Edexcel IGCSE 2009 Chemistry – 4CH0

Editable scheme of work - This document downloaded from the Edexcel site and has since been edited and updated by Angela Horn.

Class Practicals which are purple are ones which we tried at home, or would try. Please use your own judgement and don't rely on mine if you're considering doing this!

The fact that an experiment has not been marked in purple doesn't mean that it's not do-able at home - it may just mean that we didn't get round to trying or planning it.

Scheme of work

This scheme of work has been produced to help you implement this Edexcel specification. It is offered as an example of one possible model that you should feel free to adapt to meet your needs and is not intended to be in any way prescriptive. It is in editable Word format to make adaptation as easy as possible. (Please note: the single science specifications comprise two papers: Paper 1 assesses only content which is **not** in bold, and Paper 2 assesses all content **including** content in bold.)

Other course planning support

You will find other support for planning the course in the Teacher Support Materials. www.edexcel.com/igcse2009

Websites

[Few of the original links worked. The link to www.pearsonhotlinks.co.uk was no use either as it did not recognise the book, and on further investigation there was little of any use there anyway. Much better resources are on the author Jim Clark's own site, and are listed by chapter relevance: www.chemguide.co.uk

Edexcel IGCSE in Chemistry (4CH0)

The number of guided learning hours required for this qualification is 120–140, which equates to approximately 2 hours per week over 60 weeks and reflects how centres will use time for practical activities differently. Guided Learning Hours are all the times when a teacher is present to give guidance.

AH notes on resources:

You can buy small quantities of most of the chemicals you need on eBay or Amazon. Alternatively, for larger quantities see www.reagent.co.uk . Many chemicals can be supplied without restrictions, but if you need something which they say is 'restricted' then you can contact them and provide evidence that you're working towards and exam. An easy source of hydrochloric acid is 'Spirits of Salts' which is sold in hardware/cleaning shops - it's approx 30% HCl solution in water.

A good, laboratory-style balance opens up the possibilities of experiments you can do. These can be expensive, but we used the MyWeigh ibalance as recommended in the Illustrated Guide to Home Chemistry Experiments- eg see http://www.ourweigh.co.uk/precision-carat-scales/ibalance-201.html

Jim Clark, author of the Edexcel textbook, has a chapter-by-chapter list of additional resources here. http://www.chemguide.co.uk/igcse/index.html

Practical Chemistry - http://www.practicalchemistry.org - thorough notes on safety issues etc.. so may help you to decide whether it's practical to do this experiment at home. Also has good explanations and teaching tips.

RSC Classic Chemistry Experiments - Royal Society of Chemistry. Source for any activities referred to as 'CCE' or 'RSC CCE' below.

NOTE: Always worth checking the Practical Chemistry page on the CCE; often there are additional tips or updates.

RSC Classic Chemistry Demonstrations - activities listed below as 'RSC CC Demo' are for the teacher to demonstrate, not for the class to do. These too are detailed on the RSC site; just go to RSC Learn Chemistry site and search for the demonstration you need, with title as listed in the Scheme of Work.

RSC Education Playlist on Youtube

RSC Demonstration Videos - for teachers, with demo tips:

RSC/Teachers TV Video Clips: http://www.rsc.org/Education/Teachers/Resources/Practical-Chemistry/video-clips/index.asp

Doc Brown's free support page for IGCSE Edexcel Chemistry:

Khan Academy - lots of chemistry videos.

Basic chem lab techniques from About.com

MIT Chemistry Lab Techniques - YouTube collection

'Illustrated Guide to Home Chemistry Experiments' by Robert Bruce Thompson. Book aimed at home-educators and those interested in doing serious home chemistry. I have referred to it below as 'Home Chem Expt:... ' Useful on safety and practical considerations when carrying out experiments at home, plus which pieces of equipment you can substitute or improvise. Author's website, with some amendments and additions to the text. Support forums have lots of discussion from home-edders.

How to write a lab report: http://chemistry.about.com/od/chemistrylabexperiments/a/labreports.htm (I think this goes way beyond GCSE level though)

How to make Limewater - to test for CO2. Easy home-make solution of calcium hydroxide. And here is a video showing how to test for CO2 in exhaled air compared to room air, using the limewater.

Acid-Base titration step by step from titrations.info

Chemistry lab technique tutorials: http://www.sciencebuddies.org/science-fair-projects/project_ideas/Chem_Lab_Techniques.shtml

Safety issues: http://www.sciencebuddies.org/science-fair-projects/project_ideas/Chem_Safety.shtml

Chemistry Diagrams: http://www.btinternet.com/~chemistry.diagrams/index.htm

Home-ed High School Chemistry - a US-based list of resources and their chemistry curriculum, with good links.

Week	Content coverage	Learning outcomes	Exemplar activities	Exemplar resources
1	**Section 1: Principles of**	Students will be assessed on their ability to:	**Activities:**	Edexcel IGCSE Chemistry Student Book

	chemistry **a)** States of matter **b)** Atoms	**1.1** understand the arrangement, movement and energy of the particles in each of the three states of matter: solid, liquid and gas **1.2** describe how the interconversions of solids, liquids and gases are achieved and recall the names used for these interconversions **1.3** describe the changes in arrangement, movement and energy of particles during these interconversions **1.4** describe simple experiments leading to the idea of the small size of particles and their movement including: i dilution of coloured solutions ii diffusion experiments	• Model particle behaviour in the three states using trays of marbles; draw diagrams of the results. **Demonstration:** • Diffusion of gases – ammonia and hydrogen chloride (RSC 65) - needs fume cupboard so watch video instead: http://www.youtube.com/watch?v=WAJAslkwolk • Bromine diffusing into a gas jar of air.:http://www.youtube.com/watch?v=Aa03WKRB2z0&feature=related - quick, efficient vid. **Class practical:** • Diffusion in liquids (RSC 27) - potassium iodide and lead nitrate in deionised water - http://www.practicalchemistry.org/experiments/diffusion-in-liquids,185,EX.html • **Recording a heating curve for water, from ice to boiling point.** •	Pages 1–4 RSC CCE Page 68 - you can find all the RSC Classic Chemistry Experiments here: http://www.rsc.org/Education/Teachers/Resources/Books/CCE.asp [error - RSC CC Demo Page 162] http://www.practicalchemistry.org/experiments/diffusion-of-gases-ammonia-and-hydrogen-chloride,184,EX.html More Bromine diffusion - just a brief demo but in real-time: :http://www.youtube.com/watch?v=R_xDe004oTQ&feature=related **Heating curve for water: definitely do-able at home!** Tips from practicalphysics may help: http://www.practicalphysics.org/go/Experiment_207.html and here: http://www.kentchemistry.com/links/Matter/HeatingCurve.htm
2	**Section 1: Principles of chemistry** **b)** Atoms **c)** Atomic structure	Students will be assessed on their ability to: **1.5** understand the terms atom and molecule **1.8** recall that atoms consist of a central nucleus, composed of protons and neutrons, surrounded by electrons, orbiting in shells **1.9** recall the relative mass and relative charge of a proton, neutron and electron **1.10** understand the terms atomic number, mass number, isotopes and relative atomic mass (A_r)	**Activities:** • Complete table of properties of subatomic particles. • Given atomic number and mass number, make a model of a nucleus of an atom using polystyrene balls. • Given atomic numbers and mass numbers, find atomic structure and A_r of different isotopes. • Identify which atoms are isotopes, given data on their atomic structure.	Edexcel IGCSE Chemistry Student Book Pages 6–8 **Video clips:** • Atoms and Their Electrons: history of atomic theory (this seems to be a schools vid that is for sale. 30 day free trial at clickview may enable us to watch it: http://www.clickview.co.uk/) • BBC TV documentaries: Atom and The Magic of Chemistry (can't find this anywhere online)
3	**Section 1: Principles of**	Students will be assessed on their ability to:	**Activities:**	Edexcel IGCSE Chemistry Student Book

	chemistry **c)** Atomic structure	**1.12** understand that the Periodic Table is an arrangement of elements in order of atomic number **1.13** deduce the electronic configurations of the first twenty elements from their positions in the Periodic Table **1.14** deduce the number of outer electrons in a main group element from its position in the Periodic Table	• ActiveBook animation • Make a model of an atom using paper and card, to show electrons, shells and the nucleus. • Draw electronic configurations of first 20 elements. Cut out diagrams and arrange on a blank Periodic Table.	Pages 9–12 Atomic structure: ActiveBook Page 10, animation CGP GCSE Chemistry Edexcel Workbook
4	**Section 1: Principles of chemistry** **b)** Atoms **g)** Covalent substances **Section 2: Chemistry of the elements** **b)** The Periodic Table	Students will be assessed on their ability to: **1.5** understand the terms atom and molecule **1.6** understand the differences between elements, compounds and mixtures **2.5** recall the noble gases (Group 0) as a family of inert gases and explain their lack of reactivity in terms of their electronic configurations **1.37** describe the formation of a covalent bond by the sharing of a pair of electrons between two atoms **1.38** understand covalent bonding as a strong attraction between the bonding pair of electrons and the nuclei of the atoms involved in the bond **1.39** explain, using dot and cross diagrams, the formation of covalent compounds by electron sharing for the following substances: • hydrogen • chlorine • hydrogen chloride • water • methane	**Activities**: • ActiveBook animation • Identifying different particles from diagrams of them • Drawing dot/cross diagrams of molecules in the specification; drawing displayed formulae of the molecules • Making models from displayed formulae. **Demonstration:** • Exploding balloons, to compare hydrogen and helium, density and combustion. Let YouTube do the work here! Alternatively, not too difficult to do on your own - buy a helium balloon for one, and generate some hydrogen for the other. See Appendix 2.	Edexcel IGCSE Chemistry Student Book Pages 13–17 and 30–31 Simple molecular substances: ActiveBook Page 15, animation **Video clips:** • Scientific Eye: Elements section on difference between hydrogen and helium • Atoms and Their Electrons: covalent bonding

		• ammonia • oxygen • nitrogen • carbon dioxide • ethane • ethene		
5	**Section 1: Principles of chemistry** **f)** Ionic compounds	Students will be assessed on their ability to: **1.27** describe the formation of ions by the gain or loss of electrons **1.30** deduce the charge of an ion from the electronic configuration of the atom from which the ion is formed **1.31** explain, using dot and cross diagrams, the formation of ionic compounds by electron transfer, limited to combinations of elements from Groups 1, 2, 3, and 5, 6, 7 **1.32** understand ionic bonding as a strong electrostatic attraction between oppositely charged ions	**Activities:** • Draw dot/cross diagrams of electron transfer and ion formation for combinations of elements listed. Work out the formulae and name of the compounds formed. • Draw a cartoon of ionic bonding, e.g. when sodium met chlorine. **Demonstration:** • Combination of elements: aluminium with iodine, magnesium with sulfur. **Class practical:** • **A compound from two elements (RSC 14): iron plus sulfur.**	Edexcel IGCSE Chemistry Student Book Pages 17–19 RSC CCE Page 35 **Video clip:** • Atoms and Their Electrons: ionic bonding Easy win; sulfur easy to obtain.
6	**Section 1: Principles of chemistry** **Section 2: Chemistry of the elements**	Consolidation and assessment	• Revision exercises • End of Section test	ActiveBook multiple choice and revision checklists: Chapters 1, 2 and 3
7	**Section 1: Principles of chemistry** **e)** Chemical formulae and chemical equations **f)** Ionic compounds	Students will be assessed on their ability to: **1.29** recall the charges of common ions in this specification **1.20** write word equations and balanced chemical equations to represent the reactions studied in this specification **1.21** use the state symbols (s), (l), (g) and (aq)	**Activities** • ActiveBook animation • Predict the formulae of named compounds using a table of common ions. • Learn the formula and charge of ions: games, e.g. Ion Bingo • Formula test • Practice writing word equations from descriptions of chemical reactions • Practice writing balanced chemical equations including state symbols from word equations.	Edexcel IGCSE Chemistry Student Book Pages 33–38 Balancing equations for neutralisation reactions: ActiveBook Page 36, animation c Games for learning formulae: RSC Inspirational Chemistry: Resources for Modern Curricula Chapter 2

		in chemical equations to represent solids, liquids, gases and aqueous solutions respectively	**Demonstration:** ● **The combustion of iron wool (RSC 5)** see YouTube demo **Class practical:** ● Observing a range of compounds and noting their formula and names, looking for patterns.	
8	**Section 2: Chemistry of the elements** **f)** Reactivity series	Students will be assessed on their ability to: **2.31** describe how reactions with water and dilute acids can be used to deduce the following order of reactivity: potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper **2.33** understand oxidation and reduction as the addition and removal of oxygen respectively **2.32** deduce the position of a metal within the reactivity series using displacement reactions between metals and their oxides	**Activities:** ● Use practical results (see below) plus additional evidence to place metals in a reactivity series. ● Make predictions about the reactivity of a metal given its place in the reactivity series. ● Make a poster showing what happens in a displacement reaction. **Demonstration:** ● The reaction between zinc and copper oxide (RSC 11). ● Thermit reaction (RSC 74). **Class practical:** ● Reaction of metals with acids and with water ● Competition for oxygen (RSC 31).	Edexcel IGCSE Chemistry Student Book Pages 60–67 RSC CC Demo Page 22 RSC CCE Page 79 Thermit reaction is one to watch on YouTube rather than DIY - it was a favourite on Brainiac, and see, eg: YouTube Thermit reaction We did demonstration of **reaction of sodium with water** at home. We bought a tiny amount of sodium from eBay - it cost about £12 and was posted coated in oil and wrapped in film. We added phenolphthalein to the water so we could see it become alkaline, then added a small pea-sized lump to about 1l water.. I watched several videos first so we knew what to expect, wore gloves, and kept the kids back. We made a home-made safety shield from perspex. YouTube demo of sodium and potassium in water RSC Classic Chemistry Demonstrations - Reactions of Alkali Metals
9	**Section 1: Principles of chemistry** **f)** Ionic compounds **Section 2: Chemistry**	Students will be assessed on their ability to: **2.30** recall that metals can be arranged in a reactivity series based on the reactions of the metals and their compounds: potassium,	**Activities:** ● Deduce a reactivity series from practical results (see below). ● Use practical results to write chemical equations for displacement reactions.	Edexcel IGCSE Chemistry Student Book Pages 60–67 RSC CCE Page 249

	of the elements **f)** Reactivity series	sodium, lithium, calcium, magnesium, aluminium, zinc, iron, copper, silver and gold **2.32** deduce the position of a metal within the reactivity series using displacement reactions between metals and their salts in aqueous solutions **1.28** understand oxidation as the loss of electrons and reduction as the gain of electrons **2.34** understand the terms: redox, oxidising agent and reducing agent	• deduce ionic equations from displacement chemical equations. • Draw dot/cross diagrams to illustrate electron transfer in the formation of ions from atoms. • Learn OILRIG (Oxidation Is Loss, Reduction Is Gain) or LEO says GER (Loss of Electrons is Oxidation, Gain of Electrons is Reduction) or make up a mnemonic to remember redox behaviour in terms of electron transfer. **Class practical:** • Displacement reactions between metals and their salts (RSC 97).	
10	**Section 2: Chemistry of the elements** **f)** Reactivity series **Section 5: Chemistry in society** **a)** Extraction and uses of metals	Students will be assessed on their ability to: **5.1** explain how the methods of extraction of the metals in this section are related to their positions in the reactivity series **5.4** describe and explain the main reactions involved in the extraction of iron from iron ore (haematite), using coke, limestone and air in a blast furnace **2.35** recall the conditions under which iron rusts **2.36** describe how the rusting of iron may be prevented by grease, oil, paint, plastic and galvanising **2.37** understand the sacrificial protection of iron in terms of the reactivity series	**Activities:** • Make a poster about the chemical reactions in a blast furnace. • Draw conclusions from rusting experiments to compare effectiveness of different corrosion prevention methods. **Demonstration:** • Thermit reaction (RSC 74). **Class practical:** • **The causes of rusting (RSC 50).;** (uses Calcium Chloride, but could subs any dessicant granules etc - the purpose is just to absorb water. See RSC notes.)	Edexcel IGCSE Chemistry Student Book Pages 139–145 RSC CC Demo Page 196 RSC CCE Page 126 **Video clips:** • Chemistry in Action: Iron and Steel • Scientific Eye: Materials and their Properties, Rust
11	**Section 5: Chemistry in society** **a)** Extraction and uses of metals	Students will be assessed on their ability to: **5.2** describe and explain the extraction of aluminium from purified aluminium oxide by electrolysis, including: i the use of molten cryolite as a solvent and	**Activities:** • Answer comprehension questions to consolidate learning. • Draw and label a diagram of aluminium electrolysis. • Research the uses of aluminium and iron.	Edexcel IGCSE Chemistry Student Book Pages 139–145 RSC CC Demo Page 39 **Video clip:**

		to decrease the required operating temperature ii the need to replace the positive electrodes iii the cost of the electricity as a major factor **5.3** write ionic half-equations for the reactions at the electrodes in aluminium extraction **5.5** explain the uses of aluminium and iron, in terms of their properties	Relate the uses to the properties of the metals. ● Evaluate the advantages of recycling aluminium over extracting it from ore, given key facts about both processes. **Demonstration:** ● The real reactivity of aluminium (RSC 18).	● Chemistry in Action: Aluminium. ● RSC video on Aluminium Don't want to do the RSC18 demo at home; there are plenty of aluminium+HCl vids on YouTube. Poisonous fumes... What we DID enjoy to demonstrate that aluminium can be highly reactive, was mixing **powdered aluminium with iodine**, and adding a tiny amount of HOT water as a catalyst - dramatic purple smoke! You can do this outside - keep kids out of the purple smoke, and place mixture on a tin lid. Experiment notes and videos available online.
RSC**12**	**Section 1: Principles of chemistry** **Section 5: Chemistry in society**	**Consolidation and assessment**	● Revision exercises ● End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapter 5, 8 and 17.
13	**Section 2: Chemistry of the elements** **c)** Group 7 elements – chlorine, bromine and iodine **Section 4: Physical chemistry** **a)** Acids, alkalis and salts	Students will be assessed on their ability to: **4.1** describe the use of the indicators litmus, phenolphthalein and methyl orange to distinguish between acidic and alkaline solutions **4.2** understand how the pH scale, from 0 to 14, can be used to classify solutions as strongly acidic, weakly acidic, neutral, weakly alkaline or strongly alkaline **4.3** describe the use of universal indicator to measure the approximate pH value of a solution **4.4** define acids as sources of hydrogen ions, H^+, and alkalis as sources of hydroxide ions, OH^- **2.11** understand the difference between hydrogen chloride gas and hydrochloric acid	**Activities:** ● Complete a pH chart showing the pH of everyday substances. ● Write a short magazine article entitled 'What causes acidity', using information on Pages 76–78 of the Student Book. **Demonstration:** ● Hydrogen chloride gas: demonstrating its effect on moist blue litmus paper and on dry blue litmus paper. ● Solutions of HCl in methylbenzene and in water: testing the solutions with blue litmus paper. **Class practical:** ● **The pH scale (RSC 10).(need universal indicator)**	Edexcel IGCSE Chemistry Student Book Pages 70–78 RSC CCE Page 23 **Video clips:** ● Materials and their Properties: Acids and Alkalis ● Relevant video clips at: BBC Learning Zone Broadband Class Clips ● Video resource at: Teachers TV

		2.12 explain, in terms of dissociation, why hydrogen chloride is acidic in water but not in methylbenzene		
14	**Section 2: Chemistry of the elements** **g)** Test for ions and gases **Section 4: Physical chemistry** **a)** Acids, alkalis and salts	Students will be assessed on their ability to: **4.5** predict the products of reactions between dilute hydrochloric, nitric and sulfuric acids; and metals, metal oxides and metal carbonates (excluding the reactions between nitric acid and metals) **2.40** describe simple tests for hydrogen	**Activities:** ● Invent a card game to learn the name and formulae of salts. ● Complete word and chemical equations to learn the patterns in the reactions of acids. ● Derive ionic equations from chemical equations to understand the role of H^+ in the reactions. **Class practical:** ● The reaction of acids with metals, metal oxides and carbonates.	Edexcel IGCSE Chemistry Student Book Pages 70–78 Action of acids on metals - YouTube Find other vids if don't do this one.
15	**Section 1: Principles of chemistry** **b)** Atoms **Section 4: Physical chemistry** **a)** Acids, alkalis and salts	Students will be assessed on their ability to: **4.6** recall the general rules for predicting the solubility of salts in water: i all common sodium, potassium and ammonium salts are soluble ii all nitrates are soluble iii common chlorides are soluble, except silver chloride iv common sulfates are soluble, except those of barium and calcium v common carbonates are insoluble, except those of sodium, potassium and ammonium **4.7** describe how to prepare soluble salts from acids **1.7** describe techniques for the separation of mixtures, including filtration and crystallisation **4.8** describe how to prepare insoluble salts	**Activities:** ● Write up the experimental method of the salt preparation experiments: draw diagrams of the apparatus used. ● Write balanced chemical equations for the preparation of given salts. ● Learn solubility rules for a solubility quiz. ● Predict whether given salts are soluble or insoluble in water. ● Given the name of a salt, suggest methods for preparing it. **Class practical:** ● Reaction between a metal oxide and dilute acid (RSC 39)(● **Forming a salt that is insoluble in water (RSC 47).(needs magnesium sulfate and sodium carbonate**)	Edexcel IGCSE Chemistry Student Book Pages 81–87 RSC CCE Pages 99 and 118

		using precipitation reactions **4.9** describe how to carry out acid–alkali titrations		
16	**Section 4: Physical chemistry** **c)** Rates of reaction	Students will be assessed on their ability to: **4.17** describe experiments to investigate the effects of changes in surface area of a solid and concentration of solutions on the rate of a reaction **4.18** describe the effects of changes in surface area of a solid, concentration of solutions and pressure of gases on the rate of a reaction **4.20** explain the effects of changes in surface area of a solid, concentration of solutions and pressure of gases in terms of particle collision theory	**Activities:** ● Draw graphs to show the effect of concentration on rate of reaction. ● Deduce a trend from the graph, e.g. 'doubling concentration doubles rate'. ● Draw particle pictures to illustrate surface area and concentration effects. ● Write a particle theory explanation for the effects of surface area and of concentration on reaction rate. **Demonstration:** ● Clock reaction (RSC 23).(Nice vid) **Class practical:** ● **Rate of reaction – the effects of concentration and temperature (RSC 29).** ● **The effect of changing surface area on the rate of a reaction.**	Edexcel IGCSE Chemistry Student Book Pages 41–50 RSC CCE Page 73 RSC CC Demo Page 50 Multimedia Science School 11–16 Edition: Particle animation Birchfield Interactive: Rates of Reaction Ages 14–16 **Easier to do alka seltzer reaction rates**. Instructions on sciencebuddies.org and here and Home Chem Expt p 212 - Surface area alka seltzer experiment at sciencebuddies.org and a more advanced one . Alka Seltzer have other suggested studies of reaction rates.
17	**Section 4: Physical chemistry** **c)** Rates of reaction	Students will be assessed on their ability to: **4.17** describe experiments to investigate the effects of changes in temperature and the use of a catalyst on the rate of a reaction **4.18** describe the effects of changes in temperature and the use of a catalyst on the rate of a reaction **4.19** understand the term 'activation energy' and represent it on a reaction profile **4.20** explain the effects of changes in temperature on the rate of a reaction in terms of particle collision theory	**Activities:** ● Draw a graph of temperature vs rate of reaction, from practical results (see below): deduce a trend from the graph. ● Draw reaction profile diagrams to illustrate the effects of temperature change and of a catalyst. ● View ActiveBook animation of a catalytic converter as an example of the function of a catalyst. ● Use interactive animation software to visualise collision theory. Students may write an account of what they observe using animation software. (Multimedia Science School.) **Demonstration:** ● Catalysts for the thermal decomposition of potassium chlorate.	Edexcel IGCSE Chemistry Student Book Pages 41–50 Catalytic converter: ActiveBook Page 44, animation RSC CCE Pages 73, 145 RSC CC Demo Page 245 Multimedia Science School 11–16 Edition: Particle animation Birchfield Interactive: Rates of Reaction Ages 14–16 Alternative Catalysis expts: Home Chem Guide p223. OR sciencebuddies.org has one using hydrogen peroxide and

		4.21 understand that a catalyst speeds up a reaction by providing an alternative pathway with lower activation energy	• Demonstration of a liquid siphon to illustrate the concept of activation energy. **Class practical:** • Catalysis (RSC 58).(Maybe do expt • Rate of reaction – the effects of concentration and temperature (RSC 29).	potatoes. Quite a big project though. Also RSC demo reaction of Iodine and Aluminium, catalysed by water. Says it is spectacular; best done outside! YouTube vid of home demo of this.
18	**Section 1: Principles of chemistry** **Section 2: Chemistry of the elements** **Section 4: Physical chemistry**	Consolidation and assessment	• Revision exercises • End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 6, 9 and 10
19	**Section 2: Chemistry of the elements** **e)** Hydrogen and water	Students will be assessed on their ability to: **2.26** describe the reactions of dilute hydrochloric and dilute sulfuric acids with magnesium, aluminium, zinc and iron **2.27** describe the combustion of hydrogen **2.28** describe the use of anhydrous copper(II) sulfate in the chemical test for water **2.29** describe a physical test to show whether water is pure	**Activities:** • Draw a diagram of apparatus for the preparation of hydrogen. • Write chemical equations for the reaction of acids with metals to produce hydrogen and a salt. • Write a short account of the preparation of anhydrous copper(II) sulfate and its use. • Research and present methods for determining the purity of water, and how water can be purified. **Demonstration:** • Water as the product of burning hydrogen (RSC 66). • A controlled hydrogen explosion (RSC 36). • Exploding balloons (RSC 37). **Class practical:** • Making hydrogen in the lab (Student Book Page 73). Nice video of this. • Heating copper(II) sulfate (RSC 53). • Measuring the boiling point of water.	Edexcel IGCSE Chemistry Student Book Pages 71–73 and 93 RSC CCE Page 134 RSC CC Demo Pages 82–89 **Heating Copper Sulfate easy to do at home**; quick vid on home setup here. See RSC Heating Copper (2) Sulfate. See also notes from Practical Chemistry on this. Can just heat in test tube until it goes white, then later add water back. If you allow it to cool first then add water drop by drop (tap water will do), can measure temp and show this is an exothermic reaction too. Also an example of a chemical change which is reversible - see Mike Curtis Reaction pages.
20	**Section 2: Chemistry of the elements** **d)** Oxygen and oxides	Students will be assessed on their ability to: **2.16** recall the gases present in air and their approximate percentage by volume	**Activities:** • Draw a pie chart showing the composition of dry unpolluted air. • Calculate the percentage volume of oxygen in air using given experimental data from	Edexcel IGCSE Chemistry Student Book Pages 54–55 RSC CCE Page 11 Decomposition of hydrogen peroxide

		2.17 describe how experiments involving the reactions of elements such as copper, iron and phosphorus with air can be used to determine the percentage by volume of oxygen in air **2.18** describe the laboratory preparation of oxygen from hydrogen peroxide	different samples of air. **Demonstration:** ● Using copper to measure the oxygen in air (Student Book Page 54). **Class practical:** ● Using iron to measure the oxygen in air (Student Book Page 55).And vid: ● Preparation and properties of oxygen (RSC 11).(need potassium manganate)	using manganese and collecting oxygen produced - video. **Easier to do: Decomposition of hydrogen peroxide using yeast.**This is fun and really easy. Get the most concentrated Hydrogen Peroxide you can buy at a pharmacy. You can compare the effect using blood, liver, or potato as a catalyst too. Start with potato - it's slowest! See http://www.coolscience.org/CoolScience/KidScientists/h2o2.htm and also see Appendix 1 where there are instructions for a nice version of this, the Elephant Toothpaste experiment. **Extension Activity**: While you're at it, collect the oxygen coming off this experiment and practice the test for oxygen. See Appendix 1 for tips.
21	**Section 2: Chemistry of the elements** **d)** Oxygen and oxides **Section 5: Chemistry in society** **b)** Crude oil	Students will be assessed on their ability to: **2.20** describe the laboratory preparation of carbon dioxide from calcium carbonate and dilute hydrochloric acid **2.21** describe the formation of carbon dioxide from the thermal decomposition of metal carbonates such as copper(II) carbonate **2.22** recall the properties of carbon dioxide, limited to its solubility and density **2.23** explain the use of carbon dioxide in carbonating drinks and in fire extinguishers, in terms of its solubility and density **2.24** recall the reactions of carbon dioxide and sulfur dioxide with water to produce acidic	**Activities:** ● Evaluate methods of producing carbon dioxide. ● Research the large-scale production of carbon dioxide, explaining the demand for this gas. ● Watch a video on acid rain pollution then write a short magazine article on its causes and effects. **Demonstration:** ● **'Coke + Mentos' demonstration.** ● The density of carbon dioxide (RSC 56). ● The reaction of sulfur dioxide and of nitrogen dioxide with water, and the pH of the resulting solutions. **Class practical:** ● Making carbon dioxide in the lab (Student Book Page 58).	Edexcel IGCSE Chemistry Student Book Page 58 RSC CCE Pages 76, 165 RSC CC Demo Page 141 Mentos Diet Coke Geyser **GOT TO HERE checking for expts todo at home.**

		solutions **2.25** recall that sulfur dioxide and nitrogen oxides are pollutant gases which contribute to acid rain, and describe the problems caused by acid rain **5.11** recall that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming nitrogen oxides	● The effect of heat on metal carbonates (RSC 66). ● Reaction between carbon dioxide and water (RSC 30).	
22	**Section 2: Chemistry of the elements** **a)** The Periodic Table **d)** Oxygen and oxides	Students will be assessed on their ability to: **2.19** describe the reactions with oxygen in air of magnesium, carbon and sulfur, and the acid–base character of the oxides produced **2.3** explain the classification of elements as metals or non-metals on the basis of their electrical conductivity and the acid–base character of their oxides **2.2** recall the positions of metals and non-metals in the Periodic Table	**Activities:** ● Use experimental results to classify elements into two types: metal and non-metal. ● Identify metals and non-metals on the Periodic Table. Predict the character of a given element. **Demonstration:** ● Burning elements in oxygen. **Class practical:** ● Investigating the electrical conductivity of metals and non-metals. ● Testing the pH of oxides (RSC 21).	Edexcel IGCSE Chemistry Student Book Pages 55–56 and 100 RSC CCE Page 52
23	**Section 2: Chemistry of the elements** **a)** The Periodic Table **b)** Group 1 elements – lithium, sodium and potassium	Students will be assessed on their ability to: **2.1** understand the terms group and period **2.4** understand why elements in the same group of the Periodic Table have similar chemical properties **2.5** recall the noble gases (Group 0) as a family of inert gases and explain their lack of reactivity in terms of their electronic configurations **2.6** describe the reactions of the Group 1 elements with water and understand that the reactions provide a basis for their recognition as a family of elements	**Activities:** ● Watch a video about the Periodic Table. Answer comprehension questions about its development, structure and use. ● Draw conclusions about patterns and trends in Group 1 from the results of the demonstration. ● Draw dot/cross diagrams to explain the trend in reactivity in Group 1. **Demonstration:** ● Reactions of the alkali metals (RSC 72).	Edexcel IGCSE Chemistry Student Book Pages 99–105 RSC CC Demo Page 185 **Video clip:** ● Chemistry: a Volatile History (BBC), or ● Mendeleev's Dream (Channel 4)

		2.7 recall the relative reactivities of the elements in Group 1 **2.8 explain the relative reactivities of the elements in Group 1 in terms of distance between the outer electrons and the nucleus**		
24	**Section 2: Chemistry of the elements** **c)** Group 7 elements – chlorine, bromine and iodine	Students will be assessed on their ability to: **2.9** recall the colours and physical states of the elements at room temperature **2.10** make predictions about the properties of other halogens in this group **2.13** recall the relative reactivities of the elements in Group 7 **2.14** describe experiments to show that a more reactive halogen will displace a less reactive halogen from a solution of one of its salts **2.15** understand these displacement reactions as redox reactions	**Activities:** ● Watch a video or demonstration, and note the trends in colour and room temperature state of halogens. ● Deduce the reactivity series of the halogens from displacement experiments. ● Deduce chemical, ionic and half equations from experimental results to identify redox behaviour in displacement reactions. ● Deduce the likely properties of fluorine and astatine. **Demonstration:** ● Reactions of chlorine, bromine and iodine with iron and with aluminium (RSC 77). **Class practical:** ● Reactions of halogens (RSC 19).	Edexcel IGCSE Chemistry Student Book Pages 105–109 RSC CCE Page 46 RSC CC Demo Pages 204–210
25	**Section 2: Chemistry of the elements** **Section 5: Chemistry in society**	Consolidation and assessment	● Revision exercises ● End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 7 and 12
26	**Section 1: Principles of chemistry** **f)** Ionic compounds **h)** Metallic crystals	Students will be assessed on their ability to: **1.33** understand that ionic compounds have high melting and boiling points because of strong electrostatic forces between oppositely charged ions **1.34 understand the relationship between ionic charge and the melting point and boiling point of an ionic compound**	**Activities:** ● Draw conclusions about the properties of substances that have giant ionic structures. ● Make a model and draw a diagram of a sodium chloride lattice. ● Watch ICT animation of lattice formation: enact lattice formation. ● Interpret melting point data to derive link between ionic charge and melting point. ● Watch ICT animation of metallic structure. ● Draw diagrams to explain malleability and	Edexcel IGCSE Chemistry Student Book Pages 23–27 RSC CCE p 116 Birchfield Interactive: Structure and Bonding Ages 14–16

		1.35 describe an ionic crystal as a giant three-dimensional lattice structure held together by the attraction between oppositely charged ions **1.36 draw a simple diagram to represent the positions of the ions in a crystal of sodium chloride** **1.45** describe a metal as a giant structure of positive ions surrounded by a sea of delocalised electrons **1.46** explain the malleability and electrical conductivity of a metal in terms of its structure and bonding	conductivity in metals. **Class practical:** ● Giant ionic structure: the properties of sodium chloride; observing melting point, solubility, conductivity and crystal shape. ● Growing metal crystals (RSC 46).	
27	**Section 1: Principles of chemistry** **g)** Covalent substances	Students will be assessed on their ability to: **1.40** recall that substances with simple molecular structures are gases or liquids, or solids with low melting points **1.41** explain why substances with simple molecular structures have low melting points in terms of the relatively weak forces between the molecules **1.42** explain the high melting points of substances with giant covalent structures in terms of the breaking of many strong covalent bonds **1.43 draw simple diagrams representing the positions of the atoms in diamond and graphite** **1.44 explain how the uses of diamond and graphite depend on their structures, limited to graphite as a lubricant and diamond in**	**Activities:** ● Deduce properties of simple molecular substances from practical results. ● Watch ICT animation or video on simple molecular structure then draw diagrams of weak interactions between molecules. ● Watch demonstration and draw diagrams of the giant covalent structure of diamond and graphite. ● Research the uses of diamond and graphite and relate these to structure. **Demonstration:** ● Diamond and graphite: difference in properties. **Class practical:** ● Properties of simple molecular substances: observing melting point, solubility and conductivity.	Edexcel IGCSE Chemistry Student Book Pages 27–29 Birchfield Interactive: Structure and Bonding Ages 14–16

		cutting		
28	**Section 1: Principles of chemistry** **c)** Atomic structure **d)** Relative formula masses and molar volumes of gases	**1.10** understand the term relative atomic mass (A_r) **1.11** calculate the relative atomic mass of an element from the relative abundances of its isotopes **1.15** calculate relative formula masses (M_r) from relative atomic masses (A_r)	**Activities:** ● ICT Drag and Drop exercises, learning games and quizzes. ● ActiveBook animation. ● Exercises: calculating A_r from isotopic abundance. ● Drawing displayed formulae of molecules and calculating the M_r.	Edexcel IGCSE Chemistry Student Book Pages 176–178 Finding the relative formula mass: ActiveBook Page 178, animation Birchfield Interactive: Quantitative Chemistry Ages 14–16
29	**Section 1: Principles of chemistry**	Consolidation and assessment	● Revision exercises ● End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapter 4
30	**Section 1: Principles of chemistry** **d)** Relative formula masses and molar volumes of gases	Students will be assessed on their ability to: **1.16** understand the use of the term mole to represent the amount of substance **1.17 understand the term mole as the Avogadro number of particles (atoms, molecules, formulae, ions or electrons) in a substance** **1.18** carry out mole calculations using relative atomic mass (A_r) and relative formula mass (M_r).	**Activities:** ● ICT Drag and Drop exercises, learning games and quizzes to reinforce understanding of the mole concept. ● Exercises to calculate number of particles, moles from a given mass and mass from a given number of moles. **Demonstration:** ● Weighing out one mole of different substances: reinforcing that all these masses contain the same number of particles.	Edexcel IGCSE Chemistry Student Book Pages 179–182 Birchfield Interactive: Quantitative Chemistry Ages 14–16
31	**Section 1: Principles of chemistry** **e)** Chemical formulae and chemical equations	Students will be assessed on their ability to: **1.22** understand how the formulae of simple compounds can be obtained experimentally, including metal oxides and salts containing water of crystallisation **1.23** calculate empirical and molecular formulae from experimental data	**Activities:** ● Working out empirical formulae from mass or % by mass data. ● Converting empirical formulae to molecular formulae given molecular mass data. **Class practical:** ● To find the formula of hydrated copper(II) sulfate (RSC 52) - easy at home as long as you have a good balance. ● Finding the formula of an oxide of copper (RSC 90).	Edexcel IGCSE Chemistry Student Book Pages 182–184 RSC CCE Pages 131 and 233 Birchfield Interactive: Quantitative Chemistry Ages 14–16
32	**Section 1: Principles of chemistry**	Students will be assessed on their ability to:	**Activities:**	Edexcel IGCSE Chemistry Student Book Pages 187–192

	d) Relative formula masses and molar volumes of gases **e)** Chemical formulae and chemical equations	**1.24** calculate reacting masses using experimental data and chemical equations **1.19 understand the term molar volume of a gas and use its values (24 dm^3 and 24 000 cm^3) at room temperature and pressure (rtp) in calculations**	• Exercises using equations and the mole concept to predict mass of product or mass of reactant. • Exercises calculating reacting quantities using gas molar volume. **Class practical:** • Change in mass when magnesium burns (RSC 67). • Determination of relative atomic mass (RSC 17).	RSC CCE Pages 41 and 169 Birchfield Interactive: Quantitative Chemistry Ages 14–16 See below re burning magnesium.
33	**Section 1: Principles of chemistry** **e)** Chemical formulae and chemical equations	Students will be assessed on their ability to: **1.25 calculate percentage yield**	**Activities:** • Exercises in calculating % yield given product mass. • Exam questions to assist consolidation of the quantitative chemistry topic. **Class practical:** • Change in mass when magnesium burns (RSC 67).	Edexcel IGCSE Chemistry Student Book Page 193 RSC CCE Page 169 Practical Chemistry info sheet on change in mass when magnesium burns. (need a decent scale and crucible/tongs for this, plus blow torch or bunsen.)
34	**Section 4: Physical chemistry** **d)** Equilibria	Students will be assessed on their ability to: **4.22** recall that some reactions are reversible and are indicated by the symbol ⇌ in equations **4.23** describe reversible reactions such as the dehydration of hydrated copper(II) sulfate and the effect of heat on ammonium chloride **4.24** understand the concept of dynamic equilibrium **4.25** predict the effects of changing the pressure and temperature on the equilibrium position in reversible reactions	**Activities:** • ICT quizzes and games to reinforce understanding of concepts. • Exercises in predicting the shift in position of equilibrium when conditions are altered. • ActiveBook animation. **Demonstration:** • The equilibrium between ICl and ICl_3 (RSC 4). • The baling experiment: baling water from one tank to another to demonstrate dynamic equilibrium being established in a closed system. **Class practical:** • Heating copper(II) sulfate (RSC 53). • Heating ammonium chloride.	Edexcel IGCSE Chemistry Student Book Pages 125–129 Reversible reactions and equilibria: ActiveBook Page 125, animation RSC CC Demo Page 7 RSC CCE Page 134 Birchfield Interactive: Reversible reactions Ages 14–16
35	**Section 5: Chemistry in society** **d)** The industrial manufacture of	Students will be assessed on their ability to: **5.21** recall that nitrogen from air, and hydrogen	**Activities:** • Comprehension exercise to reinforce facts introduced in the video	Edexcel IGCSE Chemistry Student Book Pages 133–136 The Contact Process: ActiveBook Page

	chemicals	from natural gas or the cracking of hydrocarbons, are used in the manufacture of ammonia **5.22** describe the manufacture of ammonia by the Haber process, including the essential conditions: i a temperature of about 450 °C ii a pressure of about 200 atmospheres iii an iron catalyst **5.23** understand how the cooling of the reaction mixture liquefies the ammonia produced and allows the unused hydrogen and nitrogen to be recirculated **5.24** recall the use of ammonia in the manufacture of nitric acid and fertilisers **5.25 recall the raw materials used in the manufacture of sulfuric acid** **5.26 describe the manufacture of sulfuric acid by the contact process, including the essential conditions:** **i a temperature of about 450 °C** **ii a pressure of about 2 atmospheres** **iii a vanadium(V) oxide catalyst** **5.27 recall the use of sulfuric acid in the manufacture of detergents, fertilisers and paints**	● Make posters or flow diagrams to explain the Haber and contact processes. ● ActiveBook animation. ● Research the uses of ammonia and of sulfuric acid. ● Write 'instructions' for the operation of an ammonia plant, stressing the importance of compromise temperature and pressure conditions. **Demonstration:** ● The oxidation of ammonia (RSC 100). ● Sulfuric acid as a dehydrating agent (RSC 55). **Class practical:** ● The properties of ammonia (RSC 49). ● Making a fertiliser (RSC 91).	135, animation RSC CC Demo Pages 282 and 139 RSC CCE Pages 124 and 236 Birchfield Interactive: Reversible reactions Ages 14–16 **Video clip:** Chemistry in Action: Out of the Air
36	**Section 1: Principles of chemistry** **Section 4: Physical chemistry** **Section 5: Chemistry in society**	Consolidation and assessment	● Revision exercises ● End of Section tests	ActiveBook interactive multiple choice questions and revision checklist: Chapters 15,16, 22 and 23

37	**Section 1: Principles of chemistry** **b)** Atoms **Section 5: Chemistry in society** **b)** Crude oil	Students will be assessed on their ability to: **5.6** recall that crude oil is a mixture of hydrocarbons **5.7** describe how the industrial process of fractional distillation separates crude oil into fractions **1.7** describe techniques for the separation of mixtures, including fractional distillation **5.8** recall the names and uses of the main fractions obtained from crude oil: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen **5.9** describe the trend in boiling point and viscosity of the main fractions	**Activities:** ● BP video: fill in quiz comprehension sheet to find facts about fractions. ● Complete a diagram of a fractionating tower, detailing chain length, boiling point and use of each fraction. ● Write a description of how the process of fractional distillation works. **Demonstration:** ● The fractional distillation of crude oil ● Viscosity and combustion of the fractions.	Edexcel IGCSE Chemistry Student Book Pages 163–166 **Video clip:** BP: Refining and Products from Crude Oil BBC Bitesize vid on crude oil http://www.youtube.com/watch?v=emKj7kMvjug
38	**Section 3: Organic chemistry** **a)** Introduction **b)** Alkanes	Students will be assessed on their ability to: **3.1** explain the terms homologous series, hydrocarbon, saturated, unsaturated, general formula and isomerism **3.2** recall that alkanes have the general formula C_nH_{2n+2} **3.3** draw displayed formulae for alkanes with up to five carbon atoms in a molecule, and name the straight-chain isomers	**Activities:** ● Make models of alkanes. ● Use molecular models to derive displayed and molecular formulae. ● Use molecular models to find the isomers of pentane, draw their displayed formulae. ● ActiveBook PowerPoint.	Edexcel IGCSE Chemistry Student Book Pages 156–157 Hydrocarbons: ActiveBook Page 158, PowerPoint YouTube: It's a family thing - 2 minute fun rap on different families of organic compounds..
39	**Section 3: Organic chemistry** **b)** Alkanes **Section 5: Chemistry in society**	Students will be assessed on their ability to: **3.4** recall the products of the complete and incomplete combustion of alkanes **5.10** recall that incomplete combustion of fuels	**Activities:** ● Write chemical equations for combustion reactions. ● ActiveBook animations ● Research news articles about carbon monoxide poisoning incidents. ● Produce a gas safety advertisement,	Edexcel IGCSE Chemistry Student Book Pages 156–157 Combustion, carbon monoxide poisoning: ActiveBook Page 157, four animations RSC CCE Page 40

	b) Crude oil	may produce carbon monoxide and explain that carbon monoxide is poisonous because it reduces the capacity of the blood to carry oxygen **3.5** recall the reaction of methane with bromine to form bromomethane in the presence of UV light	explaining the cause and dangers of incomplete combustion. ● Write a chemical equation, using displayed formulae for the bromination of methane. **Demonstration:** ● The products of combustion of methane (RSC 38) ● The photochemical reactions of chlorine with methane. **Class practical:** ● Combustion (RSC 16).	”Carbon monoxide – the silent killer”: RSC Inspirational Chemistry: Resources for Modern Curricula Page 43
40	**Section 5: Chemistry in society** **b)** Crude oil	Students will be assessed on their ability to: **5.12** recall that fractional distillation of crude oil produces more long-chain hydrocarbons than can be used directly and fewer short-chain hydrocarbons than required **5.13** 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 °C	**Activities:** ● Watch BP video then answer comprehension questions on the importance of catalytic cracking. ● Use molecular models to explain why alkenes are formed during catalytic cracking. ● Use chemical equations in cracking reactions to predict a product or reactant. **Class practical:** ● Cracking hydrocarbons (RSC 96) ● Testing for unsaturation with bromine water.	Edexcel IGCSE Chemistry Student Book Pages 166–167 RSC CCE Page 247 **Video clip:** BP: Refining and Products from Crude Oil
41	**Section 3: Organic chemistry** **c)** Alkenes	Students will be assessed on their ability to: **3.6** recall that alkenes have the general formula C_nH_{2n} **3.7** draw displayed formulae for alkenes with up to four carbon atoms in a molecule, and name the straight-chain isomers **3.8** describe the addition reaction of alkenes with bromine, including the decolorising of bromine water as a test for alkenes	**Activities:** ● Complete a table showing the name, molecular formula and displayed formula of the first three alkenes. ● Write an account of observations from practical (see below), and write chemical equations to explain observations. **Class practical:** ● Testing for alkenes using bromine water.	Edexcel IGCSE Chemistry Student Book Pages 158–159 **Video clip:** BP: Refining and Products from Crude Oil
42	**Section 5: Chemistry in society** **c)** Synthetic polymers	Students will be assessed on their ability to: **5.14** recall that an addition polymer is formed	**Activities:** ● Exercises in drawing the repeat unit of polymers and identifying the monomer given	Edexcel IGCSE Chemistry Student Book Pages 169–173

		by joining up many small molecules called monomers **5.15** draw the repeat unit of addition polymers, including poly(ethene), poly(propene) and poly(chloroethene) **5.16** deduce the structure of a monomer from the repeat unit of an addition polymer **5.17 recall that nylon is a condensation polymer** **5.18 understand that the formation of a condensation polymer is accompanied by the release of a small molecule such as water or hydrogen chloride** **5.19 recall the types of monomers used in the manufacture of nylon** **5.20 draw the structure of nylon in block diagram format**	a polymer's repeat unit. ● Researching the uses of addition and condensation polymers, and linking these to the polymers' properties. **Demonstrations:** ● The nylon rope trick (RSC 64). ● Making rayon (RSC 91). **Class practical:** ● Identifying polymers (RSC 12). ● Addition polymerisation (RSC 95).	RSC CCE Pages 27 and 245 RSC CC Demo Pages 159 and 256
43	**Section 3: Organic chemistry** **d)** Ethanol	**3.9 describe the manufacture of ethanol by passing ethene and steam over a phosphoric acid catalyst at a temperature of about 300 °C and a pressure of about 60–70 atm** **3.10 describe the manufacture of ethanol by the fermentation of sugars, for example glucose, at a temperature of about 30 °C** **3.11 evaluate the factors relevant to the choice of method used in the manufacture of ethanol, for example the relative availability of sugar cane and crude oil** **3.12 describe the dehydration of ethanol to**	**Activities:** ● List the advantages and disadvantages of each method of ethanol production. ● ActiveBook PowerPoint. ● Research uses of ethanol and link each use to the appropriate production method. ● Read and discuss news articles about 'gasohol' and biofuels. ● Balance equations for the production, combustion and dehydration of ethanol. **Demonstration:** ● Fermentation. ● Dehydrating ethanol (RSC 98). **Class practical:**	Edexcel IGCSE Chemistry Student Book pp 159–161 Alcohols and their properties: ActiveBook Page 159, PowerPoint RSC CC Demo Page 275 RSC CCE Page 201

		ethene, using aluminium oxide	• The properties of alcohols (RSC 79).	
44	**Section 1: Principles of chemistry** **Section 3: Organic chemistry** **Section 5: Chemistry in society**	Consolidation and assessment	• Revision exercises • End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 19, 20 and 21
45	**Section 4: Physical chemistry** **b)** Energetics	Students will be assessed on their ability to: **4.10** recall that chemical reactions in which heat energy is given out are described as exothermic and those in which heat energy is taken in are endothermic **4.13** understand the use of ΔH to represent molar enthalpy change for exothermic and endothermic reactions **4.14** represent exothermic and endothermic reactions on a simple energy level diagram	**Activities:** • Draw enthalpy level diagrams for exothermic and endothermic reactions. • Complete exercises, identifying whether a reaction is exo- or endothermic given ΔH. **Class practical:** • Exothermic or endothermic? (RSC 22).	Edexcel IGCSE Chemistry Student Book Pages 120–123 RSC CCE Page 54
46	**Section 4: Physical chemistry** **b)** Energetics	Students will be assessed on their ability to: **4.11** describe simple calorimetry experiments for reactions, such as combustion, displacement, dissolving and neutralisation in which heat energy changes can be calculated from measured temperature changes **4.12 calculate molar enthalpy change from heat energy change**	**Activities:** • Calculating ΔH from practical results • Drawing enthalpy level diagrams for the reactions studied in the experiments. **Class practical:** • Thermometric titration (RSC 45). • Comparing the heat energy produced by combustion of various alcohols (RSC 85).	Edexcel IGCSE Chemistry Student Book Pages 202–207 RSC CCE Pages 114 and 219 **Alternative : Microscale Titration** / acid-base neutralisation. Burette is improvised from pipette and syringe.
47	**Section 4: Physical chemistry** **b)** Energetics	Students will be assessed on their ability to: **4.15** recall that the breaking of bonds is endothermic and that the making of bonds is exothermic	**Activities:** • Exercises in calculating ΔH, for given chemical reactions given bond enthalpy data.	Edexcel IGCSE Chemistry Student Book Pages 202–203

		4.16 use average bond energies to calculate the enthalpy change during a simple chemical reaction		
48	**Section 4: Physical chemistry**	Consolidation and assessment	• Revision exercises • End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 14 and 25
49	**Section 1: Principles of chemistry** **i)** Electrolysis	Students will be assessed on their ability to: **1.47** understand an electric current as a flow of electrons or ions **1.48** understand why covalent compounds do not conduct electricity **1.49** understand why ionic compounds conduct electricity only when molten or in solution **1.50** describe simple experiments to distinguish between electrolytes and non-electrolytes	**Activities:** • Watch ICT animation of conduction in metal and in an electrolyte, and note differences. • Draw diagrams of conduction in metals and in electrolytes. • Plan an experiment to distinguish between electrolyte and non-electrolyte. **Class practical:** • Testing the conductivity of metals, ionic and covalent substances. • •	Edexcel IGCSE Chemistry Student Book Pages 112–115 RSC CCE Pages 37 and 87 Birchfield Interactive: Electrolysis and its applications Ages 14–16
50	**Section 1: Principles of chemistry** **i)** Electrolysis	Students will be assessed on their ability to: **1.51** recall that electrolysis involves the formation of new substances when ionic compounds conduct electricity **1.52** describe simple experiments for the electrolysis, using inert electrodes, of molten salts such as lead(II) bromide **1.53 describe simple experiments for the electrolysis, using inert electrodes, of an aqueous solution of copper(II) sulfate** **1.54** write ionic half-equations representing the reactions at the electrodes during electrolysis	**Activities:** • Draw diagrams showing ions present, product and half equation at each electrode for the electrolysis experiments. • ActiveBook animation. **Demonstration:** • The electrolysis of molten lead bromide. **Class practical:** • The electrolysis of copper(II) sulfate solution (RSC 92).	Edexcel IGCSE Chemistry Student Book Pages 112–115 Electrolysis: ActiveBook Page 113, animation RSC CC Demo Page 238 RSC CCE Page 238
51	**Section 1: Principles of chemistry**	Students will be assessed on their ability to:	**Activities:** • Draw diagrams showing ions present,	Edexcel IGCSE Chemistry Student Book Pages 115–118

	i) Electrolysis	**1.53** describe simple experiments for the electrolysis, using inert electrodes, of aqueous solutions of sodium chloride and dilute sulfuric acid and predict the products **1.54** write ionic half-equations representing the reactions at the electrodes during electrolysis	product and half-equation at each electrode for the electrolysis experiments. **Demonstration:** ● The Hofmann voltammeter. **Class practical:** ● The electrolysis of solutions (RSC 82).	RSC CCE Page 210
52	**Section 1: Principles of chemistry** **i)** Electrolysis	Students will be assessed on their ability to: **1.55 recall that one faraday represents one mole of electrons** **1.56 calculate the amounts of the products of the electrolysis of molten salts and aqueous solutions**	**Activities:** ● Exercises in calculating amount of product in electrolysis, given current and time data. **Class practical:** ● Quantitative electrolysis (RSC 81). ● The Hofmann voltammeter.	Edexcel IGCSE Chemistry Student Book Pages 196–200 RSC CCE Page 208
53	**Section 5: Chemistry in society** **d)** The industrial manufacture of chemicals	Students will be assessed on their ability to: **5.28 describe the manufacture of sodium hydroxide and chlorine by the electrolysis of concentrated sodium chloride solution (brine) in a diaphragm cell** **5.29 write ionic half-equations for the reactions at the electrodes in the diaphragm cell** **5.30 recall important uses of sodium hydroxide, including the manufacture of bleach, paper and soap; and of chlorine, including sterilising water supplies and in the manufacture of bleach and hydrochloric acid**	**Activities:** ● Draw a diagram of the diaphragm cell including electrode half-equations. ● Research the uses of the products from the chlor-alkali industry. **Class practical** ● The electrolysis of solutions (RSC 82).	Edexcel IGCSE Chemistry Student Book Pages 136–137 RSC CCE Page 210 **Video clip:** Chemistry in Action: Chemical from Salt
54	**Section 1: Principles of chemistry** **Section 5: Chemistry in society**	Consolidation and assessment	● Revision exercises ● End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 13, 16 and 24
55	**Section 1: Principles of chemistry** **b)** Atoms	Students will be assessed on their ability to: **1.7** describe techniques for the separation of	**Activities:** ● Drawing diagrams of apparatus used in fractional distillation.	Edexcel IGCSE Chemistry Student Book Pages 89–91

	Section 2: Chemistry of the elements **e)** Hydrogen and water	mixtures, including simple distillation, fractional distillation, filtration, crystallisation and paper chromatography	• Exercises in planning purification of a range of different mixtures. **Demonstration:** • Fractional distillation of aqueous alcohol. **Class practical:** • **The chromatography of leaves (RSC 4).** See also http://www.practicalchemistry.org/experiments/chromatography-of-leaves,199,EX.html . Propanone is Acetone. Can also use Isopropyl Alcohol (rubbing alcohol) • 'Smarties' chromatography (RSC 71). This just needs sweets, water and filter paper (instead of chromatography paper). • **Purification of an impure solid (RSC 99). Needs Alum, which is easy to get.**	RSC CCE Pages 8, 179 and 256 See also http://www.sciencemadesimple.com/leaves.html NOTE: Smarties are no good for this anymore - the natural colourings they use don't work. M&Ms work well - see Practical Chemistry notes. and TES Discussion. See also Practical Chemistry notes on the Purification of an Impure Solid expt. which have additional tips.
56	**Section 2: Chemistry of the elements** **g)** Tests for ions and gases	Students will be assessed on their ability to: **2.39** describe simple tests for the anions: i Cl^-, Br^- and I^-, using dilute nitric acid and silver nitrate solution ii SO_4^{2-}, using dilute hydrochloric acid and barium chloride solution iii CO_3^{2-}, using dilute hydrochloric acid and identifying the carbon dioxide evolved **2.40** describe simple tests for the gases: i hydrogen ii oxygen iii carbon dioxide iv ammonia v chlorine	**Activities:** • Write chemical and ionic equations for reactions encountered in ion tests. • Suggest the identity of unknown substances, given ion test results. **Class practical:** • Testing salts for anions (RSC 80). • Tests to identify gases.	Edexcel IGCSE Chemistry Student Book Pages 92–96 RSC CCE Page 203
57	**Section 2: Chemistry of the elements**	Students will be assessed on their ability to:	**Activities:** • Write chemical and ionic equations for	Edexcel IGCSE Chemistry Student Book Pages 94–96

	g) Tests for ions and gases	**2.38** describe simple tests for the cations: i Li^+, Na^+, K^+, Ca^{2+} using flame tests ii NH_4^+ using sodium hydroxide solution and identifying the ammonia evolved iii Cu^{2+}, Fe^{2+} and Fe^{3+} using sodium hydroxide solution	reactions encountered in ion tests. ● Suggest the identity of unknown substances, given test results. **Class practical:** ● Testing salts for cations (RSC 80). ● Flame tests.	RSC CCE Page 203
58	**Section 1: Principles of chemistry** **e)** Chemical formulae and chemical equations	Students will be assessed on their ability to: **1.26** carry out mole calculations using volumes and molar concentrations	**Activities:** ● Exercises in calculating concentration given mass and solution volume. ● Exercises in calculating mass, given concentration and solution volume. ● Reacting mass calculations involving solutions. **Demonstration:** ● Estimating the concentration of domestic bleach (RSC 59).	Edexcel IGCSE Chemistry Student Book Pages 209–210 RSC CC Demo Page 147 See also 'Using indigestion tablets to neutralise an acid'
59	**Section 1: Principles of chemistry** **e)** Chemical formulae and chemical equations **Section 4: Physical chemistry** **a)** Acids, alkalis and salts	Students will be assessed on their ability to: **1.26** carry out mole calculations using volumes and molar concentrations **4.9** describe how to carry out acid–alkali titrations	**Activities:** ● Practice titration calculations. **Class practical:** ● Titration of sodium hydroxide with hydrochloric acid (RSC 48).	Edexcel IGCSE Chemistry Student Book Pages 209–214 RSC CCE Page 120
60	**Section 1: Principles of chemistry** **Section 2: Chemistry of the elements** **Section 4: Physical chemistry**	Consolidation and assessment	● Revision exercises ● End of Section test	ActiveBook interactive multiple choice questions and revision checklist: Chapters 11 and 26

Home Chemistry Experiments

The rest of this document is not part of the Edexcel original; it's my own notes on how you might do some of these experiments at home.

Obviously, check out how to do this safely. If you are handling acid, caustic soda or any other harmful chemicals, wear gloves and goggles and keep your feet and arms covered. Be sensible about fire. Satisfy yourself about safety requirements.

Appendix 1

From Futurelearn Kitchen Chemistry Course.

Experiment - Catalysis in biology

For this experiment you will need:

- A potato
- Yeast (dried or fresh)
- Hydrogen peroxide (available at different concentrations - max 40% - at pharmacies)
- A small amount of water
- A few drops of washing-up liquid
- A glass, jar, yoghurt pot or other container
- Safety spectacles

Please be aware that hydrogen peroxide is a bleach and will discolour any material it comes into contact with (even your hands). While it is always a good idea to wear safety spectacles when doing chemistry this is one experiment, depending on how it is carried out, where it is highly advisable.

Mix the yeast and water and leave it to stand for 5 - 10 min. There should be enough water that the mixture pours easily. While you are waiting cut a fresh piece of potato. Put some hydrogen peroxide solution in a container and add the freshly cut piece of potato. What do you observe?

Put some more hydrogen peroxide into another container and add a few drops of washing-up liquid. The enzymes in the yeast should turn the hydrogen peroxide into water and oxygen. As oxygen is a gas the washing up liquid will make a foam that captures the bubbles of the gas, making it easier to see what is happening. Add the yeast to the mixture of hydrogen peroxide and washing up liquid and observe what happens.

Testing for Oxygen

Oxygen re-ignites a glowing splint. A “glowing splint” is just a stick like a wooden kebab skewer that you have set alight and then blown out.
When you are decomposing your hydrogen peroxide, you want to catch some oxygen and then test it.
If you have made “elephant toothpaste” by putting washing-up liquid in your hydrogen peroxide before adding the catalyst, as above, then the bubbles will contain a lot of oxygen. However, the skin of the bubbles is made of water and detergent, and as we all know, poking a glowing stick into bubbles will extinguish the glow. But not necessarily with these -play around poking the glowing splint gently into the **upper part** of the foam, and see if the glow increases.
Next, repeat the experiment without adding washing-up liquid, and try putting the glowing splint down into the container, just above the liquid. Don’t put the splint into the liquid. If all goes well and oxygen is being produced, you’ll see the splint re-ignite.

Appendix 2 - Generating and testing Hydrogen

We generated hydrogen at home by adding hydrochloric acid to powdered zinc. However, it is easy to do using more readily available materials if you don’t want to buy in chemistry stock. You can make it by adding aluminium foil to caustic soda solution (sodium hydroxide). Sodium hydroxide is caustic so you need gloves, goggles, covered skin etc.. When you make up the solution, put the water in first and then add the sodium hydroxide. This is because you get an exothermic reaction between sodium hydroxide and water; if you put the sodium hydroxide in first and then add water, the heat of the initial reaction could cause steam and bubbling and splashing. Putting the water in first and then adding the sodium hydroxide reduces the splash risk. Add aluminium foil when the caustic soda is all dissolved. After a little while, the reaction will get going and hydrogen will be produced. The container will still get hot, so you may wish to stand it in a bowl of cold water. See this YouTube video on generating hydrogen with caustic soda and aluminium foil.

Using Hydrochloric acid and zinc: We found that just a large pinch of zinc powder in a test tube with 2mls of 4M Hydrochloric Acid produced enough hydrogen for us to do several tests. You are using acid so obviously, goggles and gloves on, feet and arms covered. Put the zinc in the test tube, then drop the acid onto it.

Testing for hydrogen

When you see bubbles rising, that is hydrogen. To test for the presence of hydrogen, it helps to have a partner. Put your thumb over the test tube and keep a firm seal until you feel pressure building up. Meanwhile, your partner lights the splint (wooden kebab skewer) and holds it up. We found it worked best to test as follows. The lighted splint is held still and the person with the test tube brings the tube up underneath it. Hydrogen is lighter than air so as soon as you remove your thumb, it floats up out of the tube. If the tube is directly under the flame, as close as possible, you have more chance of success. When the hydrogen meets the flame it makes a distinctive “Pop” sound which has a squeak to it.

Here’s a lower-risk way of generating hydrogen, making bubbles with the gas - requires a side-arm test-tube,, still using caustic soda.
Or you could combine it with some electrochemistry and use simply a battery and salt water; you won’t get much this way, but if you’re careful it will still be enough to test.

Hydrogen Balloon

I generated more hydrogen in a conical flask, but you could use a bottle as per the YouTube video on generating hydrogen with caustic soda and aluminium foil. I held a balloon over the neck of the flask until it was inflated a bit, then tied off the balloon and taped it to a long stick. Then I put a candle outside and took the balloon to the flame. A gratifying bang was heard

and nice flames were seen.