George Stephenson High School SCIENCE KS4 Y10 CHEMISTRY C2 Key Concepts 2 Unit Overview

Unit:Y10 CHEMISTRY C2 Key Concepts	Number of Lessons: 11

(FROM SPEC)

1.16 Explain the meaning of atomic number of an element in terms of position in the periodic table and number of protons in the nucleus	
1.17 Describe that in the periodic table a elements are arranged in order of increasing atomic number, in rows called periods b elements with similar properties are placed in the same vertical columns called groups	
1.18 Identify elements as metals or non-metals according to their position in the periodic table, explaining this division in terms of the atomic structures of the elements	
1.19 Predict the electronic configurations of the first 20 elements in the periodic table as diagrams and in the form, for example 2.8.1	4a 5b
1.20 Explain how the electronic configuration of an element is related to its position in the periodic table	4a

Ionic bonding

Students should:	Maths skills
1.21 Explain how ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams	5b
1.22 Recall that an ion is an atom or group of atoms with a positive or negative charge	
1.23 Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number	3b
1.24 Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7	1c 5b
1.25 Explain the use of the endings –ide and –ate in the names of compounds	

Students should:	Maths skills
1.26 Deduce the formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions	1c
1.27 Explain the structure of an ionic compound as a lattice structure a consisting of a regular arrangement of ions b held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions	5b

The Big Picture (Progression):

At KS2 pupils should already know:

- that some changes result in the formation of new materials, and that this kind of change is not usually reversible

At KS3 students should already know:

- chemical reactions as the rearrangement of atoms
- representing chemical reactions using formulae and using equations
- a simple (Dalton) atomic model
- differences between atoms, elements and compounds
- chemical symbols and formulae for elements and compounds

Future links and progression onto other KS4 units:

- C1 Key concepts
- C3 States of Matter
- C4 Fuels and Hydrocarbons
- C5 Acids
- C6 Earth's Atmosphere
- C7 Extracting metals and equilibria
- C8 Groups in the Periodic Table
- C10 electrolysis

Covalent bonding

Students should:	Maths skills
1.28 Explain how a covalent bond is formed when a pair of electrons is shared between two atoms	
1.29 Recall that covalent bonding results in the formation of molecules	
1.30 Recall the typical size (order of magnitude) of atoms and small molecules	1d
1.31 Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: a hydrogen b hydrogen chloride c water d methane e oxygen f carbon dioxide	5b

Types of substance

Students should:	Maths skills
1.32 Explain why elements and compounds can be classified as: a ionic b simple molecular (covalent) c giant covalent d metallic and how the structure and bonding of these types of substances results in different physical properties, including relative melting point and boiling point, relative solubility in water and ability to conduct electricity (as solids and in solution)	
1.33 Explain the properties of ionic compounds limited to: a high melting points and boiling points, in terms of forces between ions b whether or not they conduct electricity as solids, when molten and in aqueous solution	4a
1.34 Explain the properties of typical covalent, simple molecular compounds limited to: a low melting points and boiling points, in terms of forces between molecules (intermolecular forces) b poor conduction of electricity	4a

1.35	Recall that graphite and diamond are different forms of carbon and that they are examples of giant covalent substances	
1.36	Describe the structures of graphite and diamond	5b
1.37	Explain, in terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools	5b
1.38	Explain the properties of fullerenes including C_{60} and graphene in terms of their structures and bonding	5b
1.39	Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms	5b
1.40	Explain the properties of metals, including malleability and the ability to conduct electricity	5b
1.41	Describe the limitations of particular representations and models to, include dot and cross, ball and stick models and two- and three-dimensional representations	5b
1.42	Describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors of electricity	

3.12	Describe the chemical test for: a hydrogen b carbon dioxide (using limewater)	
3.13	Describe a neutralisation reaction as a reaction between an acid and a base	
3.14	Explain an acid-alkali neutralisation as a reaction in which hydrogen ions (H+) from the acid react with hydroxide ions (OH−) from the alkali to form water	
3.15	Explain why, if soluble salts are prepared from an acid and an insoluble reactant: a excess of the reactant is added b the excess reactant is removed c the solution remaining is only salt and water	
3.16	Explain why, if soluble salts are prepared from an acid and a soluble reactant: a titration must be used b the acid and the soluble reactant are then mixed in the correct proportions c the solution remaining, after reaction, is only salt and water	
3.17	*Core Practical: Investigate the preparation of pure, dry hydrated copper sulfate crystals starting from copper oxide including the use of a water bath*	
3.18	Describe how to carry out an acid-alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry salt	
3.19	Recall the general rules which describe the solubility of common types of substances in water: a all common sodium, potassium and ammonium salts are soluble b all nitrates are soluble c common chlorides are soluble except those of silver and lead d common sulfates are soluble except those of lead, barium and calcium e common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium	
3.20	Predict, using solubility rules, whether or not a precipitate will be formed when named solutions are mixed together, naming the precipitate if any	

3.21	Describe the method used to prepare a pure, dry sample of an insoluble salt	

Suggested practicals

- Carry out simple neutralisation reactions of acids, using metal oxides, hydroxides and carbonates.
- Carry out tests for hydrogen and carbon dioxide.
- Prepare an insoluble salt by precipitation.

Possible Key Learning Points	Skills	Prerequisites
Understand how to use the Periodic Table effectively Identify elements in groups and periods Describe what period number and group number tell us about atoms Apply the rules of electron configuration to determine the electron configurations of the first 20 elements Describe in terms of electrons covalent bonding Represent covalent bonding through dot and cross and stick line diagrams Describing and explaining the properties of simple covalent molecules Describing and explaining the properties of giant covalent structures Describe in terms of electrons ionic bonding Representing ionic bonding as a diagram Describe metallic bonding Representing metallic bonding as a diagram Describing and explaining the properties of metallic binding **Interleaving:** Particle theory, Chemical reactions and writing equations, atomic and molecular mass, chemical formulae	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – describe Accurate spelling of key words Numeracy Electron configuration (basic addition) Ionic formulae (common denominators) Core Practical: No core prac Interpersonal	Identifying groups, periods, metals, non-metals, atomic number and mass number on the periodic table What mass number and atomic number tell us
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities

Atom Compound Molecule Electron Proton Neutron Atomic mass Ion Ionic Covalent Metallic Delocalized Electrostatic Positive Negative Periods Groups Cation Anion Boiling point Melting point Evaporate Condense Conduct charge	As with most science topics, the amount of new terminology can be tricky. Students struggle to distinguish accurately between concentration and strength, due to the use of these words in everyday life. They also struggle to learn the different types of neutralisation reactions. Students will often state "they don't get it" when it is not an issue of complexity but rather recall of information which needs time and an active approach to memorising the equations. Revisiting and correcting use of key terminology is essential throughout the unit. **<u>Assessments:</u>** Regular in class live marking throughout the unit Describing ionic bonding, m/h challenge. KAT to be TA assessed Directed questioning **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	Molymods for covalent bonding Ionic formula – the number switch Personification of ionic bonding Trying to melt different covalent and ionic substances Marketplace Treasure hunt Videos Applications for real life – polymers/fullerenes Haiku Play doh modelling Mini quizzes Exam questions

Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
What does group number tell us? What does period number tell us? What ion is formed when an atom loses an electron? What ion is formed when an atom gains an electron? Why does atomic number tell us the amount of electrons? What do the small numbers in a formula mean? Why do metals and ionic structures conduct electricity? Why can carbon conduct electricity?		Ionic bonding is the transfer of electrons only (need to include the attraction between oppositely charged ions) Lose electrons makes a negative ion Bonds broken during boiling of simple covalent molecules More than one outer shell All substances boil at 100degreesC and freeze at 0degreesC That substances only start to evaporate above their BP and vice versa for MP Atomic number tells us the amount of electrons (we only infer this)

Unit:Y10 CHEMISTRY C2 Key Concepts	Number of Lessons: 11

(FROM SPEC)

States of matter

Students should:		Maths skills
2.1	Describe the arrangement, movement and the relative energy of particles in each of the three states of matter: solid, liquid and gas	5b
2.2	Recall the names used for the interconversions between the three states of matter, recognising that these are physical changes: contrasted with chemical reactions that result in chemical changes	
2.3	Explain the changes in arrangement, movement and energy of particles during these interconversions	5b
2.4	Predict the physical state of a substance under specified conditions, given suitable data	1d 4a

Methods of separating and purifying substances

Students should:		Maths skills
2.5	Explain the difference between the use of 'pure' in chemistry compared with its everyday use and the differences in chemistry between a pure substance and a mixture	
2.6	Interpret melting point data to distinguish between pure substances which have a sharp melting point and mixtures which melt over a range of temperatures	1a
2.7	Explain the types of mixtures that can be separated by using the following experimental techniques: a simple distillation b fractional distillation c filtration d crystallisation e paper chromatography	
2.8	Describe an appropriate experimental technique to separate a mixture, knowing the properties of the components of the mixture	

The Big Picture (Progression):
At KS2 pupils should already know:
Year 4

States of matter

Pupils should be taught to:

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

Year 5

- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- demonstrate that dissolving, mixing and changes of state are reversible changes

At KS3 students should already know:

The particulate nature of matter

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure
- changes of state in terms of the particle model

Students should:		Maths skills
2.9	Describe paper chromatography as the separation of mixtures of soluble substances by running a solvent (mobile phase) through the mixture on the paper (the paper contains the stationary phase), which causes the substances to move at different rates over the paper	
2.10	Interpret a paper chromatogram: a to distinguish between pure and impure substances b to identify substances by comparison with known substances c to identify substances by calculation and use of R_f values	3a, 3c 4a
2.11	*Core Practical: Investigate the composition of inks using simple distillation and paper chromatography*	
2.12	Describe how: a waste and ground water can be made potable, including the need for sedimentation, filtration and chlorination b sea water can be made potable by using distillation c water used in analysis must not contain any dissolved salts	

Pure and impure substances

- the concept of a pure substance
- mixtures, including dissolving
- diffusion in terms of the particle model
- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography
- the identification of pure substances

Future links and progression onto other KS4 units:

- C2 Key concepts 2
- C4 Fuels and Hydrocarbons
- C6 Earth's Atmosphere
- C7 Extracting metals and equilibria
- C8 Groups in the Periodic Table
- C10 electrolysis
- Transpiration
- The water cycle

Possible Key Learning Points	Skills	Prerequisites
Describe the arrangement and movement of particles during each change of state with regards to energy and intermolecular forces Define the term pure and describe how we test for purity. Use melting point data to determine purity Use the boiling point and melting points to deduce the state of different substances at different temperatures Describe the techniques of crytsallisaton, simple distillation, fractional distillation, chromatography and filtration and what mixtures they are used to appropriately separate. Describe how to make water potable **Interleaving:** **Simple covalent molecules – boiling point and intermolecular forces**	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – describe Accurate spelling of key words Numeracy Identifying states using boiling points and melting points (use of negative numbers). Calculating Rf values Interpreting and drawing graphs for purity and change of state Core Practical: Investigate the composition of inks using simple distillation and chromotography Interpersonal; engaging in group activities, working together and communicating effectively to carry out practicals safely	Students should be able to draw the arrangements of particles in solids, liquids and gases and describe the movement of these particles in these states. Students should know the names of the changes of state.
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities

Solid Liquid Gas Evaporate Condensation Boiling point Melting point Energy Intermolecular force Distillation Chromatography Soluble Insoluble Mixture Filtration Crystallization Potable Pure Impure Chlorination Sedimentation Mobile phase Stationary phase sublimation	Unlike most of the other topics in the GCSE series, this unit has been introduced and built on multiple times over the key stages. This is beneficial although it is worth spending time on the very basics, such as the movement of particles in each state in the first instance to weed out any misconceptions. Due to such reinforcement of the topic over the key stages students will find the planning of separating fairly straight forward, therefore the emphasis in their writing should be on language and key terminology. Students will struggle with identifying the state from boiling point and melting point and some students may benefit from a number line being provided as well. It is only the process of fractional distillation that is required in this topic and how it separates based on bp. Students will encounter alkanes later in the fuels and hydrocarbons and will go back over fractional distillation. It is best that the reasons for differing bps is left until then so as to not confuse students. **Assessments:** Regular in class live marking throughout the unit Describing how to separate alum from soil. KAT to be TA assessed Directed questioning **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA	Back to back Pass the poster Pens in pots Beat the teacher Video Teacher modelled graph annotation Group, pair, solo, Exit tickets Sublimation demo Stearic acid practical Consensus placement Cognitive conflict questions Test your memory Think pair share Separation practical Chromatography practical Pictures to words Map from memory Change- reduce – change Market place Exam questions

	Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
What does ‘pure’ mean? What happens to the movement of particles during evaporation? What happens to the movement of particles during condensation? Why do particles move more/less? Why do we use pencil instead of pen to draw the line on a chromatogram? If a substance doesn’t separate on a chromatogram what can we do? What does sublimation mean? How is a mixture different to a compound?		Bonds are broken during state changes All substances have a bp of 100degrees C All substances have a mp of 100 degrees C Tap water is impure, bottled water is pure Particles are stationary in solids

George Stephenson High School SCIENCE KS4 Y10 CHEMISTRY C4 FUELS AND HYDROCARBONS Unit Overview

Unit:Y10 CHEMISTRY C4 FUELS AND HYDROCARBONS	Number of Lessons:
TOPIC 8 Fuels and Earth Science (FROM SPEC)	**The Big Picture (Progression):** **At KS2 pupils should already know:** States of matter and changing state Simple separating techniques pollution **At KS3 students should already know:** Particle theory States of matter and changing state Melting points and boiling points Separating techniques – solutions and mixtures Chemical formula and equations Elements, mixtures and compounds Acids and acid rain Earth and atmosphere Chemical reactions – basics Simple balancing equations **Future links and progression onto other KS4 units:** Chem key concepts 1 and 2 – bonding and energy involved in state changes Chem 5 – early atmosphere Biol 9– ecosystems and material cycles Phy 5- energy stores (fuels)

Topic 8 – Fuels and Earth science

Fuels

Students should:	
8.1	Recall that hydrocarbons are compounds that contain carbon and hydrogen only
8.2	Describe crude oil as: a a complex mixture of hydrocarbons b containing molecules in which carbon atoms are in chains or rings (names, formulae and structures of specific ring molecules not required) c an important source of useful substances (fuels and feedstock for the petrochemical industry) d a finite resource
8.3	Describe and explain the separation of crude oil into simpler, more useful mixtures by the process of fractional distillation
8.4	Recall the names and uses of the following fractions: a gases, used in domestic heating and cooking b petrol, used as fuel for cars c kerosene, used as fuel for aircraft d diesel oil, used as fuel for some cars and trains e fuel oil, used as fuel for large ships and in some power stations f bitumen, used to surface roads and roofs

8.5	Explain how hydrocarbons in different fractions differ from each other in: a the number of carbon and hydrogen atoms their molecules contain b boiling points c ease of ignition d viscosity and are mostly members of the alkane homologous series	
8.6	Explain an homologous series as a series of compounds which: a have the same general formula b differ by CH_2 in molecular formulae from neighbouring compounds c show a gradual variation in physical properties, as exemplified by their boiling points d have similar chemical properties	

8.7 Describe the complete combustion of hydrocarbon fuels as a reaction in which: a carbon dioxide and water are produced b energy is given out	
8.8 Explain why the incomplete combustion of hydrocarbons can produce carbon and carbon monoxide	
8.9 Explain how carbon monoxide behaves as a toxic gas	
8.10 Describe the problems caused by incomplete combustion producing carbon monoxide and soot in appliances that use carbon compounds as fuels	
8.11 Explain how impurities in some hydrocarbon fuels result in the production of sulfur dioxide	
8.12 Explain some problems associated with acid rain caused when sulfur dioxide dissolves in rain water	
8.13 Explain why, when fuels are burned in engines, oxygen and nitrogen can react together at high temperatures to produce oxides of nitrogen, which are pollutants	
8.14 Evaluate the advantages and disadvantages of using hydrogen, rather than petrol, as a fuel in cars	
8.15 Recall that petrol, kerosene and diesel oil are non-renewable fossil fuels obtained from crude oil and methane is a non-renewable fossil fuel found in natural gas	
8.16 Explain why cracking involves the breaking down of larger, saturated hydrocarbon molecules (alkanes) into smaller, more useful ones, some of which are unsaturated (alkenes)	
8.17 Explain why cracking is necessary	

Possible Key Learning Points	Skills	Prerequisites

Lesson 1 Crude oil Lesson 2 Fractional distillation Lesson 3 Properties of a homologous series Lesson 4 Empirical Formula Lesson 5 Experiment to calculate the empirical formula of magnesium oxide Lesson 6 Combustion and Pollution Lesson 7 Pollution and LCA Lesson 8 Cracking Lesson 9 Assessments **Interleaving:** Particles (atomic structure/atomic mass) link to 'mass' of objects and ideas of density linked to forces acting on an object	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – compare Accurate spelling of key words Numeracy Core Practical: Density of solids and liquids Interpersonal Team-work and communication skills during core practical	
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities
Hydrocarbon Homologous series Alkane (Alkene) Combustion Fractional distillation Fractions Evaporate	As with most science topics, the amount of new terminology can be tricky. Students struggle to distinguish accurately between mass and weight, due to the inaccurate use of the word 'weight' in everyday life. They also struggle to fully describe resultant force and in particular when forces are balanced, and resultant force is zero and the idea of unbalanced forces changing the motion of an object (slow down/speed up). Revisiting and correcting use of key terminology is essential throughout the unit.	Starter for 5 (recall questions) Interleave particles topic – density Desirable difficulties including a variety of challenge options - 'chilli challenge' KAT and DIRT opportunities Metacognitive mediators to plan, monitor and evaluate own thinking processes Low stakes assessment through recall and interleaving approaches 5/3 and similar challenge tasks using the range of questions

Condense Viscosity ignite Cracking Finite resources Fossil fuels Physical properties Molecular formula Structural formula General formulae Empirical formula	**<u>Assessments:</u>** Regular in class live marking throughout the unit **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
	• Starter for 5 (fast 5 recall questions) each lesson • Placemat consensus • Oracy talk partners • Observing forces in the classroom. Identifying balanced and unbalanced forces. • Drawing Free Body diagrams • Calculating resultant forces and applying Newton's first law. • Investigating the relationship between mass and weight – collecting data/plotting graphs • Interpreting/describing distance time graphs • Plotting D-t graphs • Literacy – compare mass and weight	

	• Designing and testing a bridge and a boat from limited resources. Applying key learning • Calculations involving s = d/t. Including rearranging if appropriate • Exactly guess the weight of the chocolate bar and you can keep it to enforce difference between weight and mass.	

George Stephenson High School SCIENCE KS4 Y10 CHEMISTRY C7 Extracting Metals and Equilibria Unit Overview

Unit:Y10 CHEMISTRY C7 Extracting Metals and equilibria	Number of Lessons: 12

(FROM SPEC)

Topic 3 – Chemical change

Acids

Students should:		Maths skills
3.1	Recall that acids in solution are sources of hydrogen ions and alkalis in solution are sources of hydroxide ions	
3.2	Recall that a neutral solution has a pH of 7 and that acidic solutions have lower pH values and alkaline solutions higher pH values	
3.3	Recall the effect of acids and alkalis on indicators, including litmus, methyl orange and phenolphthalein	
3.4	**Recall that the higher the concentration of hydrogen ions in an acidic solution, the lower the pH; and the higher the concentration of hydroxide ions in an alkaline solution, the higher the pH**	1c
3.5	**Recall that as hydrogen ion concentration in a solution increases by a factor of 10, the pH of the solution decreases by 1**	1c
3.6	*Core Practical: Investigate the change in pH on adding powdered calcium hydroxide or calcium oxide to a fixed volume of dilute hydrochloric acid*	4a, 4c
3.7	**Explain the terms dilute and concentrated, with respect to amount of substances in solution**	
3.8	**Explain the terms weak and strong acids, with respect to the degree of dissociation into ions**	
3.9	Recall that a base is any substance that reacts with an acid to form a salt and water only	
3.10	Recall that alkalis are soluble bases	
3.11	Explain the general reactions of aqueous solutions of acids with: a metals b metal oxides c metal hydroxides d metal carbonates to produce salts	

The Big Picture (Progression):

At KS2 pupils should already know:

- that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda

At KS3 students should already know:

- defining acids and alkalis in terms of neutralisation reactions
- the pH scale for measuring acidity/alkalinity; and indicators
- reactions of acids with metals to produce a salt plus hydrogen
- reactions of acids with alkalis to produce a salt plus water

Future links and progression onto other KS4 units:

- C1 and C2 Key concepts
- C7 Extracting metals and equilibria
- C9 Rates and equilibria

3.12	Describe the chemical test for: a hydrogen b carbon dioxide (using limewater)	
3.13	Describe a neutralisation reaction as a reaction between an acid and a base	
3.14	Explain an acid-alkali neutralisation as a reaction in which hydrogen ions (H+) from the acid react with hydroxide ions (OH−) from the alkali to form water	
3.15	Explain why, if soluble salts are prepared from an acid and an insoluble reactant: a excess of the reactant is added b the excess reactant is removed c the solution remaining is only salt and water	
3.16	Explain why, if soluble salts are prepared from an acid and a soluble reactant: a titration must be used b the acid and the soluble reactant are then mixed in the correct proportions c the solution remaining, after reaction, is only salt and water	
3.17	*Core Practical: Investigate the preparation of pure, dry hydrated copper sulfate crystals starting from copper oxide including the use of a water bath*	
3.18	Describe how to carry out an acid-alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry salt	
3.19	Recall the general rules which describe the solubility of common types of substances in water: a all common sodium, potassium and ammonium salts are soluble b all nitrates are soluble c common chlorides are soluble except those of silver and lead d common sulfates are soluble except those of lead, barium and calcium e common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium	
3.20	Predict, using solubility rules, whether or not a precipitate will be formed when named solutions are mixed together, naming the precipitate if any	

3.21	Describe the method used to prepare a pure, dry sample of an insoluble salt	

Suggested practicals

- Carry out simple neutralisation reactions of acids, using metal oxides, hydroxides and carbonates.
- Carry out tests for hydrogen and carbon dioxide.
- Prepare an insoluble salt by precipitation.

Possible Key Learning Points	Skills	Prerequisites
Lesson 01 acids and indicators Lesson 02 Concentration Lesson 03 strong and weak Lesson 04 HIGHER hydrogen and hydroxide Lesson 05 Titration 1 Lesson 06 Titration 2 Lesson 07 neutralisation Lesson 08 acids and metals Lesson 09 The Mole Lesson 10 Solubility and Precipitates Lesson 11 acids and bases Lesson 12 copper sulfate **Interleaving:** Particle theory, Chemical reactions and writing equations, denaturing of enzymes, atomic and molecular mass, chemical formulae.	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – compare Accurate spelling of key words Numeracy Core Practical: Core Practical: Investigate the preparation of pure, dry hydrated copper sulfate crystals starting from copper oxide including the use of a water bath Interpersonal Team-work and communication skills during core practical	
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities

acetic acid acid ascorbic acid citric acid ethanoic acid gas sweetener corrosive harmful hydrochloric acid irritant nitric acid sulphuric acid alkali indicator litmus neutral antacid pH scale universal indicator burette dilute neutralisation neutralise Avogadro Mole Precipitate Solubility	As with most science topics, the amount of new terminology can be tricky. Students struggle to distinguish accurately between concentration and strength, due to the use of these words in everyday life. They also struggle to learn the different types of neutralisation reactions. Students will often state "they don't get it" when it is not an issue of complexity but rather recall of information which needs time and an active approach to memorising the equations. Revisiting and correcting use of key terminology is essential throughout the unit. **<u>Assessments:</u>** Regular in class live marking throughout the unit **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	Formula triangles Storyboard sequencing activities Interleave particles topic – concentration Visualising concentration and strong and weak acids Desirable difficulties including a variety of challenge options - 'chilli challenge' KAT and DIRT opportunities Challenging volumetric calculations for more able
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions

	• Neutralisation practical • Concentration qualitative and quantitative understanding • Visual approach to weak and strong acids and links to pH • Titrations • Volumetric calculations/linked to neutralisation • Mole calculations • Precipitation practical • Learning solubilty rules • Learning names of salts • Core practical (See above)	All strong acids are concentrated (plus converse)

George Stephenson High School SCIENCE KS4 Y10 CHEMISTRY C6 EARTH SCIENCE Unit Overview

Unit:Y10 CHEMISTRY C6 EARTH SCIENCE	Number of Lessons:
TOPIC 8 Fuels and Earth Science (FROM SPEC) **Earth and atmospheric science**	**The Big Picture (Progression):** **At KS2 pupils should already know:** **At KS3 students should already know:** Particle theory Density **Future links and progression onto other KS4 units:**

Students should:	
8.18	Recall that the gases produced by volcanic activity formed the Earth's early atmosphere
8.19	Describe that the Earth's early atmosphere was thought to contain: a little or no oxygen b a large amount of carbon dioxide c water vapour d small amounts of other gases and interpret evidence relating to this
8.20	Explain how condensation of water vapour formed oceans
8.21	Explain how the amount of carbon dioxide in the atmosphere was decreased when carbon dioxide dissolved as the oceans formed
8.22	Explain how the growth of primitive plants used carbon dioxide and released oxygen by photosynthesis and consequently the amount of oxygen in the atmosphere gradually increased
8.23	Describe the chemical test for oxygen
8.24	Describe how various gases in the atmosphere, including carbon dioxide, methane and water vapour, absorb heat radiated from the Earth, subsequently releasing energy which keeps the Earth warm: this is known as the greenhouse effect

8.25 Evaluate the evidence for human activity causing climate change, considering: a the correlation between the change in atmospheric carbon dioxide concentration, the consumption of fossil fuels and temperature change b the uncertainties caused by the location where these measurements are taken and historical accuracy	
8.26 Describe: a the composition of today's atmosphere b the potential effects on the climate of increased levels of carbon dioxide and methane generated by human activity, including burning fossil fuels and livestock farming c that these effects may be mitigated: consider scale, risk and environmental implications	

Possible Key Learning Points	Skills	Prerequisites
Lesson 1 Balancing Equations Lesson 2 Earths Early atmosphere Lesson 3 Climate Change Lesson 4 Greenhouse Effect Lesson 5. Assessments **Interleaving:** Particles (atomic structure/atomic mass) link to 'mass' of objects and ideas of density linked to forces acting on an object	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – compare Accurate spelling of key words Numeracy Core Practical:	

	Interpersonal Team-work and communication skills during core practical	
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities
Hydrocarbon Fractional distillation Fractions Evaporate Condense Viscosity ignite Cracking Finite resources	As with most science topics, the amount of new terminology can be tricky. Students struggle to distinguish accurately Revisiting and correcting use of key terminology is essential throughout the unit. **Assessments:** Regular in class live marking throughout the unit **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA	Starter for 5 (recall questions) Interleave particles topic – density Desirable difficulties including a variety of challenge options - 'chilli challenge' KAT and DIRT opportunities Metacognitive mediators to plan, monitor and evaluate own thinking processes Low stakes assessment through recall and interleaving approaches 5/3 and similar challenge tasks using the range of questions

	Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
	• Starter for 5 (fast 5 recall questions) each lesson • Placemat consensus • Oracy talk partners • Observing forces in the classroom. Identifying balanced and unbalanced forces. • Drawing Free Body diagrams • Calculating resultant forces and applying Newton's first law. • Investigating the relationship between mass and weight – collecting data/plotting graphs • Interpreting/describing distance time graphs • Plotting D-t graphs • Literacy – compare mass and weight • Designing and testing a bridge and a boat from limited resources. Applying key learning • Calculations involving s = d/t. Including rearranging if appropriate • Exactly guess the weight of the chocolate bar and you can keep it to enforce difference between weight and mass.	

George Stephenson High School SCIENCE KS4 Y10 CHEMISTRY C7 Extracting Metals and Equilibria Unit Overview

Unit:Y10 CHEMISTRY C7 Extracting Metals and equilibria	Number of Lessons: 12

(FROM SPEC)

Topic 4 – Extracting metals and equilibria

Obtaining and using metals

Students should:		Maths skills
4.1	Deduce the relative reactivity of some metals, by their reactions with water, acids and salt solutions	
4.2	**Explain displacement reactions as redox reactions, in terms of gain or loss of electrons**	
4.3	Explain the reactivity series of metals (potassium, sodium, calcium, magnesium, aluminium, (carbon), zinc, iron, (hydrogen), copper, silver, gold) in terms of the reactivity of the metals with water and dilute acids and that these reactions show the relative tendency of metal atoms to form cations	
4.4	Recall that: a most metals are extracted from ores found in the Earth's crust b unreactive metals are found in the Earth's crust as the uncombined elements	
4.5	Explain oxidation as the gain of oxygen and reduction as the loss of oxygen	
4.6	Recall that the extraction of metals involves reduction of ores	
4.7	Explain why the method used to extract a metal from its ore is related to its position in the reactivity series and the cost of the extraction process, illustrated by	

The Big Picture (Progression):

At KS2 pupils should already know:

- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda

At KS3 students should already know:

- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography
- combustion, thermal decomposition, oxidation and displacement reactions
- the order of metals and carbon in the reactivity series
- the use of carbon in obtaining metals from metal oxides

Future links and progression onto other KS4 units:

- C1 and C2 Key concepts
- C9 Rates and equilibria

	a heating with carbon (including iron) b electrolysis (including aluminium) (knowledge of the blast furnace is not required)	
4.8	**Evaluate alternative biological methods of metal extraction (bacterial and phytoextraction)**	
4.9	Explain how a metal's relative resistance to oxidation is related to its position in the reactivity series	
4.10	Evaluate the advantages of recycling metals, including economic implications and how recycling can preserve both the environment and the supply of valuable raw materials	
4.11	Describe that a life-cycle assessment for a product involves consideration of the effect on the environment of obtaining the raw materials, manufacturing the product, using the product and disposing of the product when it is no longer useful	
4.12	Evaluate data from a life cycle assessment of a product	

Suggested practicals

- Investigate methods for extracting metals from their ores.
- Investigate simple oxidation and reduction reactions, such as burning elements in oxygen or competition reactions between metals and metal oxides.

Reversible reactions and equilibria

Students should:	Maths skills
4.13 Recall that chemical reactions are reversible, the use of the symbol ⇌ in equations and that the direction of some reversible reactions can be altered by changing the reaction conditions	
4.14 Explain what is meant by dynamic equilibrium	
4.15 Describe the formation of ammonia as a reversible reaction between nitrogen (extracted from the air) and hydrogen (obtained from natural gas) and that it can reach a dynamic equilibrium	
4.16 Recall the conditions for the Haber process as: a temperature 450 °C b pressure 200 atmospheres c iron catalyst	
4.17 **Predict how the position of a dynamic equilibrium is affected by changes in:** **a temperature** **b pressure** **c concentration**	

Suggested practicals

- Investigate simple reversible reactions, such as the decomposition of ammonium chloride.

The following topic is only found in the GCSE in Chemistry:

Topic 5 – Separate chemistry 1

Possible Key Learning Points	Skills	Prerequisites
Lesson 1 Reactvivity of metals with water Lesson 2 Reactivity of metals with acids Lesson 3 Displacement Lesson 4 HT Ionic equation Lesson 5 metal ores Lesson 6 Extracting metals Lesson 7 Reacting masses Lesson 8 - Recycling Metals and LCA Lesson 9 - Reversible Reactions Lesson 10 - Haber Process Lesson 11 - Dynamic Equilibrium **Interleaving:** Particle theory, Chemical reactions and writing equations, atomic and molecular mass, chemical formulae.	Literacy/Oracy accurate use of key words during class Q and A sessions and within written answers Literacy KAT – compare Accurate spelling of key words Numeracy Core Practical: No core practical in this unit Interpersonal Team-work and communication skills during core practical	
Subject Specific Language	Pedagogical Notes	Make it Stick /GREENZONE Activities

Ores Displacement Reactivity Ionic Recycling Reusing Reversible Equilibrium Equilibria Haber Process Le Chatellier Dynamic	Students will be revisiting displacement reactions and an emphasis should be made on how it is important in the estraction of metals and why not all metals can be extracted using carbon. Understanding how reaction conditions can affect the position of a dynamic equilibrium involves higher order thinking and some students will require support. Revisiting and correcting use of key terminology is essential throughout the unit. **<u>Assessments:</u>** Regular in class live marking throughout the unit **End of unit assessment** 15 flash cards to learn via quizlet/paper copies Seen application question used in class to ensure students understand concepts and to demonstrate modeling and decoding of the question (metacognition) Final Assessment (30 marks) Section 1 – flash cards 10 marks (AO1) - PA Section 2 – seen application question 10 marks (AO2/3) - PA Section 3 – unseen application question (KAT to assess understanding of unit as a whole) 10 marks (AO2/3) - TA	Starter for 5 (recall questions) Interleave Chemical formulae and equations Desirable difficulties including a variety of challenge options - 'chilli challenge' KAT and DIRT opportunities Metacognitive mediators to plan, monitor and evaluate own thinking processes Case study for LCA Practical activities
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
	• Practical work – reactivity of metals with water and acids to establish reactivity series. • Displacement reactions practical and demos • Writing chemical equations including ionic equations for HT	

	• Reacting masses calculations interleaved with chemical formulae, RMM • LCA Case study – plastic vs paper bags • Reversible reactions practical • Effect of reaction conditions on dynamic equilibrium	

Unit: Y11 Chem: Groups in the periodic table	**Number of Lessons:** 11
Key Principles (from NC): • the modern Periodic Table, showing elements arranged in order of atomic number • position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons • properties and trends in properties of elements in the same group • characteristic properties of metals and non-metals • chemical reactivity of elements in relation to their position in the Periodic Table	**The Big Picture (Progression): At KS2 pupils should already have been taught to:** Not much! There is no real mention of the periodic table, atoms, or specific elements until KS3. Students will therefore be building on knowledge gained after KS2. **Links to FUNDAMENTALS UNITS:** Particles Chemical equations **Links to other ESTABLISHING UNITS:** Reactions 1 Reactions 2 Reactions 3 **Links to prior KS4 UNITS** Key concepts 1&2 Acids & Alkalis **Future links and progression onto KS4 UNITS** Rates of reaction, energy changes

Possible Key Learning Points	**Skills**	**Prerequisites**

Group 1

Students should:	Maths skills
6.1 Explain why some elements can be classified as alkali metals (group 1), halogens (group 7) or noble gases (group 0), based on their position in the periodic table	
6.2 Recall that alkali metals a are soft b have relatively low melting points	
6.3 Describe the reactions of lithium, sodium and potassium with water	
6.4 Describe the pattern in reactivity of the alkali metals, lithium, sodium and potassium, with water; and use this pattern to predict the reactivity of other alkali metals	
6.5 Explain this pattern in reactivity in terms of electronic configurations	

Group 7

Students should:	Maths skills
6.6 Recall the colours and physical states of chlorine, bromine and iodine at room temperature	
6.7 Describe the pattern in the physical properties of the halogens, chlorine, bromine and iodine, and use this pattern to predict the physical properties of other halogens	1d 2c
6.8 Describe the chemical test for chlorine	
6.9 Describe the reactions of the halogens, chlorine, bromine and iodine, with metals to form metal halides, and use this pattern to predict the reactions of other halogens	
6.10 Recall that the halogens, chlorine, bromine and iodine, form hydrogen halides which dissolve in water to form acidic solutions, and use this pattern to predict the reactions of other halogens	
6.11 Describe the relative reactivity of the halogens chlorine, bromine and iodine, as shown by their displacement reactions with halide ions in aqueous solution, and use this pattern to predict the reactions of astatine	
6.12 **Explain why these displacement reactions are redox reactions in terms of gain and loss of electrons, identifying which of the substances are oxidised and which are reduced**	
6.13 Explain the relative reactivity of the halogens in terms of electronic configurations	

Group 0

Students should:	Maths skills
6.14 Explain why the noble gases are chemically inert, compared with the other elements, in terms of their electronic configurations	
6.15 Explain how the uses of noble gases depend on their inertness, low density and/or non-flammability	
6.16 Describe the pattern in the physical properties of some noble gases and use this pattern to predict the physical properties of other noble gases	1d 2c

Suggested practicals

- Investigate displacement reactions of halogens reacting with halide ions in solution.

Key Skills Learnt

- Literacy/Oracy: To understand and use new unit specific vocabulary effectively
- Improve skills in linking properties to structure f elements
- Determining trends based on data
- Formulate conclusions based on evidence collected from experimental procedure
- Numeracy: balancing equations and constructing ionic equations

Students should already:

- Be aware of basic laboratory safety when using any chemicals
- Be able to draw electron structures using the periodic table
- Understand that reactions involve electrons
- Know that some elements (metals) will lose electrons in a reaction, and that some (non-metals) will gain electrons
- Know how to identify a group or period in the periodic table
- Be able to identify metals and non-metals using the periodic table

Subject Specific Language

Pedagogical Notes

Make it Stick Activities

Group Period Electron Alkali metal Halide Halogen Noble gas Displacement Reactivity Ion Specific names of elements in groups 1,7,0	Groups in the periodic table is a fairly short topic, with many of the key themes overlapping throughout all of the lessons. The key concepts to learn are all linked to the attraction of the electrons in the outermost electron energy levels to the positively charged nucleus. Once students grasp this concept they should be able to accurately explain why the reactivity of group 1 and group 7 elements changes down the group. Once this has been covered, the unreactive nature of group 0 elements is very straightforward for most students to grasp. The trickiest part of the topic is the ionic equations, which is HT only. There are a few key factors that students need a good understanding of in order to fully grasp these (ionic formulae from key concepts 2 is essential, and may be worth revisiting). There are some trends and colours of elements which need to be recalled, I would suggest frequent revisiting of these to help student pick up via rote learning **Assessments:** **Literacy Key Assessed Task possibilities:** Suggested KAT is to compare the reactivity of group 1 elements and suggest why they aren't used for water pipes. I used this KAT after we had covered both group 1 and group 7 elements, to see which students could successfully distinguish between the differences in their trends. **End of Topic Assessment Lesson 8** 35 Mark Total • Section 1: Quizlet Flashcards (AO1) – 15 Marks • Section 2: Seen Applications Questions (AO2/3) – 10 Marks • Section 3: Unseen Application Questions (AO2/3) – 10 Marks	Tips for Teachers to Help Learning 'Stick' • Interleaving with other units (particularly key concepts 1 and 2) • Hands up/true or false mini-plenary tasks • Demonstration of reactions • Microscale practical activity • KAT to write up combustion practical • Flash cards • Real life applications of reactions included in powerpoints • Flipped HL • Literacy task • Mini quizzes
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions
What happens to an atom during a reaction? Why would an atom gain or lose an electron? How would electrons interact with each other? How are protons and electrons attracted to each other?		All atoms gain electrons to fill up an energy level (e.g. sodium would gain 7 electrons rather than lose 1) When an electron is lost the ion formed is negatively charged Opposite charges attract All electron shells after the first one hold 8 electrons (this isn't a problem as such since

		students won't have to work with an electron structure bigger than calcium – it can be easier than going into detail about bigger atoms)

Unit: Y11 Chem: Chemical Energy Changes	**Number of Lessons:** 4
Key Principles (from NC): • Energy changes in chemistry • Measurement of energy changes in chemical reactions (qualitative) • Bond breaking, bond making, activation energy and reaction profiles (qualitative).	**The Big Picture (Progression):** **Links to FUNDAMENTALS UNITS:** Particles Chemical equations **Links to other ESTABLISHING UNITS:** Reactions 1 Reactions 2 Reactions 3 **Links to prior KS4 UNITS** Key concepts 1&2 Acids & Alkalis Extracting metals and equilibria Rates of reaction **Future links and progression onto KS4 UNITS** This is the penultimate Chemistry unit, not many links with electrolysis

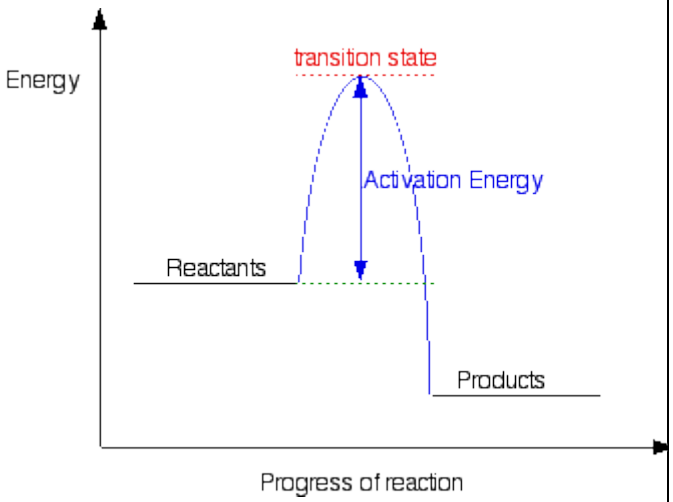
Possible Key Learning Points	**Skills**	**Prerequisites**

Heat energy changes in chemical reactions

Students should:	Maths sk
7.9 Recall that changes in heat energy accompany the following changes: a salts dissolving in water b neutralisation reactions c displacement reactions d precipitation reactions and that, when these reactions take place in solution, temperature changes can be measured to reflect the heat changes	
7.10 Describe an exothermic change or reaction as one in which heat energy is given out	
7.11 Describe an endothermic change or reaction as one in which heat energy is taken in	
7.12 Recall that the breaking of bonds is endothermic and the making of bonds is exothermic	
7.13 Recall that the overall heat energy change for a reaction is: a exothermic if more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants b endothermic if less heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants	
7.14 **Calculate the energy change in a reaction given the energies of bonds (in kJ mol^{-1})**	1a, 1c
7.15 Explain the term activation energy	
7.16 Draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy	4a

Key Skills Learnt

- Literacy/Oracy: To understand and use new unit specific vocabulary effectively
- Begin to recognize that when reactions are reversible they can predict how forward and reverse reactions would differ (e.g. endothermic one way and exothermic the opposite way)
- Formulate conclusions based on evidence collected from experimental procedure
- Identify, explain, and draw simple energy profile diagrams



- Numeracy: balancing equations and **calculating bond energies (HT)**

Students should already:

- Be aware of basic laboratory safety when using any chemicals
- Have an idea that some reactions are reversible (from Reactions 2)
- Be able to describe the process of a solute dissolving in a solvent to form a solution
- Recognise, predict the products, and construct equations for neutralization reactions
- Know what a displacement reaction is, and predict whether one will happen based on the reactivity of elements
- Be able to predict whether a precipitate will form given the reactants
- Know that in a chemical reaction, bonds are broken and formed
- Be able to define the term activation energy
- Be able to accurately measure temperature during a reaction

Subject Specific Language

Pedagogical Notes

Make it Stick Activities

Endothermic Exothermic Energy profile diagram Activation energy Reactant Product Neutralisation Displacement Precipitation Bond energy kJ mol^{-1}	This is the shortest topic in the combined science syllabus, and the penultimate chemistry topic to cover. Most of the terminology will be familiar to students already, and they will have had plenty of experience with reactions and equations. The key new terminology is the terms 'endothermic and exothermic' – lots of visual and audio reminders about these are needed. Emphasise endo – heat energy 'enters' (is transferred to) chemical energy in the bond, hence temperature decreases, and exo – heat energy 'exits' the chemical bond (is transferred from chemical energy store to heat) and is given to the surroundings, hence temperature increases. Conceptually this can be challenging for students, so it is worth reminding them of the energy topic in year 7 – and that chemical energy is stored in a bond, and that the heat energy is transferred between energy stores. Being precise with terminology is key as always. In my experience letting students see the temperature changes by experimentation is key, as otherwise it can be an abstract idea for them. The energy profile diagrams are new information, but are relatively straightforward, students just need to be able to understand that certain bonds between atoms are stronger than others, therefore more energy is stored in the bond. Bond energy calculations should be straightforward enough for students with good numeracy skills With it being such a short topic, there is plenty of room to interleave (particularly as we revisit neutralisation, displacement, precipitation). **Assessments:** **Literacy Key Assessed Task possibilities:** KAT based on the energy profile diagram, describe and compare for endothermic and exothermic reactions. **End of Topic Assessment Lesson 5** 30 Mark Total • Section 1: Quizlet Flashcards (AO1) – 10 Marks • Section 2: Seen Applications Questions (AO2/3) – 10 Marks • Section 3: Unseen Application Questions (AO2/3) – 10 Marks	Tips for Teachers to Help Learning 'Stick' • Interleaving with other units (particularly reactions 2) • Demonstration of reactions • Endothermic and Exothermic practical investigaton • KAT to write up combustion practical • Flash cards • Real life applications of reactions included in powerpoints • Flipped HL • Literacy task • Mini quizzes
Reasoning opportunities and probing questions	Suggested Activities	Possible Misconceptions

What are stores of energy? What is chemical energy? What happens during neutralisation? What would it feel like if heat energy was transferred into, or out of a substance? How would a catalyst change the activation energy of a reaction?		Heat energy being transferred to chemical energy will increase temperature Getting endo and exothermic the wrong way around All reactions are irreversible