Year 11 2020-2021

Half Term 1 (Autumn 1)

Includes Review of B5, B6, B7 and C7 due to Covid-19 school closure

GCSE Chemistry C3 Structure and Bonding			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
The structure of compounds, simple molecules and giant structures from the atomic level and their properties	**Knowledge** • Three types of bonding to join two elements together • Names of giant structures and list their properties • Definition, properties and uses of fullerenes • The different products carbon can form **Understanding** • Explain why two elements should react together based on knowledge of atomic structure • Which types of elements experience which bonding and explanation of how the bonding takes place through either shared, delocalised or exchange of electrons • Explanation of the properties based on the bonding within the structure **Skills** • Using models to represent the abstract and evaluating the strengths and limitations • Drawing scientifically and labelling appropriately • Writing scientifically to explain	Application of knowledge to 'unknown' substances to determine the type of bonding and the likely properties of these substances Independent research project on the use of polymers in real world applications, the advantages, disadvantages and possible alternatives. Independent research on nanoparticles including definition, applications and advantages and disadvantages of this technology. Independent project that summarises the uses of carbon, the bonding in its various structural forms, the applications, advantages and disadvantages Independent selection of materials and construction of models to show various type of bonding or structure	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: C3: Structure and Bonding

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 17, 19 20c,

Lesson No	Topic & Objectives	Big Question – What will students learn?	Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary	Planned Assessment	Homework or flipped learning resources DODDLE resources	Lit Num SMSC Codes
C3.1 States of Matter	**Aiming for Grade 4 LOs:** • Identify the three states of matter and their state symbols. • Describe the process of melting, freezing, boiling, and condensing. • Use the particle model to draw a representation of how particles are arranged in the three states of matter. **Aiming for Grade 6 LOs:** • Use data to determine the state of a substance at a given temperature. • Explain, in terms of particles, the energy and temperature of a substance when it is at the melting point or boiling point.	Does solid oxygen exist? Are boiling and melting temperatures always as we would predict? (Gallium/ Iodine) Why do puddles disappear if it isn't 100	**Lesson Overview** **Starters** **Sorting** (5 minutes) Give students a selection of solids, liquids, and gases. (These could be elements as used in C1.1.) Ask teams of students to sort them by state and introduce the state symbols. **Solids, liquids, and gases** (10 minutes) Students use the interactive to identify if well known substances are solids, liquids, or gases. They then match the change of state key word to its description. Finally, provide students with a list of true or false statements about the properties solids, liquids, and gases. Students have to identify whether the statements are true or false. **Main**	QnA between teachers and students Written responses to questions Class discussion Practical task assessed – graph drawing skills	Doddle: AQA States of Matter mini quiz	So3 C3 Sp2 Sp9 C5 So7 C5

	• Describe the factors that affect rate of evaporation. **Aiming for Grade 8 LOs:** • Use the particle model to describe how energy, movement, and attraction between particles change as a substance is heated or cooled. • Suggest why substances have different melting and boiling points from each other. • **Evaluate a model, explaining its limitations.**	degrees outside? How can you increase the heat without changing the temperature? Does it rain on other planets?	**Cooling curves** (40 minutes) Students complete the practical to get temperature data from stearic acid as it cools. Encourage students to plot a cooling curve (temperature against time). Ask students to annotate the graph with the sections where the stearic acid is a liquid, freezing, and solid. Encourage students to use state symbol notation and draw annotated particle diagrams to show how the particles are moving and arranged in each section of the graph. **(H) Once higher-tier students have completed their practical, they should evaluate the particle model and list some of its limitations.** **Plenaries** **Evaporation** (10 minutes) Give students the structure and boiling point of a simple molecule such as oxygen (−183 °C) and a giant ionic compound such as sodium chloride (1413 °C). Ask students to suggest why these two substances have very different boiling points. **Predict** (10 minutes) Students sketch a graph to show what happens as water is heated from −10 °C to 110 °C. (Graph axes should be temperature against time. Temperature increases from −10 °C to 0 °C. Plateau at 0 °C, where ice melts to liquid water. Temperature increases from 0 °C to 100 °C. Plateau at 100 °C where liquid water turns to steam. Temperature increases from 100 °C to 110 °C.) Students should annotate their diagrams using particle diagrams.			
C3.2 Atoms into Ions	**Aiming for Grade 4 LOs:** • State the particles involved in ionic and covalent bonding. • Describe, with an example, how a Group 1 metal atom becomes a positive ion. • Describe, with an example, how a Group 7 non-metal atom becomes a negative ion. **Aiming for Grade 6 LOs:**	Why are some ions always positive and others negative? What is unique about the	**Lesson Overview** **Starters** **Turning atoms into ions** (5 minutes) Interactive where students match the definitions with the key terms atom and ion. They then sort chemical symbols to identify which are atoms and which are ions. **Label the diagram** (10 minutes) Give students a dot and cross diagram for the reaction of sodium and chlorine to form sodium chloride. Ask students to add the electronic	QnA between teachers and students Written responses to questions Class discussion	Doddle: AQA Identifying Ions	So3 C3 Sp2 Sp9 C5 So7

	• Draw dot and cross diagrams of compounds formed between Group 1 and Group 7 elements. • Explain how electron transfer allows ionic bonding to occur in the compound formed when a Group 1 metal reacts with a Group 7 non-metal. **Aiming for Grade 8 LOs:** • Draw dot and cross diagrams of unfamiliar ionic compounds. • Suggest and explain the charge of a monatomic ion based on its position in the periodic table.	transition metals?	structures of each particle and label which species are atoms and which species are ions. **Main** **Making sense of ions** (40 minutes) Through question and answer with dot and cross diagrams, demonstrate how a lithium atom becomes a lithium ion and show this in a diagrammatic form. Then ask students to use this to draw the electronic structure of the Group 1 ions sodium and potassium. Students then draw dot and cross diagrams for atoms and ions of fluorine, oxygen, potassium, and magnesium forming potassium fluoride, potassium oxide, magnesium fluoride and magnesium oxide. **Plenaries** **Choose the bonding** (5 minutes) Ask students to classify the bonding in the following compounds: • carbon dioxide (covalent) • nitrogen monoxide (covalent) • sodium bromide (ionic) • copper chloride (ionic) • sulfur dioxide (covalent) • silver nitrate (ionic between silver and nitrate, covalent in nitrate) **Flow chart** (10 minutes) Ask students to make a flow chart, including diagrams, to show how chlorine gains one electron from a sodium atom to become sodium chloride.	Marked answers of the dot and cross diagrams		Sp1
C3.3 Ionic Bonding	**Aiming for Grade 4 LOs:** • State that opposite charges attract. • Write the charges of ions of Group 1, Group 2, Group 6, and Group 7 elements. • Describe an ionic lattice.	What do those small number mean? How accurate are our models of ionic bonding?	**Lesson Overview** **Starters** **List ions** (5 minutes) Ask students to list an ion from Group 1, Group 2, Group 6, and Group 7. Ask students to explain	QnA between teachers and students	Doddle: AQA Ionic Bonding mini quiz	So3 C3 Sp2 Sp9

	Aiming for Grade 6 LOs: - Explain how the position of an element in the periodic table relates to the charge on its most stable monatomic ion. - Explain, in terms of electronic structure, how unfamiliar elements become ions. - Interpret the formulae of familiar ionic compounds to determine the number and type of each ion present. **Aiming for Grade 8 LOs:** - Suggest the charge on unfamiliar ions using the position of the element in the periodic table. - Explain the ratio of metal and non-metal ions in compounds. - Generate the formulae of a wide range of ionic compounds when the charges of the ions are given.	Can two elements bond together?	what interaction they expect between the Group 1 and Group 2 ions and the Group 6 and Group 7 ions. **Making ions** (10 minutes) Ask students to draw a dot and cross diagram of a calcium atom and a calcium ion. They then annotate these diagrams to explain how and why calcium atoms become calcium ions. Then ask students to complete the same for oxygen atoms. **Mains** **What's the pattern?** (15 minutes) Split the students into groups of three and give each team 20 sticky notes. Instruct the students to write the symbol (as in the periodic table) for each of the first 20 elements, each on separate sticky notes. Then add the electronic structure of the atom, formula of the ion, and the electronic structure of the ion (if they form a stable monatomic ion). Ask students to group the ions by charge and see if they can work out a pattern in the ion's charge and position in the periodic table. **Modelling ionic compounds** (25 minutes) Show students some examples of 3D models of ionic compounds such as model kits and computer models. Then ask students to draw their own representation of an ionic lattice and label the positive ions, negative ions, electrostatic forces of attraction, and the formula of the compound. Discuss, or show students an animation of, the formation of sodium chloride from sodium and chlorine using dot and cross diagrams. Ask students to annotate their diagram further by explaining, using dot and cross diagrams, how the ions in the ionic lattice are formed from the atoms. **Plenaries** **Ions and group numbers** (5 minutes) Interactive where students match monatomic ions to their group in the periodic table. **Ionic formulae** (10 minutes) Provide students with a table showing the formula and charge of a series of ions.	Written responses to questions Class discussion		C5 So7 Sp5

			Students use the table to identify the chemical formula of some compounds.			
C3.4 Giant Ionic Structures	**Aiming for Grade 4 LOs:** • State that ionic compounds have high melting points and can dissolve in water. • State that ionic compounds can conduct electricity when molten or dissolved in water. • Describe an ionic lattice **Aiming for Grade 6 LOs:** • Explain why ionic compounds have a high melting point. • Describe, in terms of ions, how an ionic compound can conduct electricity. • Explain the movement of ions in solution or when molten. **Aiming for Grade 8 LOs:** • Explain in detail why ionic compounds cannot conduct electricity when they are solid but can when molten or in solution. • Justify in terms of properties that a compound has ionic bonding. • Apply the ionic model to make predictions of the physical properties of ionic compounds.	Magic conductors – how can salt conduct electricity? Why is so difficult to have liquid salt?	**Lesson Overview** **Starters** **What's the connection?** (5 minutes) Show students an image of a salt cellar, sodium chloride crystal, sodium chloride lattice, and gritting of roads. Ask students to suggest a connection (sodium chloride). **Labelling** (10 minutes) Give students a diagram of the sodium chloride lattice structure. Ask students to take one minute to label the diagram with key information that they can remember. Pass the paper on. The next person should have two minutes and they can amend previous work or add to the diagram. Repeat with a third person who should have three minutes. Then give to a fourth person who should stick the diagram in their book and make any final additions and amendments that are needed. **Main** **Testing conductivity** (40 minutes) Give students the outline of the method to investigate the conductivity of ionic compounds as a powder and when dissolved in water. Students write a full method, including a risk assessment. They then complete the practical and draw their conclusions, using the ionic lattice model to explain their observations. **Plenaries** **Giant ionic structures** (10 minutes) Interactive where students complete a paragraph to describe the bonding and properties of ionic compounds. They then decide if descriptions of properties are true or false in describing ionic compounds. **Outline method** (10 minutes) Ask students to write an outline method to show that ionic compounds have high melting points.	QnA between teachers and students Written responses to questions Class discussion Marked method for the practical	Doddle: AQA Ionic Compounds mini quiz	So3 C3 Sp2 Sp9 C5 So7 C8

C3.5 Covalent Bonding	**Aiming for Grade 4 LOs:** • Describe a covalent bond • Recognise a covalent compound from its formula, name, or diagram showing bonds. • Name familiar examples of small molecules which contain covalent bonds. **Aiming for Grade 6 LOs:** • Explain how a covalent bond forms in terms of electronic structure. • Draw dot and cross diagrams and ball and stick diagrams for H_2, Cl_2, O_2, N_2, HCl, H_2O, NH_3, and CH_4. • Describe a double bond in a diatomic molecule. **Aiming for Grade 8 LOs:** • Draw dot and cross diagrams and ball and stick diagrams for unfamiliar small molecules. • Suggest how double and triple covalent bonds can be formed. • Suggest how the properties of a double covalent bond could be different to the properties of a single covalent bond.	What happens when both elements need electrons? How well can we represent what we can't see?	**Lesson Overview** **Starters** **Diagrams** (5 minutes) Students use the particle model to represent an atom, a chlorine gas molecule, and a water molecule. **Molecular model** (10 minutes) Ask students to work in pairs. Give them a molecular modelling kit and ask them to show an atom, a bond, a molecule made of an element, and a molecule made of a compound. **Mains** **Covalent bonding** (30 minutes) Students work through the activity sheet to describe the covalent bonding in chlorine, oxygen, methane, and other simple molecules. Students then create an infomercial to advertise covalent bonds. Their advert should be no more than 30 seconds. **Formulae of covalent compounds** (10 minutes) Students work through the worked example then practise drawing dot and cross diagrams for simple covalent molecules. **Plenaries** **Table** (10 minutes) Students draw a table with four columns – molecule, formula, ball and stick, and dot and cross. Students fill in the table with H_2, O_2, H_2O, and CH_4. **Covalent bonding** (10 minutes) Interactive where students match the name and formula of a compound with its dot and cross diagram. They then complete a paragraph to describe covalent bonding.	QnA between teachers and students Written responses to questions Class discussion Marked activity sheet for different molecules	Doddle: AQA Covalent Bonding mini quiz	
C3.6 Structure of Simple Molecule s	**Aiming for Grade 4 LOs:** • State that small molecules have low melting and boiling points. • State that small molecules do not conduct electricity. • Describe an intermolecular force.	Plastic conductors? Possible and if so useful? Why are electrical cables	**Lesson Overview** **Starters** **Intermolecular forces** (10 minutes) Introduce inter molecular forces as the force of attraction between neighbouring molecules. Explain that the intermolecular forces *increase* with the *size* of the molecules. Show students molecular diagrams of oxygen, ethanol, and	QnA between teachers and students Written responses to questions	Doddle: Forces between molecules animanation	So3 C3 Sp2 Sp9

	Aiming for Grade 6 LOs: • Explain how the size of molecules affects melting and boiling points. • Explain why small molecules and polymers do not conduct electricity. • Identify substances that would have weak intermolecular forces. **Aiming for Grade 8 LOs:** • Predict the physical properties of unfamiliar covalently bonded substances. • Compare and contrast the properties of substances with different bonding. • Justify the use of a model to explain the physical properties of a small molecule and discuss the limitations of various molecular models.	coated in plastic? Salt vs sugar which is more useful? Why are some molecules so easy to turn into gas? (Salt vs Iodine)	sucrose. Ask students to put the substances in order of strongest to weakest intermolecular forces. Then ask students to identify which substance is a solid, a liquid, and a gas. **Sodium chloride versus sucrose** (5 minutes) Show students an image of a sodium chloride giant lattice and a sucrose molecule. Tell students that sodium chloride is table salt and sucrose is commonly used as granulated sugar. Ask students to compare the two substances in terms of their bonding and properties. **Mains** **Conductivity of a simple molecular compound** (20 minutes) Remind students of their experiment in Topic C3.4. Demonstrate to students that sucrose does not conduct electricity as a solid or when in solution. Ask students to explain their observation using the particle model. **Displaying data** (20 minutes) Provide students with the melting point and boiling point values for phosphorus, P_4, sulfur, S_8, chlorine, Cl_2, and argon, Ar. Students draw a ball and stick diagram to represent the element then plot a bar chart or scatter graph of the data (temperature against relative molecular mass). Ask students to draw conclusions consistent with the results, for example, melting points are always higher than boiling points and bigger molecules have higher melting and boiling points. **Plenaries** **Simple molecules** (10 minutes) Students complete a crossword on bonding, intermolecular forces, and different properties of the states of matter. They then analyse a graph of molecular size against melting point and boiling point. **Models** (10 minutes) Show students as many different ways of representing chlorine gas as you can find including 2D ball and stick, dot and cross diagrams, and 3D computer models. Ask students to evaluate the models and suggest which is best to describe each property studied in the lesson. Students justify their choice.	Class discussion Marked explanation and conclusions from their ball and stick diagram		C5 So7

C3.7 Giant Covalent Structures	**Aiming for Grade 4 LOs:** • List the main physical properties of diamond and graphite. • State that giant covalent structures have high melting points. • Describe the structure of graphite in terms of layers of carbon atoms. **Aiming for Grade 6 LOs:** • Recognise the structure of diamond and graphite from information provided in written or diagrammatic form. • Explain the properties of diamond in terms of its bonding. • Explain the properties of graphite in terms of its bonding. **Aiming for Grade 8 LOs:** • Use a molecular model of an unfamiliar giant covalent structure to predict and explain its physical properties. • Justify in detail a use for graphite based on its properties. • Justify in detail a use for diamond based on its properties.	How can the same element make diamond and the graphite in your pencil? Graphite vs diamond – which is really most valuable?	**Lesson Overview** **Starters** **Link the items** (5 minutes) Show students a carbon electrode, pencil, drill bit, graphite lubricant powder, carbon fingerprint powder, and a diamond (imitation). Ask students to suggest the connection (all carbon). **Giant covalent structures** (10 minutes) Give students the ball and stick diagrams of diamond and graphite. Ask students to label with key phrases such as carbon atom, covalent bond, free moving delocalised electrons, layers. Students then identify whether phrases describe the properties of graphite or diamond. **Main** **Carbon blogging** (40 minutes) Introduce students to carbon, the bonding, properties, and uses of graphite, and the bonding, properties, and uses of diamond. Students then create a comparison table that includes the structure, describes the properties, and explains them in terms of structure and bonding. Students then use their comparison table to summarise the key points about carbon in the form of graphite and diamond as a blog article. Students should include a labelled diagram and links to at least one other interesting web page. **Plenaries** **Uses of carbon** (5 minutes) Give small groups of students a use of carbon, and then ask them to suggest which allotrope would be the best to use and then explain why. **Comparing structures** (10 minutes) Show students an image of a carbon dioxide molecule and the structure of silicon dioxide. Students explain the differences in properties between the two substances in terms of their structure and bonding.	QnA between teachers and students Written responses to questions Class discussion Marked answer for the comparing of structures	Doddle: AQA Covalent substances mini quiz AQA: Carbon structures mini quiz	

C3.9 Bonding in Metals	**Aiming for Grade 4 LOs:** • State that metals form a giant structure. • Recognise metallic bonding in diagrams. **Aiming for Grade 6 LOs:** • Describe metallic bonding. • Recognise and represent metallic bonding diagrammatically. **Aiming for Grade 8 LOs:** • Explain how metal atoms form giant structures. • Evaluate different models of metallic bonding.	Why might metals be the most useful material in the world? What are the limitations to metals? What are memory metals and how do they work?	**Lesson Overview** **Starters** **Structure spotting** (5 minutes) Show students diagrams of a giant covalent structure, a giant ionic structure, and a simple covalent molecule. Students describe each of the structures, list the types of bonding involved, and any properties they would expect the substance to have. Then show students a metallic structure. Ask students if this is a different type of bonding, and point out the differences from the other giant structures they have met. **Bonding in metals** (10 minutes) Students label a diagram of metallic bonding to show the key features. They then complete a matching exercise to briefly summarise the key features of the three types of bonding they have studied – ionic, covalent, and metallic. **Mains** **Growing silver crystals** (25 minutes) Ask students to draw a results table to note the appearance of the reactants. Run the experiment and students make observations after 10 minutes, then again after 20 minutes. Encourage students to write word and balanced symbol equations to illustrate the reaction. **Survey** (15 minutes) Allow students to tour the school in small groups to find examples of metal crystals in different structural materials. Galvanised steel and brass often allow the crystals to be seen. If possible, supply students with a digital camera and encourage them to take a digital image, annotate the image to highlight the crystal, and then add information to explain the bonding and structure in that image. Ensure students understand which parts of the site should not be visited and be given clear instruction of the time allowed for this activity. This activity could be carried out in between observations in the practical. Alternatively, supply students with images of galvanised steel and brass. **Plenaries** **What's the connection?** (5 minutes) Show students any models of metallic crystals that the school may have, a	QnA between teachers and students Written responses to questions Class discussion Marked answers – observations and word and balanced symbol equation from the practical task	Doddle: Metallic and Covalent bonding mini quiz	So3 C3 Sp2 Sp9 C5 So7 C5

			diagram, and 3D computer simulations. Ensure that students can pick out the key features of each model, for example, the metal ions and the electrons. **Silver crystals** (10 minutes) Ask students to look carefully at their silver crystals. Students use their knowledge of metallic bonding to explain the structure of the crystal in both prose and a labelled diagram.			
C3.10 Giant Metallic Structures	**Aiming for Grade 4 LOs:** • List the physical properties of metals. • Describe the structure of a pure metal. **Aiming for Grade 6 LOs:** • Explain key physical properties of metals using the model of metallic bonding. • Describe why metals are alloyed. **Aiming for Grade 8 LOs:** • Explain in detail, including labelled diagrams, how alloying affects the structure and bonding in metals and its effect on properties. • Justify in detail why alloys are more often used than pure metals.	Why might metals be more valuable when they are not pure? (Gold / aluminium	**Lesson Overview** **Starters** **Periodic look up** (5 minutes) Provide students with a periodic table. Ask students to find the symbol of copper, Cu, the atomic number of gold (79), the mass number of iron (56), and give the electronic structure of aluminium (2, 8, 3). **What do you know?** (10 minutes) Split the class into four groups and assign each group one of the metals copper, gold, iron, or aluminium. Ask each group to list the physical properties of their metal and any uses that they know of for that substance. Use question and answer to generate a common list of the physical properties of metals. **Mains** **Making models of metals** (40 minutes) Explain that a model is a simplified version of what actually happens that helps scientists understand observations and make predictions. Run the practical as outlined. Ask students to explain malleability and ductility of a pure metal and an alloy by using labelled diagrams of the experiment. Students then complete a table with the three columns (metal property, explanation, illustrated use). Students should explain the key physical properties (ductile, malleable, thermal conductor, and electrical conductor) and illustrate a use for each property limited to copper, gold, iron, and aluminium. For example, copper is used in electrical wires because it is ductile and a good electrical conductor. Students develop their ideas of metallic	QnA between teachers and students Written responses to questions Class discussion	Doddle: Metallic structures animation	So3 C3 Sp2 Sp9 C5 So7

			bonding into a model and use this to explain some of the properties of metals and alloys. **Plenaries** **Question time** (5 minutes) Ask students to write five questions about the structure and bonding in metals. Encourage students to use the learning objectives to help them. Ask the students to swap their questions with a partner who should answer them for homework. **Metals and alloys** (10 minutes) Interactive where students complete a paragraph to explain the bonding and properties of metals. They then identify the reason why an alloy is sometimes used in place of a pure metal.			

GCSE Physics P4 Electrical Circuit			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
What electricity is and how can we use it.	**Knowledge** • Symbols to represent components in circuits and what they do • Recognise and be able to draw simple series and parallel circuits • Charge, potential difference and resistance calculations • Voltage, current and resistance – what they are and how to measure them • List factors that increase resistance **Understanding** • Comparison between voltage, current and resistance in series and parallel circuits • Design circuits to meet particular requirements or that are capable of performing certain functions **Skills** • Construct and interpret current-potential difference graphs • Calculate charge, potential difference and resistance.	Individual research project on static charge in which knowledge and understanding is demonstrated through small practical, every day examples of this Link to previous topic and understanding that those metals which delocalise more electrons are the better electrical conductors. Construction of complete circuits with minimal supervision and problem solving without teacher support Detailed model or analogy constructed which highlights the differences between series and parallel circuits in terms of current and voltage. Application of knowledge to a wide variety of circuits draw in difference ways. Confidence in completing multistep processes that may also require the re-arrangement of equations and / or conversions between units.	BBC Bitesize Doddle – power points and quick quizzes You tube: ‘Free science lessons’ Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: P4: Electrical Circuits

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: **4b and c, 5, 11, 12 and 13l**

Lesson No	Topic & Objectives	Big Question – What will students learn?	Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary	Planned Assessment	Homework or flipped learning resources DODDLE resources	Lit Num SMSC Codes
P4.2 Current and Charge	**Aiming for Grade 4 LOs:** • Identify circuit components from their symbols. • Draw and interpret simple circuit diagrams. • Construct a simple electrical circuit. **Aiming for Grade 6 LOs:** • Describe the operation of a variable resistor and a diode and their effects on current. • Calculate the charge transferred by a steady current in a given time. • Construct an electrical circuit and accurately measure the current. **Aiming for Grade 8 LOs:** • Explain the nature of an electric current in wires in terms of electron behaviour. • Perform a range of calculations, including rearrangement of the equation *Q* = *It*.	How do we describe a circuit to another person? What is electricity?	**Lesson Overview** **Starters** **It's symbolic** (5 min) Show a set of slides/diagrams to the students containing common symbols and ask them to say what they mean. Use road signs, hazard symbols, washing symbols, and so on. **Describe the circuit** (10 min) Give the students diagrams of two circuits containing cells, switches, and bulbs, one series and one parallel. Ask them to describe both in one paragraph. The students can demonstrate their understanding of circuit symbols, establishing prior knowledge of concepts such as current, voltage, series, and parallel. **Main** **Circuit tests** (40 min) Construct a 'torch' circuit, showing the students each component and discussing its operation. Demonstrate how circuits should be constructed methodically to avoid problems later. At the same time show some of the other components that will be introduced later. Discuss the nature of a current, with a	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Describe the structure of a metal? How does the metallic structure enable it to conduct electricity? **Doddle task:** Electrical circuits (presentation) Relationship between current and voltage (interactive)	C3 C3 C3

	• Measure the current in a circuit accurately and use it to calculate the rate of flow of electrons.		focus on the rate of flow of charge, leading to the equation *Q* = *It*. A few example calculations are required to embed the units. Students then construct the circuit described in the practical and test it, with the focus on connecting the apparatus correctly. They can then add the ammeter to collect numerical information and practise using it. Students add a diode to their circuit, note the effect, and discuss its operation ensuring the student's link the direction of the arrow on the symbol to the direction of the current. **Plenaries** **Current calculations** (5 min) Give the students a few calculations based on the equation to perform. **Circuit symbols and resistance** (10 min) Students work through the interactive to match the circuit symbols and relevant units with their definitions.			
P4.3 Potential Difference and Resistance	**Aiming for Grade 4 LOs:** • State that resistance restricts the size of a current in a circuit. • State Ohm's law and describe its conditions. • Measure the current and potential difference in a circuit to determine the resistance. **Aiming for Grade 6 LOs:** • Calculate the potential difference. • Calculate the resistance of a component. • Measure the effect of changing the length of a wire on its resistance in a controlled experiment. **Aiming for Grade 8 LOs:** • Describe potential difference in terms of work done per unit charge. • Rearrange equations for resistance and potential difference. • Investigate a variety of factors that may affect the resistance of a	How is it possible to change the brightness of a bulb? – dimmer switches How do electrons move through different components? Is it possible to stop the flow of electrons?	**Lesson Overview** **Starters** **Resistors** (5 min) Show the students the circuit symbols for all of the different types of resistor and ask them to describe the similarities in the symbols. **Rearranging equations** (10 min) Students use the interactive to identify the three correct arrangements of the equation for charge flow. They then answer an example calculation for each arrangement. **Main** **How does the resistance of a wire depend on its length?** (40 min) Discuss the nature of potential difference and demonstrate how it is measured in a circuit along with current. Use the Maths skills interactive to give students some practice using the equation. Students then investigate the effect of changing the length of a wire on the resistance.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Which appliances in the home make use of the heating effect of resistance? **Doddle task:** Effect of length on resistance (animation)	C3 C3

	metal wire, such as the current through it, length, cross-sectional area, and metal used.		Different groups of students can be given wires of differ diameters or materials to show that the pattern is the same (resistance is proportional to length) and identify some other factors which affect resistance. **Plenaries** **An electron's tale** (5 min) Students write a paragraph about the journey of an electron around a circuit containing a bulb and a resistor. They should write about the energy transfers that are going on in the circuit. **Reinforced resistance** (10 min) Additional calculations should be used to reinforce learning, differentiating by student ability as appropriate.			
P4.4. Component Characteristics	**Aiming for Grade 4 LOs:** • Identify the key characteristics of electrical devices. • Identify components from simple I–V graphs. • State the operation of a diode in simple terms. **Aiming for Grade 6 LOs:** • Describe the resistance characteristics of a filament lamp. • Describe the characteristics of a diode and light-emitting diode. • Investigate the resistance characteristics of a thermistor and a LDR. **Aiming for Grade 8 LOs:** • Explain the resistance characteristics of a filament lamp in terms of electrons and ion collisions. • Determine the resistance of a component based on information extracted from a *I–V* graph. • Compare the characteristics of a variety of electrical components, describing how the components can be used.	How widely are thermistors and LDR's used in everyday life? Is a diode a useful component in a circuit?	**Lesson Overview** **Starters** **Comparing wires** (5 min) Show the students a graph of the current–p.d. characteristics of three wires. They use the interactive to put the three wires in order of highest resistance to lowest resistance. They then complete a paragraph to describe what characteristics affect the resistance of a wire. **Thermistors and LDRs** (10 min) Introduce thermistors and LDRs briefly. Set up a circuit with a thermistor attached by crocodile clips and place the thermistor into a beaker of hot water. Measure the resistance of the thermistor, and ask students to predict what would happen to the resistance measurement as the water cools. **Main** **Investigating different components** (40 min) Discuss the results of the investigation into the characteristics of a wire from Topic P4.3. The students then investigate the behaviour of a filament lamp, a diode, and a resistor, as described. Ensure that the students can identify and describe the resulting I–V graphs clearly. Results should be shared so that all students are aware of the characteristics of the components.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Where might you find thermistors being used in your home? What is the purpose of the thermistor? **Doddle task:** Resistors (presentation) Current-voltage graphs (animation) Current-voltage graph of a diode (animation)	C3 C3 C3 C3

			Plenaries **What's in the box?** (5 min) An electrical component has been placed inside a black box with only the two connections visible. The students should suggest an experiment to find out what it is. This should involve a detailed analysis of the V–I characteristics. **Thermistors and LDRs – revisited** (10 min) Revisit the circuit with the thermistor from the start of the lesson to see how the resistance of the thermistor has increased as the water cooled. Then ask students to predict what would happen to the resistance of an LDR if it was placed closer to a bright light. Set up the circuit to demonstrate.			
P4.5 Series Circuits	**Aiming for Grade 4 LOs:** • State that the current in any part of a series circuit is the same. • Calculate the potential difference provided by cell combinations. • Calculate the total resistance of two resistors placed in series. **Aiming for Grade 6 LOs:** • Find the potential difference across a component in a circuit by using the p.d. rule. • Calculate the current in a series circuit containing more than one resistor. • Investigate the resistance of series circuits with several components. **Aiming for Grade 8 LOs:** • Explain in detail why the current in a series circuit is the same at all points by using the concept of conservation of charge (electrons). • Analyse a variety of series circuits to determine the current through, p.d. across, and resistance of combinations of components. • Evaluate in detail the investigation of series circuits and explain discrepancies.	Why aren't the reading on our meters ever what we expect? Current conserved but voltage shared – what does this mean? Can we completely reduce the current by continually adding resistors?	**Lesson Overview** **Starters** **Adding wires** (10 min) Show the students a circuit with a wire of resistance 2 Ω and ask them what would happen if a second length of identical wire was placed 'in series'. Would the resistance go up or down? What would happen if the wire was placed in parallel with the first? **One way only** (5 min) Ask students: In what situation are we allowed only one way through something? Suggest a tour or road system. Discuss the idea of conservation – the same number of people or cars go out and come in. **Main** **Investigating potential differences in a series circuit** (25 min) Demonstrate the conservation of current and the addition of potential differences by using ammeters and voltmeters in a series circuit, accounting for any discrepancies. Students then investigate potential difference, discovering that the total p.d. around a branch (summing the p.d.s across the series components) is the same as the p.d. provided by the power supply. There will be some variation in measurements and a discussion of meter precision and error should take place. **Resistors in series** (15 min) Discuss resistance in series and allow students to confirm the information using fixed	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Why is it important not to overload an extension lead? What would cause the extension lead to be "overloaded"? **Doddle task:** Investigating series circuits (animation)	C3 C3

			resistors in a circuit by constructing a circuit containing fixed value resistors. **Plenaries** **Controlling current** (5 min) Interactive where students are given combinations of cells and resistors and the current they would produce, some correct and some incorrect. Students identify which combinations are correct. **Circuit rules** (10 min) The students should start making a list of circuit rules to help them work out the currents, potential differences, and resistances in series and parallel circuits.			
P4.6 Parallel Circuits	**Aiming for Grade 4 LOs:** • Identify parallel sections in circuit diagrams. • State the effect of adding resistors in parallel on the size of the current in a circuit. • State that the p.d. across parallel sections of a circuit is the same. **Aiming for Grade 6 LOs:** • Measure the p.d. across parallel circuits and explain any discrepancies. • Describe the effect on the resistance in a circuit of adding a resistor in parallel. • Investigate the effect of adding resistors in parallel on the size of the current in a circuit. **Aiming for Grade 8 LOs:** • Analyse parallel circuits in terms of current loops. • Calculate the current at any point in a circuit. • Evaluate in detail an investigation into the effect of adding resistors in parallel on a circuit.	Are parallel circuits more useful than series circuits? It is easier to control (reduce) the current in a parallel or series circuit?	**Lesson Overview** **Starters** **Circuit jumble** (5 min) Show the students a diagram of a parallel circuit with three branches and several components on each branch. The wires and components are jumbled up, and the students must redraw the circuit properly. **The river** (10 min) Show the students a picture of a river branching and re-joining. Ask them to explain what happens to the current in the river (mass of water passing a point each second) before, during, and after the split. They should compare this to the current in circuits. **Main** **Investigating parallel circuits** (30 min) Students construct a simple parallel circuit and measure the current in the two branches. Use a conservation model to explain this – electrons are not created or destroyed, so the current into a junction is the same as the current out of it. The students should perform some example calculations on parallel circuits. Students need to analyse a circuit with the worked example in the student book to consolidate the current and p.d. rules. **Resistors in parallel** (10 min) The students should test a pair of resistors in series and parallel using the practical task. Explain this by discussing the new current loop	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** How has Christmas tree lights changed over time? **Doddle task:** Investigating series circuits (animation) AQA Electrical circuits (mini quiz) AQA Series and parallel (mini quiz)	C3 C3 C3 C3

			provided by the new branch whilst the old current loop still exists. **Plenaries** **Stair lights** (5 min) Students design a simple circuit that can be used to turn the lights on and off from the top and bottom of a set of stairs. **Another circuit** (10 min) Interactive where students analyse a parallel circuit to determine the current from a battery.			

GCSE Physics P5 Electricity in the Home			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
How electricity from power stations reaches and is used in our homes	**Knowledge** • Components of the national grid • Components of a plug • Power and charge calculations • Appliances often have energy efficiency ratings **Understanding** • Explanation for the need of step up and step down transformers • Explanation of the safety features in all UK plugs • Comparison between alternating and direct current • Calculation of power and charge • Explanation of the energy transfers in a circuit • Evaluation of appliance efficiency. **Skills**	A comparison between UK plugs and those around the world – what safety features may be different, why and the potential consequences of this. Extended scientific writing on the safety features of plugs with a labelled diagram Links to previous topics of energy transfers to show the energy transfers in a circuit and to calculate wasted energy and efficiency when given the appropriate data Confidence in completing multistep processes that may also require the re-arrangement of equations and / or conversions between units. Independent research into the charge of an electron and how many pass through a wire when the current is 1A.	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: P5 Electricity in the Home

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 20 and 24

Lesson No	Topic & Objectives	Big Question – What will students learn?	Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary	Planned Assessment	Homework or flipped learning resources DODDLE resources	Lit Num SMSC Codes
P5.1 Alternating Current	**Aiming for Grade 4 LOs:** • State that the UK mains supply is a high-voltage alternating current supply. • State simple differences between a.c. and d.c. sources. • Describe how the trace on an oscilloscope changes when the frequency or amplitude of the signal is changed. **Aiming for Grade 6 LOs:** • Describe the characteristics of the UK mains supply. • Compare a.c. traces in terms of period and amplitude (voltage). • Operate a cathode ray oscilloscope to display an a.c. trace.	What are the differences between alternating and direct current? How can we 'see' current? (oscilloscope)	**Lesson Overview** **Starters** **Waveforms** (5 min) Show the students a wave diagram (e.g., picture from the student book) and ask them to discuss it. They should recognise the sine wave shape of the wavelength (or period) and the amplitude. **Mains facts** (10 min) Ask the students some true/false questions about mains electricity to see what they already know. These should include some basic questions that have already been covered on d.c. and some testing of their knowledge of mains electricity. **Main**	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Is mains voltage the same in all countries? **Doddle task:** Mains electricity (presentation)	C3 C3

	Aiming for Grade 8 LOs: • Explain the process of half-wave rectification of an a.c. source. • Analyse a.c. traces with an oscilloscope to determine the voltage and frequency. • Compare and contrast the behaviour of electrons in a wire connected to d.c. and a.c. supplies.		**Alternating and direct current** (20 min) Discuss d.c. using a simple series circuit and ask students to describe electron movement. Introduce the idea that the electrons can be made to move back and forth rapidly (an a.c. supply), which still transfers energy to devices. Discuss the structure of a mains circuit, outlining the function of the live, neutral, and then earth wires. Emphasise the higher, rapidly varying voltages. The characteristics of the mains (50 Hz and around 230 V) should also be covered, noting that the peak voltage is significantly higher (325 V). Outline the basic features of the National Grid in terms of transformers and changes in voltage. **Investigating an alternating potential difference** (20 min) Demonstrate or allow students to use an oscilloscope. They should be able to form a steady trace and measure the key characteristics of a.c. and d.c. sources by using the scales. They should also interpret some additional traces when given the oscilloscope settings in questions. Show students the waveform produced by half-wave rectification by placing a diode in series with a resistor and a low-voltage a.c. source. **Plenaries** **a.c./d.c.?** (5 min) Give the students a set of electrical appliances and ask them to stack them into one of two piles: a.c. operation and d.c. operation. **Traces** (10 min) Show the students a series of oscilloscope traces with settings data (time base) and ask them to extract data from them, such as the peak p.d. and period.			
P5.2 Cables and Plugs	**Aiming for Grade 4 LOs:** • Identify the live, neutral, and earth wires in a three-pin plug. • Identify the key components of a typical three-pin plug and socket.	Why are plugs different around the world?	**Starters** **Mystery object** (5 min) Place a mains plug in a bag and ask one student to describe it to the rest of the class but only	Question & Answer,	**Rich question to research:**	

	• Identify simple and obvious hazards in electrical wiring. **Aiming for Grade 6 LOs:** • Discuss the choices of materials used in cables and plugs in terms of their physical and electrical properties. • Describe why a short circuit inside a device presents a hazard. • Identify a variety of electrical hazards associated with plugs and sockets. **Aiming for Grade 8 LOs:** • Explain when there will be a current in the live, neutral, and earth wires of an appliance. • Discuss in detail the hazards associated with poor electrical wiring.	Is it safe to re-wire your own plug? Are our plugs the safest in the world?	using shape and texture. This can be made more difficult by using a continental plug. **Material sorting** (10 min) Give each group of students a bag containing a range of materials and ask them to sort the materials in any way they wish. They must explain how they sorted them to other student groups in terms of the properties. Ensure that sorting criteria include conductors, insulators, hard, and flexible. **Main** **Plugs, cables, and short circuits** (40 min) Show the student's appliances with three-pin plugs (do not use loose plugs without devices connected). The students discuss the choices of materials and physical design of the pins and socket. Recap the purpose of each of the three wires. Show partially stripped three-core and two-core cables and discuss the materials and design. Compare these to the leads used in low-voltage experiments. Students need to understand that thick cables are less likely to overheat than thin ones. Demonstrate the practical and discuss what would happen if the wire was in contact with flammable materials. **Plenaries** **Materials summary** (5 min) Students make a table listing the parts of a plug and cable, the materials used, and the reasons for those choices. This should be centred on ideas about good conductors and insulators along with flexibility or rigidity. **Wonky wiring** (10 min) Students use the interactive to match the colour of a wire's insulation with what pin of a plug it is attached to. They then complete a paragraph to describe the hazards associated with plugs and sockets.	Mini white boards, Exam style question	How are plugs in the UK different to those used in Europe? **Doddle task:** Match each wire to its colour and description (interactive)	C3 C3
P5.3 Electrical Power	**Aiming for Grade 4 LOs:** • State that the power of a device is the amount of energy transferred by it each second.	Which fuse for which? How can we ensure that all	**Lesson Overview** **Starters**	Question & Answer,	**Rich question to research:**	

and Potential Difference	• Describe the factors that affect the rate of energy transfer by a current in a circuit. • Explain why different fuses are required for different electrical devices in simple terms. **Aiming for Grade 6 LOs:** • Calculate the power of systems. • Calculate the power of electrical devices. • Select an appropriate fuse for a device. **Aiming for Grade 8 LOs:** • Measure and compare the power of electrical devices and explain variations in readings. • Calculate the electrical heating caused by resistance. • Combine a variety of calculations to analyse electrical systems.	appliances are safe in our homes? Hairdryers and washing machines need different amounts of power – how can we plug both into the mains?	**Power** (5 min) Can the students give a scientific definition (and an equation) for power? Once a formal definition has been made, ask how this could be connected to electrical current where no force is apparently causing anything to move. **Electrical units** (10 min) Students use the interactive to match up electrical quantities with their definitions, abbreviations, and units. Include current *I* (amperes), voltage *V* (volts), resistance Ω (ohms), power *P* (watts), and energy (*E*, joules). Can the students provide any definitions for these units? **Main** **Energy and power** (25 min) Recap the concept of energy and the power equation that was met when studying mechanical power. The students should try some simple calculations to refresh their understanding. Ask students what factors will affect the rate of energy transfer by a current and then introduce the equation $P = IV$. The practical can be used to support this section. As usual, several example calculations will be required to embed this. **Fuses, resistance and heating** (15 min) The students should apply the power calculation to select fuses for a variety of devices using the mains p.d. of 230 V. Show how the equations $V = IR$ and $P = IV$ can be combined algebraically, and ask the students to perform some heating calculations based on $P = I^2R$. **Plenaries** **Electrical error** (5 min) 'I'm sick of all my stuff fusing; I'm going to put a 13 A fuse in all of my things, so that they'll all keep working.' Ask students to discuss the hazards associated with doing this. **Match the fuse** (10 min) The students need to find the correct fuse for an electrical appliance after being told the power rating. This involves calculating the current and	Mini white boards, Exam style question	What are the advantages of using a circuit breaker like an RCCB? **Doddle task:** AQA Mains electricity (mini quiz)Electrical power (presentation) Investigating power consumption (interactive)	C3 C3 C3

			then choosing the fuse that is slightly higher. Use 3 A, 5 A, 13 A, and 30 A fuses.			
P5.4 Electrical Currents and Energy transfer	**Aiming for Grade 4 LOs:** • Describe how an electric current consists of a flow of charge (electrons in a wire). • Identify the factors that affect the energy transfer in a circuit. • State that a battery or power supply provides energy to a current whereas a resistor causes a transfer of energy to the surroundings. **Aiming for Grade 6 LOs:** • Calculate the charge transferred by a current in a given time. • Calculate the energy transferred by a charge passing through a potential difference. • Apply the law of conservation of energy in a circuit. **Aiming for Grade 8 LOs:** • Perform calculations involving rearrangement of the equations $Q = It$ and $E = VQ$. • Explain how energy is conserved in terms of current and p.d. during energy transfers by an electric current. • Use algebra to combine the equations $Q = It$ and $E = VQ$ to form the relationships $E = VIt$ and $P = IV$.	How does the law of conservation apply to a circuit? How can a flow of electrons switch on a lamp? How do moving electrons transfer energy? Does electricity able us to transfer energy into any form?	**Lesson Overview** **Starters** **Current and p.d. rules** (5 min) Ask the students to describe the rules for current and potential difference in series and parallel circuits. **Energy transfer** (10 min) How many electrical appliances can the students describe energy transfers for? The students can also estimate the electrical efficiency of the appliances after they are clear about which of the energy pathways are useful. **Main** **Charge and current** (15 min) Show a simulation or model of an electric current and discuss the movement of electrons around the circuit. Ensure that students understand that the charge is conserved throughout the circuit. Introduce the equation $Q = It$ and ask the students to perform a few calculations with it. **The power of lamps** (25 min) Use the idea of a potential difference to describe energy transfer when charges pass through a resistor. Support this with measurement of the current and p.d. for a lamp with increasing brightness, as described in the practical, so that the students can relate the two factors to energy transfer. **Plenaries** **Electrical spelling** (5 min) Hold a spelling competition about electrical words using mini-whiteboards. **Electric crossword** (10 min) Interactive where students complete a crossword with answers based on the key words of the topics covered so far.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Who invented the first electric light bulb? When was electric light bulbs first used in the home? **Doddle task:** Relationship between current and voltage (interactive)	C3 C3

P5.5 Appliances and Efficiency	**Aiming for Grade 4 LOs:** • Describe the factors that affect the cost of using various electrical devices. • Calculate energy transfer in joules. • State that energy transfer can be measured in kilowatt-hours. **Aiming for Grade 6 LOs:** • Calculate energy transfer in kilowatt-hours. • Convert between efficiencies stated in percentages and those stated in decimal forms. • Calculate the power rating of a device from the energy transferred and the time of operation. **Aiming for Grade 8 LOs:** • Convert between relevant units during calculations of energy transfer. • Analyse the use of a variety of electrical devices to determine their cost of operation. • Compare a range of electrical devices in terms of efficiency using calculations to support any conclusions.	Does electricity cost too much? Why might people use more electricity than they realise? Should there be a minimum efficiency that all appliances should reach?	**Lesson Overview** **Starters** **Multiple purchase** (5 min) Ask the students to work out the unit cost of an everyday object from a bill (e.g., how much a chocolate bar costs when it is bought in a pack of five for £1.20). **Conversion factors** (10 min) Ask students to convert between some factors such as converting four days into hours then seconds, three miles into kilometres, and so on. Discuss why people use different units for the same quantity. **Main** **Electrical energy transfer** (25 min) Replace earlier units with kilowatts as the base for power and hours for time to show that the values can be simpler for everyday devices. Ensure the students understand that the kilowatt-hour is just a different unit for energy, and show them how many joules the kWh represents. The students should try some simple calculations using the kWh to reinforce learning. Recap the energy and power equation ($E = Pt$), finding the energy transferred in joules but use larger values such as 200 W and 40 minutes. Show that using this system can produce large numbers that are difficult to understand. Discuss the idea that using kilowatts and hours as units may be better in some circumstances. **Electrical efficiency** (15 min) Recap on the concept of efficiency and the ideas of useful and less useful energy transfers. Describe the power version of the efficiency equation and ask the students to apply this equation to a range of calculations. Students should also discuss the reasons for inefficiency – heating by the current and frictional forces. **Plenaries** **Comparing kettles** (10 min) Provide the students with data about UK and USA kettles including voltage, current, and operating time. Students identify which kettle is the	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Can any device be 100% efficient? **Doddle task:** AQA Mains electricity (mini quiz)	C3 C3

			most efficient. They then complete a paragraph to describe what makes electrical appliances efficient. **Big bill** (5 min) Ask the students to verify their school's electricity bill or a simplified version of it.			

GCSE Chemistry C4 Chemical Calculations			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Use of the unit ‘mole’ to speak about quantities of atoms in real world applications	**Knowledge** • Definition of relative atomic mass and molecular mass • Mole calculation linking mass and formula mass • Definition of term balanced equation, yield. • Mathematical processes to calculate percentage yield and mass. • Definition of concentration **Understanding** • Explain what is meant by the term ‘mole’ • Balance equations • Calculate relative formula mass; moles, mass or mr when given the other two values; percentage yield; mass of substance needed or produced in chemical equations • Calculating concentrations **Skills** • Using standard form • Converting between measurements • Using scientific equations and calculations • Compare numbers in ratio • Calculate percentages including percentage increase or decrease	Confident and independent use of math to calculate a variety of different values Development of their own mnemonics / multi step process to answer the longer questions Suggesting why the product mass might vary from the reacting masses in real world applications. Independent research on the real world applications of these calculations by companies such as Procter and Gamble. Completion of multi step equations to calculate mass of product produced or reacting masses. Study of atom economy, titration and calculations and volume of gas equation.	BBC Bitesize Doddle – power points and quick quizzes You tube: ‘Free science lessons’ Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: C4 Chemical calculations (Industrial use of chemistry)

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 23,24, 25 (f,h,k)

Lesson No	Topic & Objectives	Big Question – What will students learn?	Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary)	Planned Assessment	Homework or flipped learning resources DODDLE resources	Lit Num SMSC Codes
C4.1 Relative masses and moles	**Aiming for Grade 4 LOs:** • Use the periodic table to identify the relative atomic mass for the first 20 elements. • Calculate the relative formula mass for familiar compounds when the formula is supplied and is without brackets. **Aiming for Grade 6 LOs:** • Use the periodic table to find the relative atomic mass of all elements. • Calculate the relative formula mass for unfamiliar compounds when the formula is given. • **State the units for the amount of substance.** **Aiming for Grade 8 LOs:**	The average human is made of $7X10^{27}$ atoms – how we make this number more useful? Why do we use moles instead of talking about individual atoms? What do moles have to do with chemistry!?	**Starters** **Looking at Avogadro** (10 minutes) Give the students sealed samples of a mole of various safe elements such as 56 g iron or 32 g sulfur. Tell students that a mole of helium would occupy 24 dm^3 at room temperature and pressure. Ask the students what they all have in common (they are all elements). Then ask them to think about particles and explain that every sample has the same number of particles. Then ask students to suggest why each sample has a different mass (each atom has a different mass). Introduce the idea that all the samples contain a mole. **Main** **Amount of substance** (40 minutes) Using a molecular modelling kit, ask small groups of students to make a model of a hydrogen molecule. Through question and answer, ascertain that the relative atomic mass of hydrogen is 1 and as a molecule of hydrogen is made up of two hydrogen atoms, H_2, the relative mass of a molecule	QnA between teachers and students Written responses to questions Class discussion Marked answers on relative formula mass	Doddle: What is relative atomic mass animation	So3 C3 Sp2 Sp9 C2 C5 So7

	• Explain why relative atomic masses may not be a whole number. • Explain why some elements have the same relative atomic mass as each other. • **Calculate the number of moles or mass of a substance from data supplied.**		of hydrogen would be 2. Repeat for oxygen, nitrogen, and then water. Students calculate the relative molecular mass of a series of molecules. Explain the concept of Avogadro's constant and the mole. Ask students to suggest how many atoms are in a mole of hydrogen atoms (6.02×10^{23}), and how many atoms are in a mole of hydrogen molecules (12.04×10^{23}), and then how many hydrogen atoms are in a mole of water molecules (12.04×10^{23}). Students then use the activity sheet to carry out further calculations involving the mole. **Plenaries** **Atomic mass and isotopes** (5 minutes) Show students an A Level periodic table. Ask them to explain why the relative atomic masses are not whole numbers. Then ask students to suggest why the relative atomic mass of cobalt and nickel is the same in the periodic table of the student book, but not in the A Level periodic table. Keywords: Avogadro Moles Mass Relative molecular mass Relative formula mass Atomic Elements Compound Empirical formula			
C4.2 Equations and calculatio ns **(higher only)**	**Aiming for Grade 6 LOs:** • Explain why chemical equations must be balanced. • Calculate the relative formula mass for one substance when the relative formula masses are given for all the other substances in a balanced symbol equation.	How do we know how much of a substance we need? What could happen if we add unnecessary product when manufacturing chemicals	**Starters** **Balancing equations** (5 minutes) Use the interactive to show students chemical equations of familiar chemical reactions, without the balancing numbers. Students balance them, then use the balanced symbol equation of the reaction of magnesium and hydrochloric acid to choose the correct words to complete a paragraph on the reaction. **Mass** (10 minutes) Demonstrate the magnesium and dilute hydrochloric acid reaction outlined, without trapping the hydrogen gas in a boiling tube. Ask students	QnA between teachers and students Written responses to questions Class discussion	Doddle: Balancing symbol equations animation Formulae and equations mini quiz	So3 C3 Sp5 Sp2 Sp9 C5 So7

	Aiming for Grade 8 LOs: • Interpret balanced symbol equations in terms of mole ratios. • Use balanced symbol equations to calculate reacting masses.		to predict (suggest what would happen and why) to the mass of the chemicals in the reaction. Use question and answer to illicit that the mass would drop as one of the reactants is lost to the atmosphere. Then ask students to suggest what would happen to the mass if this experiment was completed in sealed pressure-stable container (mass remains the same). **Main** **Magnesium and hydrochloric acid** (20 minutes) Students carry out the practical then write a word equation and a balanced symbol equation for the reaction. Students describe the ratio of chemicals in terms of individual atoms or molecules. Then remind students about what a mole is. Ask them to write a new paragraph explaining the ratio of the chemicals in terms of moles. Students then explain the ratio of reactant and products in terms of mass if they were given 24 g of magnesium to react with excess hydrochloric acid. **Moles and mass** (20 minutes) Students summarise the individual steps in the worked examples of the student book as tasks to complete to help them work out a calculation. **Plenaries** **Important** (5 minutes) Ask students to think of a reason why reacting mass calculations could be useful in everyday life/industry. Then ask students to share their ideas in small groups and encourage each group to give a different reason. **Predict** (10 minutes) Explain to students that calcium is also a Group 2 metal and reacts in a similar way to magnesium with hydrochloric acid. Ask them to write a balanced symbol equation for this reaction and suggest what mass of calcium is needed to make 2 g of hydrogen gas. Keywords: Balanced equations Moles Mass Molecular mass	Completed worksheet on balancing equations		

C4.3 From masses to balanced equations **(higher only)**	Aiming for Grade 6 LOs: • Explain why chemical equations must be balanced. • Identify the limiting reactant in a chemical reaction. **Aiming for Grade 8 LOs:** • Explain the effect of a limiting reactant on the amount of product made. • Explain the effect of a limiting reactant on the amount of product made.	What could happen if we add unnecessary product when manufacturing chemicals? What effect could a limiting factor have on manufacture?	**Starters** **Balanced?** (5 minutes) Give students a series of balanced and unbalanced symbol equations. Students sort them, then complete a paragraph on limiting reactants. **Interpret the equations** (10 minutes) Students look carefully at the following equations: 1. copper sulfate + magnesium → magnesium sulfate + copper 2. $CuSO4 + Mg \rightarrow MgSO4 + Cu$ 3. $2CuSO4 + 2Mg \rightarrow 2MgSO4 + 2Cu$ 4. $12CuSO4 + 12Mg \rightarrow 12MgSO4 + 12Cu$ 5. $CuSO4(aq) + Mg(s) \rightarrow MgSO4(aq) + Cu(s)$ Ask students to identify the similarities (all represent the same reaction) and differences (word equation has no ratios, last equation also has state symbols). Explain to students that as long as the mole ratios remain the same, different multipliers can be used to balance equations. Ask students to suggest why it is important that formula equations are balanced. **Mains** **Equations and calculations** (40 minutes) Students use the worked example from the student book to create a flow chart that summarises how to balance a symbol equation when given reacting masses. They use a second colour to annotate their flow chart with the worked example. Students then create a second flow chart to summarise the steps involved in calculating reacting masses when given a balanced symbol equation, using the worked example on the activity sheet. They annotate their flow chart with the worked example in a second colour. Students then use their flow charts to answer a series of questions involving these calculations. **Plenaries**	QnA between teachers and students Written responses to questions Class discussion Moles to balance equations worksheet	Doddle: Reacting masses worksheet Atoms and atomic mass mini quiz What happens to total mass in a chemical reaction animation	So3 C3 Sp2 Sp9 C5 So7 C8

			Reactant definitions (5 minutes) Ask students to define limiting reactant and reactant in excess. Then give students some descriptions of a reaction and ask them to identify the limiting reactant and the reactant in excess. **Podcast** (10 minutes) Students work in small groups to write a podcast. Their podcast should explain the importance of balanced symbol equations, how they can be generated from reacting masses, and what a limiting reactant is. (Podcasts could be recorded if the school has this facility or if students are able to use their own devices such as smart phones.) Keywords: Limiting reactant Balanced equations Law of conservation			
C4.6 Expressing concentration	**Aiming for Grade 4 LOs:** • Describe what the concentration of a solution is. • Calculate the concentration of a solution in g/dm^3 when given the mass of solute in g and volume of solution in dm^3. **Aiming for Grade 6 LOs:** • **Explain how concentration of a solution can be changed.** • Calculate the mass of solute (in g) in a solution when given the concentration in g/dm^3 and volume in dm^3 or cm^3. **Aiming for Grade 8 LOs:** • Calculate the mass of a chemical when any volume and concentration is given. • Explain the concentration of a solution in terms of particles.	How can we determine the concentration of a substance? How do the most concentrated acids compare to those that are dilute?	**Lesson Overview** **Starters** **Equation triangle** (5 minutes) Show students the equation triangle to calculate the concentration of a solution in g/dm3. Then ask them to use it to write three formulae with each term as the subject of the equation. **Squash** (10 minutes) Show students a 'double' concentrated bottle of squash, a 'normal' bottle of squash, and a 'ready to drink' bottle of squash. Ask students to put them in order of most concentrated to least concentrated, then most dilute to least dilute. Then ask students to define the terms concentrated and dilute in terms of squash. **Main** **Making a standard solution** (25 minutes) Demonstrate how to make a standard solution. Then allow students in small groups to make their own standard solution. Encourage students to use the worked example in the student book to calculate the concentration of the solution that they have made in g/dm^3. In order to	QnA between teachers and students Written responses to questions Class discussion Using concentration calculations worksheet	Doddle: Concentration of solutions presentation	So3 C3 Sp2 Sp9 C5 So7

	•		calculate this value they will need to note the mass of solid used and convert the volume into dm^3. **Concentrations of solutions** (15 minutes) Ask students to copy out the key points from the student book and illustrate each one with a explanation and a worked example **Plenaries** **Algebra** (5 minutes) Ask students to show mathematically that: mass = concentration × volume × relative formula mass Then provide students with some volumes and concentrations of solutions. Students calculate the amount of solute in the solution. **Diagrams** (10 minutes) Ask students to draw particle diagrams of a concentrated solution made of 20 acid particles (red circles) and 20 water molecules (blue circles). Ask students to draw a diagram with half the concentration of acid. Keywords: Solution Concentration Volume Solute Mass Decimetre Cubed meniscus			

GCSE Disease and Illness Review This series of lesson summarises the most salient points from B5,B6 and B7 to recap on the learning during the Covid-19 HT5 Home Learning Additional support for students will be provided for these topics via enrichment and intervention			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Communicable and non-communicable disease, prevention and treatment	**Knowledge** • Identify the difference between non communicable and communicable disease • Identify communicable disease, pathogens that cause them and spread • Identify body defences to infection disease. **Understanding** • Suggests links between lifestyle and health • Explain the difference between symptom management and cure • Evaluate treatment options also considering the nature of illness itself. **Skills** • Draw a detailed conclusions that consider the interaction between two data sets • Appropriate line of best fit is drawn • Evaluate whether the data is sufficient to decide if the hypothesis is supported. (considering validity) • Synthesis and evaluate a range of conclusions from secondary sources to use in debate (considering validity) • Suggest: apply knowledge and understanding to a new situation • Calculate a simple percentages • Calculate a percentage increase or decrease	Research the effect of having a compromised immune system will impact the chance of humans contracting diseases taking into account how this risk will alter depending on the disease.	BBC Bitesize Doddle – power points and quick quizzes You tube: ‘Free science lessons’ Seneca learning platform World Health Organisation website NHS website Booklets provided for home learning in class and at home throughout Covid-19 pandemic

Scheme of Work 2020-2021 Subject: GCSE Science: Disease and Illness Review 2020-2021						
Year Group: 10 /11 Specification: AQA Combined Science Trilogy Skill focus: 13, 14, 25						
Lesson No	**Topic & Objectives**	**Big Question – What will students learn?**	**Key Activities & Specialist Terminology** **(Do Now Task / Starter/Tasks/Plenary**	**Planned Assessment**	**Homework or flipped learning resources** **DODDLE resources**	**Lit** **Num** **SMSC Codes**
B5 Summary 1 Pathogens and Disease	**Aiming for Grade 4 LOs:** • Describe health as a state of physical and mental wellbeing. • State that pathogens are microorganisms that cause disease. • Name some diseases that are caused by viruses, bacteria, protists and fungi • Describe how different pathogens are spread **Aiming for Grade 6 LOs:** • . Describe how bacteria and viruses cause disease. • Link ways of controlling the spread of malaria to specific parts of the protist's life cycle.	What determines the governmental response to outbreaks of infectious illness?	**Lesson Overview** **Starters** **Healthy and unhealthy / Communicable / Non Communicable –** (5 min) give students five minutes to think about what these mean and draw out definitions **Communicable diseases** (5 min) Ask the class to list any communicable (infectious) diseases they have had. Discuss which are the most common. **Main** **Pathogens and the spread of diseases** (40 min) Introduce the term pathogen as a microorganism that causes infectious diseases in living things, including plants. Ask students to have a discussion about how they think pathogens are spread – you may wish to provide pictures on the board to support and draw out lesser known methods of transference.	QnA between teachers and students Written responses to questions Class discussion Graph interpretation, describe and explain question	Learn the keywords for this topic: Communicable Non-communicable Droplet infection Direct contact Validity Pathogens Micro-organisms Bacteria Fungi Virus Protest Contamination Control Disinfectant Ebola	So3 C3 Sp2 Sp9 Sp1 C2

	Aiming for Grade 8 LOs: • Explain how pathogens are passed from one organism to another, and use this to suggest ways of preventing the spread. • Explain why viral infections are often more difficult to prevent and treat than bacterial infections		Students use information provided in a treasure hunt style to complete the table covering all the specific pathogens they need to be aware of. **Plenary** (10 mins) Quick quiz to consolidate learning of different pathogens, their cause, symptoms, treatment and spread Case Study – Pick an infectious disease such as Ebola and provide some basic information. Ask the students to decide how severe the outbreak could be and what measures they would put in place to control the spread effectively.		Reproduce HIV Measles Salmonella Gonorrhoea Toxins Malaria Protist Vector Stomach acid Skin Scab mucus White blood cell Engulf Antibodies Anti-toxins Neutralise Doddle: Health, Lifestyle and disease presentation	
B5 Summary 2 Human Defence Responses	**Aiming for Grade 4 LOs:** • Describe some ways in which the human body defends itself against the entry of pathogens. • State that white blood cells help defend the body against pathogens. • Show how one part of a model is similar to real life. **Aiming for Grade 6 LOs:** • Describe how human body defence mechanisms stop the entry of pathogens. • Describe the role of white blood cells in the defence against disease.	Why are we sick all the time? What is our immune system? Why are haematologists interested in white blood cells?	**Lesson Overview** **Starters** **What's the link?** (10 min) Present students with the following list: organs skin, blood, and stomach. Ask them what they think they all have in common (the objectives of the lesson should be a big clue–they are organs in humans that help defend against infection). Then ask students for their answer, and reasons why they think this. **Phagocytosis** (5 min) Show the class an animation or video of white blood cells ingesting pathogens. Question students on what it is showing and why it is important for our health. **Main**	QnA between teachers and students Written responses to questions Class discussion 6 mark question on the role of white blood cells	Doddle: Monoclonal Antibodies min quiz (H) Defence systems mini quiz Plant defences and disease mini quiz	So3 C3 Sp2 Sp9 Sp1 C2 C5

	• Use a model to explain how the body defends itself against disease. **Aiming for Grade 8 LOs:** • Explain how a reduced or overactive immune system can cause illness. • Explain in detail how antibody production fights pathogens. • Evaluate an analogy of the human defence systems against disease.		**Human defence systems** (20 min) Discuss that humans have many mechanisms to stop pathogens from entering the body. Supply groups of students with a long piece of paper (you can use a roll of cheap wallpaper). Ask one volunteer to lie down on the paper so someone else can draw round them. Then ask students to add drawings and labels to illustrate parts of the defence system. After recording their initial thoughts, allow groups to use information from the student book to add further information. Students should either copy the diagram or take a photo, print it out, and attach to their notes. Then students explain the role of white blood cells in defending our bodies against invading pathogens. For example: • Why are your white blood cells known as the second line of defence? • State and describe the three main ways in which white blood cells can destroy pathogens. • Suggest why it takes a while for you to start to get better following an infection. • Explain why you can't get chickenpox twice. **Plenaries** **Model defences** (5 min) Ask students to explain how different parts of a castle are analogous to the human body's defence mechanisms (e.g., the walls of the castle are like the skin because they both keep invaders out). **Where is it found?** (5 min) Interactive activity where students select the correct defence mechanisms in the human body. They then match the defence mechanism to where it is found in the human body.			
B7 Summary 1 Smoking, Carcinogenic substances and Cancer	**Aiming for Grade 4 LOs:** • Define a tumour as a mass of abnormally growing cells. • State some causes of cancer. • List some of the benefits and risks of chemotherapy.	What might happen if all cancers were cured over night? Why do you think we haven't been	**Lesson Overview** **Starters** **Cell cycle order** (10 min) Provide students with the stages of the cell cycle from Topic B2.1. Students put the stages in the correct order. Discuss how cells may sometimes stop responding to the normal mechanisms that control the cell cycle and divide rapidly. **Main** **Cancer** (10 min) Introduce the term tumour as a mass of abnormally dividing cells. Explain the difference between	Q & A between students and teachers Mind map on benign and malignant tumour Written task on cancer	Doddle: Cancer presentation AQA cancer quiz	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 6 LOs: • Describe the difference between benign and malignant tumours. • Describe why carcinogens and ionising radiation increase the risk of tumours forming. • Analyse data to assess the risks and benefits of chemotherapy. **Aiming for Grade 8 LOs:** • Explain how benign and malignant tumours can be life-threatening. • Link a lack of control in the cell cycle to tumour formation. • Evaluate the risks of chemotherapy in relation to data, drug testing, and consequences in order to come to an informed decision.	able to cure cancer? Is it ever right to refuse treatment to a patient?	benign and malignant tumours, and suggest how they cause health problems. (30 min) Students collect information on a number of factors that could increase the risk of cancer including smoking and other carcinogenic substances in treasure hunt or market place style Students then create a leaflet or a poster to educate the public about the causes of cancer (e.g., carcinogens, ionising radiation, some viruses), and some of the risks and benefits of cancer treatments (e.g., radiotherapy, chemotherapy). **Plenaries** **Cancer risk factors** (10 min) Read out some lifestyle choices, for example, smoking, a stressful job, a diet high in fat, having the HPV vaccination, using sunbeds. Ask students to raise two hands if they think a lifestyle choice greatly increases the risk of cancer, one hand if they think there is a link, and no hands if they think there is no link. Ask students to justify their choice.	Checking students' responses 6 mark exam question		
B7 Summary 2 Diet, Disease and Diabetes	**Aiming for Grade 4 LOs:** • Describe some health problems caused by a poor diet and lack of exercise. • List some ways in which people can avoid becoming overweight. **Aiming for Grade 6 LOs:** • Describe causal mechanisms for the link between exercise and health. Suggest measures to prevent a further rise in the number of people with type 2 diabetes.	Do we take exercise seriously enough? Should we be charged for gyms? Should exercise be compulsory for some people? Is it enough just to diet/ or just to exercise?	**Lesson Overview** **Starters** **Exercise and health** (10 min) Tell the class that people who exercise are healthier (less likely to develop non-communicable diseases) than those who don't exercise. Ask students to list possible reasons why. **Energy in, energy out** (5 min) Show the students the trailer for the documentary fi lm *Super Size Me*. Ask pairs to discuss why you could become obese if you eat too much. **Main** **Preventing the diabetes epidemic** (40 min) Provide groups of students with some sticky notes. Ask them to write down information from the student book about the effects on the body of eating too much unhealthy food and not taking enough exercise. Students should stick the notes down on the desk to create flow charts. These should contain several paths describing how eating unhealthily leads to the problems outlined in the student book, such	Students to carry out different type of exercise in groups and measure the pulse rate	Doddle: Cardio vascular presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 8 LOs: • Suggest reasons for the correlation between exercise and health, and decide whichare causal. Explain in detail why eating a poor diet can lead to health problems.		as type 2 diabetes and heart disease Then tell the class that the number of people their age being diagnosed with type 2 diabetes is rising. Students should explain why, using what they have learnt. Ask groups to work as a Government advisory group and come up with suggestions to stop this epidemic. **Plenaries** **Health problems** (10 min) Students use the interactive to choose which health problems are associated with a poor diet and lack of exercise. **Obesity data** (5 mins) Show students a piece of data that that shows a correlation between a factor and obesity, for example, country of residence, age, sex, ethnicity, or income. They then describe the pattern.			
B6 Summary 1 Preventing Illness Vaccination	**Aiming for Grade 4 LOs:** • Describe why people are vaccinated. • State that vaccines contain dead or inactive forms of a pathogen. **Aiming for Grade 6 LOs:** • Explain how vaccination works. Describe what an antibody and an antigen are. **Aiming for Grade 8 LOs:** • Explain why, if a large proportion of the population is vaccinated, the spread of the pathogen is reduced. • Apply ideas about specificity of antibodies.	What is herd immunity? Should you be fined if you do not vaccinate your children? Why do you have to have more vaccinations if you travel abroad?	**Lesson Overview** **Starters** **Vaccination** (5 min) Show the class an image of someone having a vaccination. Ask them what is happening, and ask why people have vaccinations. Ask students to name any vaccinations they have had. **Antigens and antibodies** (10 min) Draw a diagram of a pathogen surrounded by antibodies attached to antigens and ask students to copy it, or provide them with the unlabelled diagram. Then ask them to label and annotate as many key features as they can. **Mains** **How do vaccinations work?** (30 min) Students use information in the student book to create a storyboard to explain how vaccinations work. Students' storyboards should include the following stages in the process of vaccination: • Vaccine contains dead or inactive forms of pathogen. • Vaccine injected into body. • White blood cells produce antibody against pathogen. • (Several years later) live pathogen infects body. • White blood cells make antibody quickly, pathogen is destroyed. Higher-tier students should include information on the specificity of antibodies. **Vaccination** (10 min) Bump up your grade worksheet where students analyse the ethics of vaccination, why people may choose not to have a vaccination, and potential impacts this could have on the wider population in terms of herd immunity. **Plenaries**	Class discussion Q & A between students and teachers. Concept map on vaccination Group work on how vaccination works	Learn the Keywords for the topic: Vaccination immunity white blood cell antibodies antibiotic infection resistance disinfectant virus bacteria fungus pain killer septicaemia allergy placebo, effectiveness double blind, efficacy toxicity Doddle: Vaccination and medication presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

			Vaccination (5 min) Use the interactive in which students match key words on the subject of vaccination to their definitions. **Smallpox** (10 min) Tell the class that smallpox is a viral disease that has been eradicated. This was achieved by means of a worldwide vaccination programme. Ask students to read the information on herd immunity in the student book and then write down how this works.			
B6 Summary 2 Drug through Antibiotics	**Aiming for Grade 4 LOs:** • Name some drugs based on extracts from plants or microorganisms. • Order the events that led to the development of penicillin. • Describe what an antibiotic is. • State that viral infections cannot be treated with antibiotics. • Decide when a painkiller or antibiotic should be used to treat an illness. **Aiming for Grade 6 LOs:** • Describe how antibiotics work. • Describe what is meant by antibiotic-resistant bacteria. • Explain why it is difficult to develop drugs to treat viral infections. • Discuss the advantages and disadvantages of looking for new drugs from living organisms. **Aiming for Grade 8 LOs:** • Suggest a reasoned explanation for a pattern in data. • Explain in detail how antibiotic-resistant bacteria arise. • Explain why scientists are constantly developing new antibiotics.	Are you more likely to survive a bacterial infection than a viral one? Are all drugs the same? Is it morally responsible to sell drugs that do not cure you? What can you do to help beat antibiotic resistance? Why can't we just discover new antibiotics?	**Lesson Overview** **Starters** **Deaths from maternal septicaemia** (10 min) Show students Figure 2 in the student book. Reveal how the graph shows the impact of the introduction of antibiotics on deaths from maternal septicaemia. **Key words** (5 min) Write the words antibiotics, antiseptics, antibodies, analgesics, and disinfectant onto the board. Ask students to suggest what these key words for the lesson mean. **Mains** **The discovery of penicillin** (20 min) Provide pairs of students with cards showing the events/stages in how penicillin was discovered and developed into a useful drug. Students put them into the correct order. Present students with the statement: *If Fleming was a tidier scientist we would not have any antibiotics.* *Ask pairs to write down one argument that supports this statement, and one that refutes it.* **Drug development** (20 min) Students analyse data on the effectiveness of plant and microorganism extracts on the growth of bacteria. They use the data to decide which extract is the best option to go on to the next stage of drug development. **How do antibiotics work?** (20 min) Explain that antibiotics are drugs used to treat bacterial infections. Ask students to answer a series of questions to find out more: • How do antibiotics work? • Why won't your doctor give you antibiotics for 'flu? • Why is it difficult to treat viral infections? • Why are antibiotics becoming less useful? Students can use the student book to find the answers. **Doctor, doctor** (20 min) Ask students why we use painkillers, and ask them to name some examples. Discuss	Class discussion on difference between antibiotics and pain killer Q & A between students and teachers. Exam style questions	Doddle: Resistance bacteria presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

			that painkillers are used to treat the symptoms of a disease, for example, to stop a headache if you have a cold, but they cannot cure the disease. Ask the class to work in groups. Provide each group with patient cards that contain symptoms. Students take part in a role-play exercise where a doctor must prescribe various patients with either antibiotics or paracetamol depending on their symptoms. The Rise of Antibiotic Resistance – following an explanations, students should use the keywords to write a paragraph describing antibiotic resistance, the problems it may cause and the ways we can slow its evolution **Plenaries** **Rainforest problem** (5 min) Show the class an image or video that shows part of a rainforest being destroyed. Ask students to discuss in pairs why this could hinder the search for cures for diseases. **Antibiotic or painkiller?** (5 min) State a list of illnesses, for example, cold, salmonella, measles, gonorrhoea, and migraine. Ask students if they would treat each illness with painkillers or antibiotics.			

Scheme of Work 2020-2021 Subject: GCSE Science: C7 Energy Changes Review						
Year Group: 10 /11 **Specification: AQA Combined Science Trilogy** **Skill focus: 13**						
Lesson No	**Topic & Objectives**	**Big Question – What will students learn?**	**Key Activities & Specialist Terminology** **(Do Now Task / Starter/Tasks/Plenary**	**Planned Assessment**	**Homework or flipped learning resources** **DODDLE resources**	**Lit** **Num** **SMSC Codes**
C7 Summary Review Exothermic and Endothermic Reactions and possible uses	**Aiming for Grade 4 LOs:** • Define exothermic and endothermic reactions. • State that energy is conserved in a chemical reaction. • Safely complete a calorimetry experiment for a reaction that takes place in solution. **Aiming for Grade 6 LOs:** • Describe examples of exothermic and endothermic reactions. • Explain, using observations from calorimetry, how to classify a reaction as exothermic or endothermic. • Explain in detail how to carry out a calorimetry experiment.	Do we really need to know if a reaction is exothermic or endothermic? How reliable can our measurements be?	**Lesson Overview** **Starters** **General equations** (5 minutes) Provide students with partially completed word equations for the reactions between metals and acids, carbonates and acids, acids and alkalis, metals and oxygen, hydrocarbons and oxygen, and carbon dioxide and water. Students complete the equations. **Demonstrate** (10 minutes) Show students a single-use ice pack for a sports injury. Use question and answer to get students to understand that this is a chemical reaction which produces a cooling effect – an endothermic change. Then show students single-use handwarmers and lead them to understand that energy is transferred from the chemical reaction to the surroundings, raising the temperature – an exothermic change. Remind students that energy is conserved and then ask students to consider	QnA between teachers and students Written responses to questions Class discussion 6 mark question on how to conduct an investigation	Learn the meanings of the keywords: Endothermic Exothermic Reliable Energy Transfer Calorimetry Reaction profile Joules Bonds Products Reactants	So3 C3 Sp2 Sp9

	Aiming for Grade 8 LOs: • Explain a chemical reaction in terms of energy transfer. • Plan, carry out, and evaluate the errors in a calorimetry investigation. **Aiming for Grade 6 LOs:** • Explain how an energy change from a chemical reaction can be used. • Write balanced symbol equations for familiar reactions. **Aiming for Grade 8 LOs:** • Suggest a chemical reaction for a specific purpose based on the energy change for the reaction. • Evaluate in detail the uses of exothermic and endothermic reactions.		what happens to the energy in the reactant during and after the reaction. **Main** **Investigating temperature changes** (40 minutes plus time next lesson) Students read the outline of the investigation in the student book. They then design an investigation, including a results table to record their observations. Run the practical as detailed if students cannot come up with their own ideas. Encourage students to plot a graph of temperature against time. Ensure students evaluate their experimental procedure, considering sources of error, and explaining how to improve their investigation. **Plenaries** **Calorimetry** (10 minutes) Introduce calorimetry to students, including how calorimetry can be used to find out the energy changes in a combustion reaction and reactions in solutions. Students consider the errors involved in the reactions. **Summary** (10 minutes) Students make a compare and contrast table for exothermic and endothermic reactions. Their table should include the definition of each, effect on surrounding temperature, and an example of each.			
C7 Summary 2 Reaction Profiles and Bond Calculations	**Aiming for Grade 4 LOs:** • Define activation energy. • Sketch a generic reaction profile diagram for an exothermic or endothermic reaction.		**Lesson Overview** **Starters** **Copy and complete** (5 minutes) Ask students to complete these sentences: • In a (chemical) change, reactant bonds are (broken) and new substances are made as product bonds are (formed). • Breaking bonds (takes in) energy from the surroundings and this is an (endothermic) change. • Making bonds (releases) energy to the surroundings and this is an	QnA between teachers and students Written responses to questions Class discussion	Doddle: Bonds and exothermic reaction presentation	So3 C3 Sp2 Sp9 C5

	Aiming for Grade 6 LOs: • Label activation energy on a reaction profile diagram. • Generate a specific reaction profile diagram for a given chemical reaction when its energy change is also supplied. • Explain, using the particle model, how reactants become products in a chemical reaction. • Explain why bond breaking is endothermic and bond making is exothermic. **Aiming for Grade 8 LOs:** • Explain why chemical reactions need activation energy to start them. • Use the particle model to explain how a chemical reaction occurs. • Calculate the energy needed to break the reactant bonds and the energy released when the product bonds are made. • Calculate the energy change for a reaction, including the correct unit. • Explain in terms of bond energies how a reaction is either exothermic or endothermic. **Aiming for Grade 6 LOs:** • Explain, using the particle model, how reactants become products in a chemical reaction. • Explain why bond breaking is endothermic and bond making is exothermic. • Define bond energy and identify all the bonds that break and are made in a chemical reaction.	What are the benefits of a diagram compared to an equation? Why aren't there reactions happening all around us all of the time?	(exothermic) change. **Energy changes** (10 minutes) Interactive where students complete a paragraph on the energy changes involved in the making and breaking of bonds. They then label two reaction profile diagrams as endothermic or exothermic, identifying the reactants, products, and activation energy. **Mains** **Reaction profiles (burning hydrogen)** (20 minutes) Demonstrate a hydrogen explosion as detailed. Then allow students to test the gas on a small scale themselves. Prepare a boiling tube of hydrogen with a bung in the top. Students should wear chemical splash-proof eye protection and put a lighted splint into the open mouth of the boiling tube. They should observe a pop. This demonstration must be carefully monitored by a teacher or technician. Ask students to write equations for the reaction and then illustrate the reaction in a reaction profile diagram. They should annotate the activation energy and describe this as the energy provided by the flame, and add the actual chemicals which are the reactants and the products. **Reaction profiles (burning methane)** (20 minutes) Light a Bunsen burner and turn it to the blue flame. Ask students to write an equation to illustrate this reaction. Then give students a molecular modelling kit. Encourage students to work in small groups to illustrate the combustion of methane by making the models of the reactants and then forming the products. Ask students to explain why energy is needed to break the bonds and then why energy is released when bonds are made. Students should then sketch the reaction profile for this reaction. **Calculating bond energies** (40 minutes) Go through the worked example in the student book of calculating the energy change in the Haber Process.	Type of reaction identified from reaction profile – mini white boards		

	Aiming for Grade 8 LOs: • Calculate the energy needed to break the reactant bonds and the energy released when the product bonds are made. • Calculate the energy change for a reaction, including the correct unit. • Explain in terms of bond energies how a reaction is either exothermic or endothermic.		Students use the worked example to summarise the steps in performing this calculation: • Draw displayed formulae for the balanced symbol equation. • Total each type of bond on the reactants side. • Total each type of bond on the product side. • Calculate the energy required to break the reactant bonds. • Calculate the energy transferred to the surroundings when the product bonds are made. • Energy change = energy required to break product bonds – energy transferred to the surroundings when products are made. Students then use their summary to answer further questions. **Plenaries** **Thought shower** (5 minutes) Explain to students that the calculated energy change of a reaction using average bond energy values are usually different to the measured amount. Ask students to discuss in small groups the reasons for this. **Plenaries** **Reaction profiles** (10 minutes) Students use the calculation sheet to analyse reaction profiles to determine if they are exothermic or endothermic reactions. **Modelling** (10 minutes) Choose the group that included the highest level chemistry in modelling the combustion of methane in Main 2 to share and explain their model with the rest of the class.			