solute · solution · saturated solution.	Unique to Edexcel. This also provides an opportunity to develop skills about processing and interpreting experimental and graphical data.
	1.5C know what is meant by the term solubility in the units g per 100 g of solvent	
	1.6C understand how to plot and interpret solubility curves	
	1.7C *practical: investigate the solubility of a solid in water at a specific temperature*	

3 Atoms, elements and compounds

Cambridge	Edexcel	Notes
3.1 Atomic structure and the Periodic Table		
State the relative charges and approximate relative masses of protons, neutrons and electrons	1.15 know the structure of an atom in terms of the positions, relative masses and relative charges of sub-atomic particles	Identical treatment
Define *proton number* (atomic number) as the number of protons in the nucleus of an atom Define *nucleon number* (mass number) as the total number of protons and neutrons in the nucleus of an atom	1.16 know what is meant by the terms atomic number, mass number…	Note use of different terms – atomic number and mass number are more widely used.
Use proton number and the simple structure of atoms to explain the basis of the Periodic Table (see section 9), with special reference to the elements of proton number 1 to 20	1.18 understand how elements are arranged in the Periodic Table: · in order of atomic number · in groups and periods.	Treatment of these topics is similar.
Define *isotopes* as atoms of the same element which have the same proton number but a different nucleon number	1.16 know what is meant by the terms … isotopes	Treatment of these topics is similar.
	1.16 know what is meant by the terms … relative atomic mass (A_r) 1.17 be able to calculate the relative atomic mass of an element (A_r) from isotopic abundances	Calculations required. Also see Stoichiometry section
Understand that isotopes have the same properties because they have the same number of electrons in their outer shell		Not mentioned specifically but students would be expected to understand this form the discussion on isotopes/electronic configuration etc
State the two types of isotopes as being radioactive and non-radioactive		Not required
State one medical and one industrial use of		

radioactive isotopes		Edexcel emphasis on understanding the principles of Chemistry rather than rote learning
Describe the build-up of electrons in 'shells' and understand the significance of the noble gas electronic structures and of the outer shell electrons. (The ideas of the distribution of electrons in s and p orbitals and in d block elements are **not** required.)	1.19 understand how to deduce the electronic configurations of the first 20 elements from their positions in the Periodic Table 1.24 understand why the noble gases (Group 0) do not readily react	Treatment of these topics is similar.
	1.23 understand why elements in the same group of the Periodic Table have similar chemical properties	Emphasising the importance of electronic configuration in determining the reactions of elements.
3.2 Structure and bonding		
3.2.1 Bonding: the structure of matter		
	1.14 know what is meant by the terms atom and molecule	
Describe the differences between elements, mixtures and compounds, and between metals and non-metals	1.8 understand how to classify a substance as an element, compound or mixture 1.20 understand how to use electrical conductivity and the acid-base character of oxides to classify elements as metals or non-metals	Similar approach. Emphasis on electrical conductivity and nature of oxides in classifying metals/non-metals. Malleability explained in bonding section.
Describe an alloy, such as brass, as a mixture of a metal with other elements	**2.26C know that an alloy is a mixture of a metal and one or more elements, usually other metals or carbon**	Brass not needed specifically – different forms of steel covered below.
3.2.2 Ions and ionic bonds		
Describe the formation of ions by electron loss or gain	1.37 understand how ions are formed by electron loss or gain	Treatment of these topics is similar.
Describe the formation of ionic bonds between metallic and non-metallic elements	1.41 understand ionic bonding in terms of electrostatic attractions	Emphasis on understanding
	1.38 know the charges of these ions: · metals in Groups 1, 2 and 3 · non-metals in Groups 5, 6 and 7 · Ag^{+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Pb^{2+}, Zn^{2+}	Note: Groups are ***not*** numbered using Roman numerals in Edexcel syllabus

	· hydrogen (H^+), hydroxide (OH^-), ammonium (NH_4^+), carbonate (CO_3^{2-}), nitrate (NO_3^-), sulfate (SO_4^{2-}).	A more complete approach is required for Edexcel with the emphasis on understanding how to derive the formula of any ionic compound. This is essential understanding if students are to pursue Chemistry further.
Describe the formation of ionic bonds between elements from Groups I and VII	1.40 draw dot-and-cross diagrams to show the formation of ionic compounds by electron transfer, limited to combinations of elements from Groups 1, 2, 3 and 5, 6, 7 *only outer electrons need be shown*	
	1.39 write formulae for compounds formed between the ions listed above	
Describe the lattice structure of ionic compounds as a regular arrangement of alternating positive and negative ions	1.42 understand why compounds with giant ionic lattices have high melting and boiling points	Emphasis on understanding rather than description
3.2.3 Molecules and covalent bonds		
Describe the formation of single covalent bonds in H_2, Cl_2, H_2O, CH_4, NH_3 and HCl as the sharing of pairs of electrons leading to the noble gas configuration	1.44 know that a covalent bond is formed between atoms by the sharing of a pair of electrons	A more complete approach to covalent bonding – the emphasis is on understanding covalent bonding and being able to draw dot and cross diagrams for a wide variety of molecules, including organic molecules. Molecules where the central atom does not have a noble gas electronic configuration should be mentioned. An understanding of the nature of a covalent bond in terms of electrostatic attraction between the shared pair of electrons and both nuclei required.
	1.45 understand covalent bonds in terms of electrostatic attractions	
Describe the electron arrangement in more complex covalent molecules such as N_2, C_2H_4,	1.46 understand how to use dot-and-cross diagrams to represent covalent bonds in:	

CH_3OH and CO_2	· diatomic molecules, including hydrogen, oxygen, nitrogen, halogens and hydrogen halides · inorganic molecules including water, ammonia and carbon dioxide · organic molecules containing up to two carbon atoms, including methane, ethane, ethene and those containing halogen atoms.	
Describe the differences in volatility, solubility and electrical conductivity between ionic and covalent compounds	1.43 know that ionic compounds do not conduct electricity when solid, but do conduct electricity when molten and in aqueous solution 1.51 know that covalent compounds do not usually conduct electricity **1.55C understand why covalent compounds do not conduct electricity** **1.56C understand why ionic compounds conduct electricity only when molten or in aqueous solution**	Emphasis on understanding. Solubility not mentioned specifically. Electrical conductivity can be understood based on the chemical principles covered in the syllabus. (solubility very difficult to explain without reference to polarity of solvents, which is not in either syllabus)
Explain the differences in melting point and boiling point of ionic and covalent compounds in terms of attractive forces	1.42 understand why compounds with giant ionic lattices have high melting and boiling points 1.47 explain why substances with a simple molecular structures are gases or liquids, or solids with low melting and boiling points *the term intermolecular forces of attraction can be used to represent all forces between molecules*	Treatment of these topics is similar.
	1.48 explain why the melting and boiling points of substances with simple molecular structures increase, in general, with increasing relative molecular mass	Explanation in terms of increasing strength of intermolecular forces.
3.2.4 Macromolecules		
Describe the giant covalent structures of graphite and diamond	1.50 explain how the structures of diamond, graphite and C_{60} fullerene influence their	Emphasis on how the structure and bonding influence properties rather than describing structures.

	physical properties, including electrical conductivity and hardness	C_{60} fullerene required.
	1.49 explain why substances with giant covalent structures are solids with high melting and boiling points	
Relate their structures to their uses, e.g. graphite as a lubricant and a conductor, and diamond in cutting tools		Specific uses not required
Describe the macromolecular structure of silicon(IV) oxide (silicon dioxide)		SiO_2 not required.
Describe the similarity in properties between diamond and silicon(IV) oxide, related to their structures		
3.2.5 Metallic bonding		
Describe metallic bonding as a lattice of positive ions in a 'sea of electrons' and use this to describe the electrical conductivity and malleability of metals	**1.52C know how to represent a metallic lattice by a 2-D diagram** **1.54C explain typical physical properties of metals, including electrical conductivity and malleability**	Similar material covered but emphasis on understanding and explanation
	1.53C understand metallic bonding in terms of electrostatic attractions	This links together all three sections of bonding in that they all involve electrostatic attractions.

4 Stoichiometry

Cambridge	Edexcel	Notes
4.1 Stoichiometry		
Use the symbols of the elements and write the formulae of simple compounds		Basic knowledge that students would be expected to know.
Deduce the formula of a simple compound from the relative numbers of atoms present		
Deduce the formula of a simple compound from a model or a diagrammatic representation		
Determine the formula of an ionic compound from the charges on the ions present		see above
Construct word equations and simple balanced chemical equations	1.25 write word equations and balanced chemical equations (including state symbols): · for reactions studied in this specification · for unfamiliar reactions where suitable information is provided.	Treatment of these topics is similar. Ionic equations should be covered as useful in section on Redox
Construct equations with state symbols, including ionic equations		
Deduce the balanced equation for a chemical reaction, given relevant information		
Define *relative atomic mass*, A_r, as the average mass of naturally occurring atoms of an element on a scale where the ^{12}C atom has a mass of exactly 12 units	1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r)	Also see…3.1 Atomic structure and the Periodic Table
Define *relative molecular mass*, M_r, as the sum of the relative atomic masses. (*Relative formula mass* or M_r will be used for ionic compounds.) (Calculations involving reacting masses in simple proportions may be set. Calculations will **not** involve the mole concept.)	1.26 calculate relative formula masses (including relative molecular masses) (M_r) from relative atomic masses (A_r)	Treatment of these topics is similar.
Define the *mole* and the *Avogadro constant*	1.27 know that the mole (mol) is the unit for the amount of a substance	Avogadro constant not required – slightly different emphasis
Use the molar gas volume, taken as 24 dm^3 at room temperature and pressure	1.28 understand how to carry out calculations involving amount of substance, relative atomic mass (A_r) and relative formula mass (M_r)	Treatment of these topics is similar.
Calculate stoichiometric reacting masses, volumes of gases and solutions, and		

concentrations of solutions expressed in g / dm^3 and mol / dm^3. (Calculations involving the idea of limiting reactants may be set. Questions on the gas laws and the conversion of gaseous volumes to different temperatures and pressures will not be set.)	1.29 calculate reacting masses using experimental data and chemical equations **1.34C understand how to carry out calculations involving amount of substance, volume and concentration (in mol/dm^3) of solution** **1.35C understand how to carry out calculations involving gas volumes and the molar volume of a gas (24 dm^3 and 24 000 cm^3 at room temperature and pressure (rtp))**	
Calculate empirical formulae and molecular formulae	1.32 know what is meant by the terms empirical formula and molecular formula 1.31 understand how the formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water of crystallisation 1.33 calculate empirical and molecular formulae from experimental data	
Calculate percentage yield and percentage purity	1.30 calculate percentage yield	Percentage purity not required
	1.36 *practical: know how to determine the formula of a metal oxide by combustion (e.g. magnesium oxide) or by reduction (e.g. copper(II) oxide)*	

5 Electricity and chemistry

Cambridge	Edexcel	Notes
5.1 Electricity and chemistry		
	1.57C know that anion and cation are terms used to refer to negative and positive ions respectively	
Define electrolysis as the breakdown of an ionic compound, molten or in aqueous solution, by the passage of electricity		Specific definition not required
Describe the electrode products and the observations made during the electrolysis of: — molten lead(II) bromide — concentrated hydrochloric acid — concentrated aqueous sodium chloride — dilute sulfuric acid between inert electrodes (platinum or carbon) **Describe electrolysis in terms of the ions present and reactions at the electrodes in the examples given** State the general principle that metals or hydrogen are formed at the negative electrode (cathode), and that non-metals (other than hydrogen) are formed at the positive electrode (anode) Predict the products of the electrolysis of a specified binary compound in the molten state	**1.58C describe experiments to investigate electrolysis, using inert electrodes, of molten compounds (including lead(II) bromide) and aqueous solutions (including sodium chloride, dilute sulfuric acid and copper(II) sulfate) and to predict the products** **1.60C *practical: investigate the electrolysis of aqueous solutions***	Emphasis on a practical approach Similar approach to understanding of the process and prediction of products
Relate the products of electrolysis to the electrolyte and electrodes used, exemplified		Only inert electrodes required for Edexcel

by the specific examples in the Core together with aqueous copper(II) sulfate using carbon electrodes and using copper electrodes (as used in the refining of copper)		
Describe the electroplating of metals		Not required
Construct ionic half-equations for reactions at the cathode	**1.59C write ionic half-equations representing the reactions at the electrodes during electrolysis and understand why these reactions are classified as oxidation or reduction**	
Outline the uses of electroplating		Not required
Describe the reasons for the use of copper and (steel-cored) aluminium in cables, and why plastics and ceramics are used as insulators		Students should be able to relate the properties of aluminium and copper to their uses
Describe the transfer of charge during electrolysis to include: **— the movement of electrons in the metallic conductor** **— the removal or addition of electrons from the external circuit at the electrodes** **— the movement of ions in the electrolyte**		Students should understand reactions at the electrodes as oxidation and reduction
Predict the products of electrolysis of a specified halide in dilute or concentrated aqueous solution		Effect of concentration not required
Describe, in outline, the manufacture of: **— aluminium from pure aluminium oxide in molten cryolite (refer to section 10.3)** **— chlorine, hydrogen and sodium hydroxide from concentrated aqueous sodium chloride (Starting materials and essential conditions should be given but not technical details or diagrams.)**		Not required excep[t that students should understand why aluminium is extracted by electrolysis
Describe the production of electrical energy from simple cells, i.e. two electrodes in an electrolyte. (This should be linked with the reactivity series in		Not required

section 10.2 and redox in section 7.4.)		

6 Chemical energetics

Cambridge	Edexcel	Notes
6.1 Energetics of a reaction		practical approach
Describe the meaning of *exothermic* and *endothermic* reactions	3.1 know that chemical reactions in which heat energy is given out are described as exothermic, and those in which heat energy is taken in are described as endothermic	Treatment of these topics is similar.
	3.2 describe simple calorimetry experiments for reactions such as combustion, displacement, dissolving and neutralisation	Practical approach
	3.3 calculate the heat energy change from a measured temperature change using the expression $Q = mc\Delta T$	Calculations required.
	3.4 calculate the molar enthalpy change (ΔH) from the heat energy change, Q	
Draw and label energy level diagrams for exothermic and endothermic reactions using data provided Interpret energy level diagrams showing exothermic and endothermic reactions	**3.5C draw and explain energy level diagrams to represent exothermic and endothermic reactions**	Treatment of these topics is similar.
Describe bond breaking as an endothermic process and bond forming as an exothermic process	**3.6C know that bond-breaking is an endothermic process and that bond-making is an exothermic process**	Treatment of these topics is similar.
Calculate the energy of a reaction using bond energies	**3.7C use bond energies to calculate the enthalpy change during a chemical reaction**	

	3.8 *practical: investigate temperature changes accompanying some of the following types of change:* · *salts dissolving in water* · *neutralisation reactions* · *displacement reactions* · *combustion reactions.*	Emphasis on practical work
6.2 Energy transfer		
Describe the release of heat energy by burning fuels	4.11 know that a fuel is a substance that, when burned, releases heat energy	
State the use of hydrogen as a fuel		
Describe the use of hydrogen as a fuel reacting with oxygen to generate electricity in a fuel cell. (Details of the construction and operation of a fuel cell are not required.)		
Describe radioactive isotopes, such as ^{235}U, as a source of energy		Not required

7 Chemical reactions

Cambridge	Edexcel	Notes
7.1 Physical and chemical changes		
Identify physical and chemical changes, and understand the differences between them		Not mentioned specifically but required ion pre-International GCSE work
7.2 Rate (speed) of reaction		
Describe and explain the effect of concentration, particle size, catalysts (including enzymes) and temperature on the rate of reactions	3.10 describe the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas, temperature and the use of a catalyst on the rate of a reaction 3.11 explain the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas and temperature on the	Similar approach except enzymes not required

	rate of a reaction in terms of particle collision theory 3.12 know that a catalyst is a substance that increases the rate of a reaction, but is chemically unchanged at the end of the reaction 3.13 know that a catalyst works by providing an alternative pathway with lower activation energy	
Describe and explain the effects of temperature and concentration in terms of collisions between reacting particles. (An increase in temperature causes an increase in collision rate and more of the colliding molecules have sufficient energy (activation energy) to react whereas an increase in concentration only causes an increase in collision rate.)		
	3.14C draw and explain reaction profile diagrams showing Δ*H* and activation energy	Should be used to explain how a catalyst works
Describe the application of the above factors to the danger of explosive combustion with fine powders (e.g. flour mills) and gases (e.g. methane in mines)		Not required specifically
Devise and evaluate a suitable method for investigating the effect of a given variable on the rate of a reaction Demonstrate knowledge and understanding of a practical method for investigating the rate of a reaction involving gas evolution Interpret data obtained from experiments concerned with rate of reaction	3.9 describe experiments to investigate the effects of changes in surface area of a solid, concentration of a solution, temperature and the use of a catalyst on the rate of a reaction *3.15 practical: investigate the effect of changing the surface area of marble chips and of changing the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid*	Treatment of these topics is similar.

Note: Candidates should be encouraged to use the term *rate* rather than *speed*.	*3.16 practical: investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution*	
Describe and explain the role of light in photochemical reactions and the effect of light on the rate of these reactions. (This should be linked to section 14.4.)		Not required for Edexcel
Describe the use of silver salts in photography as a process of reduction of silver ions to silver; and photosynthesis as the reaction between carbon dioxide and water in the presence of chlorophyll and sunlight (energy) to produce glucose and oxygen		
7.3 Reversible reactions		
Understand that some chemical reactions can be reversed by changing the reaction conditions. (Limited to the effects of heat and water on hydrated and anhydrous copper(II) sulfate and cobalt(II) chloride.) (Concept of equilibrium is **not** required.)	3.17 know that some reactions are reversible and this is indicated by the symbol ⇌ in equations 3.18 describe reversible reactions such as the dehydration of hydrated copper(II) sulfate and the effect of heat on ammonium chloride	Similar approach but reference to ammonium chloride required rather than cobalt(II) chloride
Demonstrate knowledge and understanding of the concept of equilibrium	**3.19C know that a reversible reaction can reach dynamic equilibrium in a sealed container** **3.20C know that the characteristics of a reaction at dynamic equilibrium are:** **· the forward and reverse reactions occur at the same rate** **· the concentrations of reactants and products remain constant.**	Treatment of these topics is similar.
Predict the effect of changing the conditions (concentration, temperature and pressure) on other reversible reactions	**3.22C know the effect of changing either temperature or pressure on the position of equilibrium in a reversible reaction:** **· an increase (or decrease) in temperature shifts the position of**	Similar approach but effect of concentration not required

	equilibrium in the direction of the endothermic (or exothermic) reaction **· an increase (or decrease) in pressure shifts the position of equilibrium in the direction that produces fewer (or more) moles of gas** ***References to Le Chatelier's principle are not required***	
	3.21C understand why a catalyst does not affect the position of equilibrium in a reversible reaction	
7.4 Redox		
Define *oxidation* and *reduction* in terms of oxygen loss/gain. (Oxidation state limited to its use to name ions, e.g. iron(II), iron(III), copper(II), manganate(VII).) **Define *redox* in terms of electron transfer** **Define *oxidising agent* as a substance which oxidises another substance during a redox reaction. Define *reducing agent* as a substance which reduces another substance during a redox reaction.** **Identify oxidising agents and reducing agents from simple equations**	2.20 understand the terms: · oxidation · reduction · redox · oxidising agent · reducing agent in terms of gain or loss of oxygen and loss or gain of electrons.	The tern *oxidation state* is not required but otherwise a similar approach
Identify redox reactions by changes in oxidation state and by the colour changes involved when using acidified potassium manganate(VII), and potassium iodide. (Recall of equations involving $KMnO_4$ is not required.)		Not required

8 Acids, bases and salts

Cambridge	Edexcel	Notes
8.1 The characteristic properties of acids and bases		
Describe the characteristic properties of acids as reactions with metals, bases, carbonates and effect on litmus and methyl orange	2.37 describe the reactions of hydrochloric acid, sulfuric acid and nitric acid with metals, bases and metal carbonates (excluding the reactions between nitric acid and metals) to form salts 2.28 describe the use of litmus, phenolphthalein and methyl orange to distinguish between acidic and alkaline solutions	Treatment of these topics is similar.
Describe the characteristic properties of bases as reactions with acids and with ammonium salts and effect on litmus and methyl orange	2.32 know that alkalis can neutralise acids	Reaction of ammonia with alkalis only required in test for ammonia gas
Describe neutrality and relative acidity and alkalinity in terms of pH measured using universal indicator paper (whole numbers only)	2.29 understand how to use the pH scale, from 0–14, can be used to classify solutions as strongly acidic (0–3), weakly acidic (4–6), neutral (7), weakly alkaline (8–10) and strongly alkaline (11–14) 2.30 describe the use of universal indicator to measure the approximate pH value of an aqueous solution	Treatment of these topics is similar.
Describe and explain the importance of controlling acidity in soil		Not required as a specific example
	2.31 know that acids in aqueous solution are a source of hydrogen ions and alkalis in a aqueous solution are a source of hydroxide ions	

Define *acids* and *bases* in terms of proton transfer, limited to aqueous solutions	2.35 understand acids and bases in terms of proton transfer 2.36 understand that an acid is a proton donor and a base is a proton acceptor	Treatment of these topics is similar.
Describe the meaning of weak and strong acids and bases		Not required for Edexcel
8.2 Types of oxides		
Classify oxides as either acidic or basic, related to metallic and non-metallic character	2.38 know that metal oxides, metal hydroxides and ammonia can act as bases, and that alkalis are bases that are soluble in water 1.20 understand how to use electrical conductivity and the acid-base character of oxides to classify elements as metals or non-metals	Treatment of these topics is similar.
Further classify other oxides as neutral or amphoteric		Not required for Edexcel
	2.11 describe the combustion of elements in oxygen, including magnesium, hydrogen and sulfur	Details required. Relate to oxides formed.
8.3 Preparation of salts		
	2.34 know the general rules for predicting the solubility of ionic compounds in water: · common sodium, potassium and ammonium compounds are soluble · all nitrates are soluble · common chlorides are soluble, except those of silver and lead(II) · common sulfates are soluble, except for those of barium, calcium and lead(II) · common carbonates are insoluble, except for those of sodium, potassium and ammonium	Useful knowledge as this section requires students to have an appreciation of which salts/reagents are soluble/insoluble

	· common hydroxides are insoluble except for those of sodium, potassium and calcium (calcium hydroxide is slightly soluble).	
Demonstrate knowledge and understanding of preparation, separation and purification of salts as examples of some of the techniques specified in section 2.2.2 and the reactions specified in section 8.1 **Demonstrate knowledge and understanding of the preparation of insoluble salts by precipitation** **Suggest a method of making a given salt from a suitable starting material, given appropriate information**	2.39 describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an insoluble reactant **2.40C describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an acid and alkali** **2.33C describe how to carry out an acid-alkali titration** **2.41C describe an experiment to prepare a pure, dry sample of an insoluble salt, starting from two soluble reactants**	Treatment of these topics is similar.
	2.42 *practical: prepare a sample of pure, dry hydrated copper(II) sulfate crystals starting from copper(II) oxide*	Specific practicals required
	2.43C *practical: prepare a sample of pure, dry lead(II) sulfate*	
8.4 Identification of ions and gases		
Describe the following tests to identify: *aqueous cations*: aluminium, ammonium, calcium, chromium(III), copper(II), iron(II), iron(III) and zinc (using aqueous sodium hydroxide and aqueous ammonia as appropriate). (Formulae of complex ions are **not** required.) *cations*: use of the flame test to identify lithium, sodium, potassium and copper(II) *anions*: carbonate (by reaction with dilute acid and then	2.44 describe tests for these gases: · hydrogen · oxygen · carbon dioxide · ammonia · chlorine. 2.45 describe how to carry out a flame test 2.46 know the colours formed in flame tests for these cations: · Li^+ is red · Na^+ is yellow · K^+ is lilac · Ca^{2+} is orange-red	Some differences in the ions/gases for which tests required. The use of aqueous ammonia to distinguish between ions in aqueous solution not required.

limewater), chloride, bromide and iodide (by reaction under acidic conditions with aqueous silver nitrate), nitrate (by reduction with aluminium), sulfate (by reaction under acidic conditions with aqueous barium ions) and sulfite (by reaction with dilute acids and then aqueous potassium manganate(VII)) *gases*: ammonia (using damp red litmus paper), carbon dioxide (using limewater), chlorine (using damp litmus paper), hydrogen (using lighted splint), oxygen (using a glowing splint), and sulfur dioxide (using aqueous potassium manganate(VII))	· Cu^{2+} is blue-green. 2.47 describe tests for these cations: · NH_4^+ using sodium hydroxide solution and identifying the gas evolved · Cu^{2+}, Fe^{2+} and Fe^{3+} using sodium hydroxide solution. 2.48 describe tests for these anions: · Cl^-, Br^- and I^- using acidified silver nitrate solution · SO_4^{2-} using acidified barium chloride solution · CO_3^{2-} using hydrochloric acid and identifying the gas evolved.	

9 The Periodic Table

Cambridge	Edexcel	Notes
9.1 The Periodic Table		
Describe the Periodic Table as a method of classifying elements and its use to predict properties of elements	1.18 understand how elements are arranged in the Periodic Table: · in order of atomic number · in groups and periods.	
9.2 Periodic trends		
Describe the change from metallic to nonmetallic character across a period	1.21 identify an element as a metal or a non-metal according to its position in the Periodic Table	Similar understanding required
Describe and explain the relationship between Group number, number of outer shell electrons and metallic/non-metallic character	1.22 understand how the electronic configuration of a main group element is related to its position in the Periodic Table	

9.3 Group properties		
Describe lithium, sodium and potassium in Group I as a collection of relatively soft metals showing a trend in melting point, density and reaction with water	2.1 understand how the similarities in the reactions of these elements with water provide evidence for their recognition as a family of elements 2.2 understand how the differences between the reactions of these elements with air and water provide evidence for the trend in reactivity in Group 1 **2.4C explain the trend in reactivity in Group 1 in terms of electronic configurations**	Emphasis on understanding and explanations rather than description
Predict the properties of other elements in Group I, given data, where appropriate	2.3 use knowledge of trends in Group 1 to predict the properties of other alkali metals	
Describe the halogens, chlorine, bromine and iodine in Group VII, as a collection of diatomic non-metals showing a trend in colour and density and state their reaction with other halide ions	2.5 know the colours, physical states (at room temperature) and trends in physical properties of these elements 2.7 understand how displacement reactions involving halogens and halides provide evidence for the trend in reactivity in Group 7 **2.8C explain the trend in reactivity in Group 7 in terms of electronic configurations**	Emphasis on understanding and explanations rather than description
Predict the properties of other elements in Group VII, given data where appropriate	2.6 use knowledge of trends in Group 7 to predict the properties of other halogens	
Identify trends in Groups, given information about the elements concerned		Not required except for Group 1 and 7
9.4 Transition elements		Not required for Edexcel Syllabus
Describe the transition elements as a collection of metals having high densities, high melting points and forming coloured compounds, and which, as elements and compounds, often act as		

catalysts		
Know that transition elements have variable oxidation states		
9.5 Noble gases		
Describe the noble gases, in Group VIII or 0, as being unreactive, monoatomic gases and explain this in terms of electronic structure	1.24 understand why the noble gases (Group 0) do not readily react	
State the uses of the noble gases in providing an inert atmosphere, i.e. argon in lamps, helium for filling balloons		Specific uses not required

10 Metals

Cambridge	Edexcel	Notes
10.1 Properties of metals		
List the general physical properties of metals	1.20 understand how to use electrical conductivity and the acid-base character of oxides to classify elements as metals or non-metals	
Describe the general chemical properties of metals, e.g. reaction with dilute acids and reaction with oxygen		see 'reactivity series' for reactions of metals with acids. Reactions with oxygen not required.
Explain in terms of their properties why alloys are used instead of pure metals	**2.27C explain why alloys are harder than pure metals**	
Identify representations of alloys from diagrams of structure		Students should be expected to do this
10.2 Reactivity series		
Place in order of reactivity: potassium, sodium, calcium, magnesium, zinc, iron, (hydrogen) and copper, by reference to the reactions, if any, of the metals with: — water or steam	2.17 know the order of reactivity of these metals: potassium, sodium, lithium, calcium, magnesium, aluminium, zinc, iron, copper, silver, gold	Some differences in metals required but overall a similar approach.

— dilute hydrochloric acid and the reduction of their oxides with carbon Deduce an order of reactivity from a given set of experimental results	2.15 understand how metals can be arranged in a reactivity series based on their reactions with: · water · dilute hydrochloric or sulfuric acid.	Position of hydrogen relevant to electrolysis so should be included Carbon not mentioned specifically here but included in 'extraction of metals' section
	2.21 *practical: investigate reactions between dilute hydrochloric and sulfuric acids and metals (e.g. magnesium, zinc and iron)*	
Describe the reactivity series as related to the tendency of a metal to form its positive ion, illustrated by its reaction, if any, with: **— the aqueous ions** **— the oxides** **of the other listed metals**	2.16 understand how metals can be arranged in a reactivity series based on their displacement reactions between: · metals and metal oxides · metals and aqueous solutions of metal salts.	
Describe and explain the action of heat on the hydroxides, carbonates and nitrates of the listed metals	2.12 describe the formation of carbon dioxide from the thermal decomposition of metal carbonates, including copper(II) carbonate	relation to reactivity series not required
Account for the apparent unreactivity of aluminium in terms of the oxide layer which adheres to the metal		Unreactivity of aluminium should be known – included in reactivity series above.
10.3 Extraction of metals		
	2.22C know that most metals are extracted from ores found in the Earth's crust and that unreactive metals are often found as the uncombined element	
Describe the ease in obtaining metals from their ores by relating the elements to the reactivity series	**2.23C explain how the method of extraction of a metal is related to its position in the reactivity series, illustrated by carbon extraction for iron and electrolysis for aluminium**	
Describe and state the essential reactions in the extraction of iron from hematite		Specific details not required
Describe the conversion of iron into steel using		Not required

basic oxides and oxygen		
	2.24C be able to comment on a metal extraction process, given appropriate information ***detailed knowledge of the processes used in the extraction of a specific metal is not required***	Emphasis on understanding
Know that aluminium is extracted from the ore bauxite by electrolysis		Not required except an understanding of why aluminium is extracted by electrolysis
Describe in outline, the extraction of aluminium from bauxite including the role of cryolite and the reactions at the electrodes		
Discuss the advantages and disadvantages of recycling metals, limited to iron/steel and aluminium		
Describe in outline, the extraction of zinc from zinc blende		
10.4 Uses of metals		
Name the uses of aluminium: — in the manufacture of aircraft because of its strength and low density — in food containers because of its resistance to corrosion Name the uses of copper related to its properties (electrical wiring and in cooking utensils) Name the uses of mild steel (car bodies and machinery) and stainless steel (chemical plant and cutlery) **Describe the idea of changing the properties of iron by the controlled use of additives to form steel alloys**	**2.25C explain the uses of aluminium, copper, iron and steel in terms of their properties** ***the types of steel will be limited to low-carbon (mild), high-carbon and stainless***	Treatment of these topics is similar.

Explain the uses of zinc for galvanising and for making brass		use of Zinc in galvanising is required. Reference to brass not required

11 Air and water

Cambridge	Edexcel	Notes
11.1 Water		
Describe chemical tests for water using cobalt(II) chloride and copper(II) sulfate	2.49 describe a test for the presence of water using anhydrous copper(II) sulfate 2.50 describe a physical test to show whether a sample of water is pure	Cobalt(II) chloride not required Physical test also required
Describe, in outline, the treatment of the water supply in terms of filtration and chlorination		Not required for Edexcel
Name some of the uses of water in industry and in the home		
Discuss the implications of an inadequate supply of water, limited to safe water for drinking and water for irrigating crops		
11.2 Air		
State the composition of clean, dry air as being approximately 78% nitrogen, 21% oxygen and the remainder as being a mixture of noble gases and carbon dioxide	2.9 know the approximate percentages by volume of the four most abundant gases in dry air	
	2.10 understand how to determine the percentage by volume of oxygen in air using experiments involving the reactions of metals (e.g. iron) and non-metals (e.g. phosphorus) with air	Emphasis on a practical approach and understanding different methods for determining the percentage of oxygen in air
	2.14 *practical: determine the approximate percentage by volume of oxygen in air using a metal or a non-metal*	

Describe the separation of oxygen and nitrogen from liquid air by fractional distillation		Not required
Name the common pollutants in the air as being carbon monoxide, sulfur dioxide, oxides of nitrogen and lead compounds	4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air 4.15 explain how the combustion of some impurities in hydrocarbon fuels results in the formation of sulfur dioxide	Reference to nitrogen oxides formation below, Reference to lead compounds is not required.
State the source of each of these pollutants: — carbon monoxide from the incomplete combustion of carbon-containing substances — sulfur dioxide from the combustion of fossil fuels which contain sulfur compounds (leading to 'acid rain') — oxides of nitrogen from car engines — lead compounds from leaded petrol		
State the adverse effect of these common pollutants on buildings and on health and discuss why these pollutants are of global concern	4.13 understand why carbon monoxide is poisonous, in terms of its effect on the capacity of blood to transport oxygen *references to haemoglobin are not required* 4.16 understand how sulfur dioxide and oxides of nitrogen contribute to acid rain	Treatment of these topics is similar.
Describe and explain the presence of oxides of nitrogen in car engines and their catalytic removal	4.14 know that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming oxides of nitrogen	Catalytic converters not required
State the conditions required for the rusting of iron	2.18 know the conditions under which iron rusts	Treatment of these topics is similar.
Describe and explain methods of rust prevention, specifically paint and other coatings to exclude oxygen	2.19 understand how the rusting of iron may be prevented by: · barrier methods · galvanising · sacrificial protection.	

Describe and explain sacrificial protection in terms of the reactivity series of metals and galvanising as a method of rust prevention		
11.3 Nitrogen and fertilisers		Not required for Edexcel
Describe the need for nitrogen-, phosphorus- and potassium-containing fertilisers		
Describe and explain the essential conditions for the manufacture of ammonia by the Haber process including the sources of the hydrogen and nitrogen, i.e. hydrocarbons or steam and air		
Describe the displacement of ammonia from its salts		
11.4 Carbon dioxide and methane		
State that carbon dioxide and methane are greenhouse gases and explain how they may contribute to climate change	2.13 know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change	references to methane as a greenhouse gas not required.
State the formation of carbon dioxide: — as a product of complete combustion of carbon-containing substances — as a product of respiration — as a product of the reaction between an acid and a carbonate — from the thermal decomposition of a carbonate	2.12 describe the formation of carbon dioxide from the thermal decomposition of metal carbonates, including copper(II) carbonate	All reactions except respiration also included in Edexcel syllabus – reaction with acids covered in a separate section
Describe the carbon cycle, in simple terms, to include the processes of combustion, respiration and photosynthesis		Not required
State the sources of methane, including decomposition of vegetation and waste gases from digestion in animals		

12 Sulfur

Cambridge	Edexcel	Notes
Name some sources of sulfur		Not required for Edexcel
Name the use of sulfur in the manufacture of sulfuric acid		
Describe the manufacture of sulfuric acid by the Contact process, including essential conditions and reactions		
Describe the properties and uses of dilute and concentrated sulfuric acid		
State the uses of sulfur dioxide as a bleach in the manufacture of wood pulp for paper and as a food preservative (by killing bacteria)		

13 Carbonates

Cambridge	Edexcel	Notes
13.1 Carbonates		Not required for Edexcel
Describe the manufacture of lime (calcium oxide) from calcium carbonate (limestone) in terms of thermal decomposition		
Name some uses of lime and slaked lime such as in treating acidic soil and neutralising acidic industrial waste products, e.g. flue gas desulfurisation		
Name the uses of calcium carbonate in the manufacture of iron and cement		

14 Organic chemistry

Cambridge	Edexcel	Notes
14.1		
Name and draw the structures of methane, ethane, ethene, ethanol, ethanoic acid and the products of the reactions stated in sections 14.4–14.6	4.2 understand how to represent organic molecules using empirical formulae, molecular formulae, general formulae, structural formulae and displayed formulae	More general approach required and students should understand the difference between the ways of representing organic molecules

State the type of compound present, given a chemical name ending in *-ane*, *-ene*, *-ol*, or *-oic acid* or a molecular structure **Name and draw the structures of the unbranched alkanes, alkenes (not *cis-trans*), alcohols and acids containing up to four carbon atoms per molecule**	4.4 understand how to name compounds relevant to this specification using the rules of International Union of Pure and Applied Chemistry (IUPAC) nomenclature *students will be expected to name compounds containing up to six carbon atoms* 4.21 understand how to draw the structural and displayed formulae for alkanes with up to five carbon atoms in the molecule, and to name the unbranched-chain isomers 4.26 understand how to draw the structural and displayed formulae for alkenes with up to four carbon atoms in the molecule, and name the unbranched-chain isomers *knowledge of cis/trans or E/Z notation is not required* **4.30C understand how to draw structural and displayed formulae for methanol, ethanol, propanol (*propan-1-ol only*) and butanol (*butan-1-ol only*), and name each compound** ***the names propanol and butanol are acceptable*** **4.35C understand how to draw structural and displayed formulae for unbranched-chain carboxylic acids with up to four carbon atoms in the molecule, and name each compound**	Ability to name larger molecules required

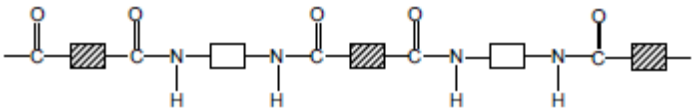
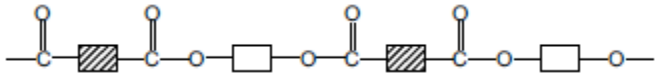
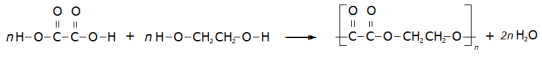
Name and draw the structural formulae of the esters which can be made from unbranched alcohols and carboxylic acids, each containing up to four carbon atoms		See 'esters' section below
	4.1 know that a hydrocarbon is a compound of hydrogen and carbon only	
	4.5 understand how to write the possible structural and displayed formulae of an organic molecule given its molecular formula	More emphasis on understanding organic Chemistry
	4.6 understand how to classify reactions of organic compounds as substitution, addition and combustion *knowledge of reaction mechanisms is not required*	
14.2 Fuels		
Name the fuels: coal, natural gas and petroleum		Not required
Name methane as the main constituent of natural gas		
Describe petroleum as a mixture of hydrocarbons and its separation into useful fractions by fractional distillation	4.7 know that crude oil is a mixture of hydrocarbons 4.8 describe how the industrial process of fractional distillation separates crude oil into fractions	The term 'crude oil' is used rather than 'petroleum'
Describe the properties of molecules within a fraction	4.10 know the trend in colour, boiling point and viscosity of the main fractions	
Name the uses of the fractions as: — refinery gas for bottled gas for heating and cooking — gasoline fraction for fuel (petrol) in cars — naphtha fraction for making chemicals	4.9 know the names and uses of the main fractions obtained from crude oil: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen	Similar approach but some differences in fractions

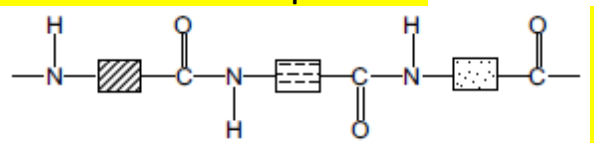
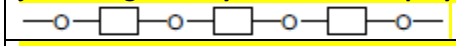
— kerosene/paraffin fraction for jet fuel — diesel oil/gas oil for fuel in diesel engines — fuel oil fraction for fuel for ships and home heating systems — lubricating fraction for lubricants, waxes and Polishes — bitumen for making roads		
14.3 Homologous series		
Describe the concept of homologous series as a 'family' of similar compounds with similar chemical properties due to the presence of the same functional group **Describe the general characteristics of a homologous series** **Recall that the compounds in a homologous series have the same general formula** **Describe and identify structural isomerism**	4.3 know what is meant by the terms homologous series, functional group and isomerism	Treatment of these topics is similar.
14.4 Alkanes		
	4.19 know the general formula for alkanes	
Describe the properties of alkanes (exemplified by methane) as being generally unreactive, except in terms of burning	4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air	Unreactivity not stressed
Describe the bonding in alkanes		Covered in covalent bonding section
Describe substitution reactions of alkanes with chlorine	4.22 describe the reactions of alkanes with halogens in the presence of ultraviolet radiation, limited to mono-substitution *knowledge of reaction mechanisms is not required*	
14.5 Alkenes		

	4.23 know that alkenes contain the functional group >C=C<	
	4.24 know the general formula for alkenes	
Describe the manufacture of alkenes and of hydrogen by cracking	4.17 describe how long-chain alkanes are converted to alkenes and shorter-chain alkanes by catalytic cracking (using silica or alumina as the catalyst and a temperature in the range of 600–700 ºC)	
	4.18 explain why cracking is necessary, in terms of the balance between supply and demand for different fractions	
Distinguish between saturated and unsaturated hydrocarbons: — from molecular structures — by reaction with aqueous bromine	4.20 explain why alkanes are classified as saturated hydrocarbons 4.25 explain why alkenes are classified as unsaturated hydrocarbons 4.28 describe how bromine water can be used to distinguish between an alkane and an alkene	Treatment of these topics is similar.
Describe the properties of alkenes in terms of addition reactions with bromine, hydrogen and steam	4.27 describe the reactions of alkenes with bromine to produce dibromoalkanes	Reaction with hydrogen not required. Reaction with steam covered in alcohols section
Describe the formation of poly(ethene) as an example of addition polymerisation of monomer units		See 'polymers' section below
14.6 Alcohols		
	4.29C know that alcohols contain the functional group –OH	
Describe the manufacture of ethanol by fermentation and by the catalytic addition of steam to ethene	**4.32C know that ethanol can be manufactured by:** **· reacting ethene with steam in the presence of a phosphoric acid catalyst at a temperature of about 300 ºC and a pressure of about 60–70 atm** **· the fermentation of glucose, in the absence of air, at an optimum**	

	temperature of about 30 ºC and using the enzymes in yeast	
	4.33C understand the reasons for fermentation, in the absence of air, and at an optimum temperature	
Outline the advantages and disadvantages of these two methods of manufacturing ethanol		Not required
Describe the properties of ethanol in terms of burning	**4.31C know that ethanol can be oxidised by:** **· burning in air or oxygen (complete combustion)** **· reaction with oxygen in the air to form ethanoic acid (microbial oxidation)** **· heating with potassium dichromate(VI) in dilute sulfuric acid to form ethanoic acid**	Additional reactions required
Name the uses of ethanol as a solvent and as a fuel		Specific uses not required
14.7 Carboxylic acids		
	4.34C know that carboxylic acids contain the COOH functional group	
Describe the properties of aqueous ethanoic acid	**4.36C describe the reactions of aqueous solutions of carboxylic acids with metals and metal carbonates**	Emphasis on chemical properties
Describe the formation of ethanoic acid by the oxidation of ethanol by fermentation and with acidified potassium manganate(VII)	**4.31C know that ethanol can be oxidised by:** **· reaction with oxygen in the air to form ethanoic acid (microbial oxidation)** **· heating with potassium dichromate(VI) in dilute sulfuric acid to form ethanoic acid**	Microbial oxidation required Different oxidising agent
Describe ethanoic acid as a typical weak acid		Classification of acids as strong/weak not required

Describe the reaction of a carboxylic acid with an alcohol in the presence of a catalyst to give an ester		Esters are a separate topic in Edexcel syllabus – see below
	4.37C know that vinegar is an aqueous solution containing ethanoic acid	
	(g) Esters **4.38C know that esters contain the functional group –COO-**	More detailed knowledge and understanding of Organic Chemistry required.
	4.39C know that ethyl ethanoate is the ester produced when ethanol and ethanoic acid react in the presence of an acid catalyst	
	4.40C understand how to write the structural and displayed formulae of ethyl ethanoate	
	4.41C understand how to write the structural and displayed formulae of an ester, given the name or formula of the alcohol and carboxylic acid from which it is formed and vice versa	
	4.42C know that esters are volatile compounds with distinctive smells and are used as food flavourings and in perfumes	
	4.43C *practical: prepare a sample of an ester such as ethyl ethanoate*	
14.8 Polymers		
14.8.1 Polymers		
Define polymers as large molecules built up from small units (monomers)	4.44 know that an addition polymer is formed by joining up many small molecules called monomers	
Understand that different polymers have different units and/or different linkages		Covered below.
14.8.2 Synthetic polymers		

Name some typical uses of plastics and of man-made fibres such as nylon and *Terylene*		Specific uses not required
Describe the pollution problems caused by non-biodegradable plastics	4.47 explain problems in the disposal of addition polymers, including: · their inertness and inability to biodegrade · the production of toxic gases when they are burned.	
Deduce the structure of the polymer product from a given alkene and *vice versa*	4.45 understand how to draw the repeat unit of an addition polymer, including poly(ethene), poly(propene), poly(chloroethene) and (poly)tetrafluoroethene 4.46 understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa	Treatment of these topics is similar.
Explain the differences between condensation and addition polymerisation		An understanding of this would be expected from the discussions of the two types of polymers
Describe the formation of nylon (a polyamide) and *Terylene* (a polyester) by condensation polymerisation, the structure of nylon being represented as:  **and the structure of *Terylene* as:** 	**4.48C know that condensation polymerisation, in which a dicarboxylic acid reacts with a diol, produces a polyester and water** **4.49C understand how to write the structural and displayed formula of a polyester, showing the repeat unit, given the formulae of the monomers from which it is formed including the reaction of ethanedioic acid and ethanediol:** 	Only polyesters required

Details of manufacture and mechanisms of these polymerisations are not required.)		
	4.50C know that some polyesters, known as biopolyesters, are biodegradable	
14.8.3 Natural polymers		Not required for Edexcel
Name proteins and carbohydrates as constituents of food		
Describe proteins as possessing the same (amide) linkages as nylon but with different units		
Describe the structure of proteins as: 		
Describe the hydrolysis of proteins to amino acids. (Structures and names are not required.)		
Describe complex carbohydrates in terms of a large number of sugar units, considered as  **, joined together by condensation polymerisation, e.g.** 		
Describe the hydrolysis of complex carbohydrates (e.g. starch), by acids or enzymes to give simple sugars		
Describe the fermentation of simple sugars to produce ethanol (and carbon dioxide). (Candidates will not be expected to give the molecular formulae of sugars.)		
Describe, in outline, the usefulness of chromatography in separating and identifying the products of hydrolysis of carbohydrates and proteins		