Year 10 2020-2021

Half Term 1 (Autumn 1)

GCSE Biology B2 Cell Division			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
How the process of cell division creates an organism in animals and plants; understand the term stem cell and the dilemmas involved in their use	**Knowledge** • State what is meant by the term mitosis • Define the term gametes • State the number of chromosomes in animal cells • State what is meant by cloning • Define stem cells and their uses • List arguments for and against use of stem cells **Understanding** • Explain each stage of the cell cycle including percentages • Explain why chromosomes are usually found in pairs • Describe the importance of cell differentiation in multicellular organism • Explain the use of tissue culture • Describe therapeutic cloning • Evaluate the use of stem cells in medicine and demonstrate a structured argument for or against **Skills** • Evaluate the model in terms of its strengths and limitations. • Calculate a simple percentages	Complete independent research on how stem cells are acquired and where they can be taken from Independently use math percentage skills to calculate the estimated time of each stage of the cell cycle Create a speech / information document detailing the ethical and religious reasons against the use of stem cells and counter argue this with the positives from a doctors point of view Suggest uses of tissue culture in the agricultural industry Evaluate the uses of stem cells for particular diseases Research an independent study on the process and uses of therapeutic cloning	BBC Bitesize Doddle – power points and quick quizzes You tube: ‘Free science lessons’ Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: B2: Cell Division (How do we grow?)

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 17e

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
B2.1 Cell Division	**Aiming for Grade 4 LOs:** • State that human body cells have 46 chromosomes and gametes have 23. • State that mitosis is a stage in cell division. • State the meaning of most of the key words – mitosis, chromosomes, gene, gametes. **Aiming for Grade 6 LOs:** • Explain why chromosomes in body cells are normally found in pairs. • Describe situations where mitosis is occurring. • Use the key words to describe the process of mitosis. **Aiming for Grade 8 LOs:**	How do we grow? What happens when mitosis goes wrong? What is the link between cell division and chemotherapy for cancer?	**Lesson Overview** **Starters** **Cell key words** (10 min) Bump up your grade sheet where students review their understanding from KS3 of the key words nucleus, gene, DNA, and chromosome and develop their definitions. They are also introduced to the key word mitosis. **Cell division** (10 min) Draw an image representing a single zygote (fertilised egg) on the board. Ask students to use what they recall from KS3 to draw images to show the stages before and after the egg is fertilised. Discuss their ideas, drawing out the process of fertilisation before and cell division after. Introduce the key word mitosis as a stage of cell division. **Mains**	Class discussion Q&A between students and teachers Written work Clarifying their misconception Live marking	Learn the Keywords for the topic: Cells chromosomes mitosis Nucleus Fertilisation Embryo cloning, interphase differentiated	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Explain why genetic material must be doubled during mitosis. • Explain in detail what happens at each stage of the cell cycle. • Use the key words to write detailed explanations of why mitosis is an important process in living things and how characteristics are inherited.		**Chromosomes** (10 min) Refer students to student book section *The* *information in the cells*. Ask students questions about the numbers of chromosomes in body cells and gametes, and why they are found in pairs in body cells. **Observing mitosis** (20 min) Show students a diagram of the cell cycle. Ask them to estimate the percentage of time involved in each of the three stages, calculate how long the interphase stage would take if the whole cycle took 24 hours, and suggest why the interphase stage is the longest. Students then complete the practical where they use light microscopes to observe prepared slides showing mitosis. Ask them to spot cells at different stages and draw examples. They can use Figure 3 from the student book to help them. **Plenaries** **Mitosis** (10 min) Students use the interactive to match the key words from this lesson to their meanings and then carry out a cloze exercise about mitosis. **Cell cycle length** (5 min) Tell the class that, on average, human cells take 24 hours to divide. Ask them to calculate how long it takes for one cell to form a group of 64 cells.		adult stem cells embryonic stem cells Doddle: AQA cell division mini quiz, cell growth and cycle mini quiz	
B2.2 Growth and Division	**Aiming for Grade 4 LOs:** • Define the terms growth and differentiation. • State why plant clones are genetically identical to each other. • Attempt to clone a plant by using apparatus correctly. **Aiming for Grade 6 LOs:** • Describe the importance of cell differentiation in multicellular organisms.	What advantages could there be to human cloning? Do plants age??	**Lesson Overview** **Starters** **Human life** (10 min) Show students an image of an embryo containing a few cells and an image of a very old person. Ask them to design a flow chart to show what happens to the cells of a person as they grow older. Discuss their ideas and explain that in development from an embryo to an adult, cell division is used for growth (increase in size) as well as for repair and replacement. In adults, it is mainly just used for repair and replacement. Introduce the word growth to mean a permanent increase in size.	Class discussion Q & A between students and teachers Mind map on advantages and disadvantages of cloning	Doddle: Cloning presentation and cloning worksheet, How was Dolly the sheep created? Animation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Explain how using tissue culture creates a clone of a plant. • Attempt to clone a plant by using apparatus correctly and following safety rules. **Aiming for Grade 8 LOs:** • Compare and contrast differentiation in plants and animals. • Explain why it is easier to clone a plant than an animal. • Explain and carry out a practical accurately and safely in order to successfully clone a plant.	Do plants hold the secret to anti-aging?	**Growth in plants and animals** (5 min) Show the class an image of a tall tree and a human. Ask them to discuss in pairs how the growth of a plant and a human are the same and how they are different. Make sure students understand that in plants growth is due to cell elongation and division, whereas in humans it is just cell division. **Main** **Cauliflower cloning** (40 min) Tell the class that plant cells contain undifferentiated cells in tissues called meristems. They will follow a procedure to clone a new cauliflower plant using these cells. Students work in pairs and follow the practical sheet to carry out the task. They must pay careful attention to working accurately and safely in order to ensure cloning is successful. Students then answer questions about differentiation and cloning in plants. **Plenaries** **Differentiation** (10 min) Ask students to return to the flow chart they designed in the starter 'Human life' and add in information about where differentiation occurs and what it is used for. **Cell differentiation** (5 min) Interactive where students select the correct word for each gap in a paragraph about cell differentiation and then sort statements into plant and animal cell groups.			
B2.3 Stem Cells	**Aiming for Grade 4 LOs:** • State that a stem cell is a cell that is not differentiated. • State that plant stem cells can be used to create clones. • State ways in which stem cells can be used to treat medical conditions. **Aiming for Grade 6 LOs:**	Could an organ supermarket be a thing in the future? Does the potential of stem cells	**Lesson Overview** **Starters** **Differentiation** (5 min) Ask students to write down a definition of the term differentiation. Gather ideas to come to an agreed meaning and write this on the board. Discuss why cells	Mind map on advantages and disadvantages of using stem cells Clarifying misconception	Doddle: stem cells presentation and quiz	SO3 SO9 SP1 SP2 SP5

	• Describe differences between embryonic and adult stem cells. • Explain why plant clones are produced in agriculture. • Describe how stem cells can be used to treat medical conditions. **Aiming for Grade 8 LOs:** • Explain why embryonic stem cells are particularly useful for treating medical conditions. Explain how stem cells can be used to treat medical conditions.	mean we can live forever? How many parts of our body can we replace before we are no longer ourselves? If your body is constantly renewing, are you the same person you were 7 years ago?	differentiate and remind students that undifferentiated cells are known as stem cells. **Plant copies** (10 min) Remind students of the practical they did in Topic B2.2 where they cloned a cauliflower (this is an ideal opportunity to check on how the practical is doing). Ask students to discuss in pairs reasons why people might want to clone plants. Gather together the ideas as a class. **Main** **Stem cells** (15 min) Remind students about how embryonic stem cells have the potential to differentiate into any type of cell. Students then use information from the student book to help them answer questions about stem cells. **Writing scientifically with stem cells** (25 min) Provide students with example articles on stem cells. Alternatively, provide students with short examples of science articles printed from websites or cut out from magazines. Ask them to discuss in pairs what they think about the articles (Did they capture their attention and hold it? Did they explain the science well? Did they leave them wanting to know more?). Go through with the class the main points on how to write a science article. Students then research how stem cells are used to help medical conditions and use the information to write their own article on stem cells. This activity can be extended to a whole lesson. **Plenaries** **Peer assessment** (10 min) Students use the checklist on the activity sheet to peer assess the articles written in Main 2 and give useful feedback. **Stem cells** (10 min) Interactive here students match the correct words to statements and then select words to fi ll in the gaps in a paragraph about stem cells.	during question answers Discussion of ethical issues		SP9 C2
	Aiming for Grade 4 LOs:		**Lesson Overview**	Exam questions		SO3

B2.4 Stem Cell Dilemmas	• List some arguments for and against the use of stem cells. • Verbally communicate simple ideas during a group discussion. **Aiming for Grade 6 LOs:** • Describe what therapeutic cloning can be used for. • Explain the reasons for ethical and religious objections to use of stem cells in medicine. • Verbally communicate well-constructed arguments. **Aiming for Grade 8 LOs:** • Explain the process of therapeutic cloning. • Evaluate the use of stem cells in medicine. • Clearly communicate strong, well-researched arguments in a persuasive manner.	When is it appropriate to use stem cells? Should the donation of stem cells be 'opt out' like organ donation? Should we all give our stem cells? Is stem cell technology only going to benefit the rich? Should science overrule religious beliefs when it comes to saving lives?	**Starters** **Stem cell decision** (10 min) Tell students to imagine that a close friend or family member has been diagnosed with diabetes and has to inject themselves with insulin every day for the rest of their lives. There is a new treatment available using stem cells grown from embryos. Would they advise them to use the treatment? Ask the class to discuss in small groups what information they would need to find out before they could make a decision. Listen to ideas from the class and discuss that there are many possible risks to the treatment and these have to be weighed up alongside possible benefits. Also, some students may mention religious or ethical objections to using embryonic stem cells. **Ethical dilemmas** (5 min) Read out a series of statements: • Organ transplants using donated organs from people who have died. • Organ transplants from living donors. • Taking the morning-after pill. • Using contraception. • Using unwanted embryos for medical research (they will be destroyed after use). • Testing new medical treatments on healthy volunteers. • Testing new medical treatments on animals. After each statement ask students to rate out of 5 how they feel about it, with 1 being very comfortable and 5 being totally against it. Discuss individual views and elicit that different people have different viewpoints for different reasons. Before a decision can be made these have to be taken into account. **Main** **Viewpoints** (40 min) Assign students to the different roles shown on the activity sheet and ask them to read through their character's thoughts on the use of stem cells and prepare a 60-second speech arguing their character's viewpoint. Ask students to form groups containing all the	Class discussion Mind map on far and against the use of stem cells	Doddle: Stem cells presentation and quiz	SO9 SP1 SP2 SP5 SP9 C2

			roles and to each present their viewpoint. As a class, ask groups for the main points they found out during their discussion and record these on the board. As a class, discuss all of the points they have found, then have students individually write their own conclusions on the ethics of stem cell research. **Plenaries** **The future of stem cell research** (10 min) Bump up your grade worksheet where students review the process of therapeutic cloning and the ethical difficulties involved, evaluating the potential benefits and possible drawbacks. **Stem cell dilemmas** (5 min) Interactive here students match the correct words to statements and then select words to fill in the gaps in a paragraph about stem cells.			

GCSE Chemistry C1 Atomic Structure			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Atomic structure and Separating mixtures	**Knowledge** • Structure of the atom • Key dates, scientists and developments in the history of the atom • Definitions of ions and isotopes • Methods in separating mixtures **Understanding** • How experiments have driven changed our understanding of atomic structure • Predict the ions formed from elements • Identify isotopes • Select appropriate methods of separating given mixtures **Skills** • Link a conclusion / investigation to the amendment of a scientific idea • Evaluate models used to explain the abstract • Confident use of symbols to represent elements and compounds	Application of knowledge to predict ion formations and begin to make the link between this and why only certain atoms bond together In depth understanding of the atomic mass number and how it can be a 0.5 value Extended scientific writing to describe the developments to the atomic model over time Justified reasoning of the separation method chosen and the strengths and limitations of each one Linking atomic structure to patterns previous explored in KS3 of the periodic table	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: C1: Atomic Structure

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 16, 17 and 18

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
C1.1 Atoms	**Aiming for Grade 4 LOs:** • Define the word element. • Classify familiar substances as elements or compounds. • Use the Periodic Table to find the symbols or names of given elements. **Aiming for Grade 6 LOs:** • Describe the basic structure of an atom. • Explain, including diagrams, the difference between a pure element, a mixture, and a compound. • Name and give the chemical symbol of the first 20 elements in the Periodic Table. **Aiming for Grade 8 LOs:** • Use chemical symbols of atoms to produce the chemical formulae of	What is everything made of? How many objects could you make out of a lego set? How do scientists overcome language barriers?	**Lesson Overview** **Starters** **Thumbs up or thumbs down?** (5 minutes) Ask students to put their thumbs up if they think a statement is true, and thumbs down if they think a statement is false. • There are 1000 elements. *False* • All substances are made of atoms. *True* • Compounds are listed on the periodic table. *False* • Sulfur is a compound. *False* • Sodium is an element. *True* • An element contains only one type of atom. *True* **Thought shower** (10 minutes) Write the word atom on the board. Ask students to work in small groups to write as many facts as they can think of about atoms. Then invite each group to write one fact on the class thought shower. Look at the board and state how many misconceptions are	QnA between teachers and students Written responses to questions Class discussion Verbal assessment on plenary using white boards	Doddle: Introducing atoms revision Atoms and Elements worksheet	So3 C3 Sp2 Sp9 C5 So7 C5

	a range of elements and compounds. • Explain the significance of chemical symbols used in formulae and equations.		written and through question and answer correct all the statements. **Mains** **Arranging the elements** (30 minutes) In small groups, give students the activity sheet with partially-completed information cards on a selection of elements – sodium, argon, gold, chlorine, potassium, neon, lithium, fluorine, hydrogen, carbon, oxygen, and bromine. Students complete the information cards and find as many ways as they can to group the elements. Ask students if they can find the symbols for each of the elements in the sample. Ask students to consider the basic structure of the atoms that make up elements, as in Figure 4 in the student book, and to speculate how the atoms of different elements might differ. **Hydrogen, oxygen, and water** (10 minutes) Have two bunged test tubes of hydrogen, two bunged test tubes of oxygen, and two bunged test tubes of water, all labelled with their contents. Wearing eye protection, put a glowing splint into each sample. Note observations (oxygen: splint re-lights, hydrogen: no effect, water: splint goes out). Repeat with a lighted splint (oxygen: splint burns slightly brighter, hydrogen: a squeaky pop is heard, water: splint goes out). Ask students to suggest how the properties of the elements relate to the compound that they make (no relation). Ask students to draw particle models to show hydrogen, oxygen, and water. **Plenaries** **Show-me boards** (5 minutes) Give students an A4 dry-wipe board, pen, and eraser. Ask students to write the correct symbol for one of the first 20 elements, or the symbol of one of the named elements you call out. **Atoms** (10 minutes) Interactive where students label a periodic table then summarise the difference between atoms, elements, and compounds. Encourage students to give examples of elements and compounds.			

C1.2 Chemical Equations	**Aiming for Grade 4 LOs:** • Describe familiar chemical reactions in word equations. • State that mass is conserved in a chemical reaction. **Aiming for Grade 6 LOs:** • Explain why mass is conserved in a chemical reaction. • Describe familiar chemical reactions with balanced symbol equations including state symbols. • Balance given symbol equations. **Aiming for Grade 8 LOs:** • Justify in detail how mass may appear to change in a chemical reaction. • Describe unfamiliar chemical reactions with more complex balanced symbol equations, including state symbols. • Write balanced symbol equations.	How do we combine elements to make other substances? How are chemical reactions comparable to baking a cake? What are the limitations of the reactions we are able to do?	**Lesson Overview** **Starters** **Mass what?** (5 minutes) Show students images of different experiments with the equation below the image. Ask students to suggest what happens to the mass and why, for example, iron rusting in an open beaker or a sealed test tube. **Chemical equations** (15 minutes) Use the interactive to revise the state symbols used in a balanced symbol equation. Then explain to students how to balance symbol equations. Students then match a list of reactants from balanced symbol equations with the products formed from the reaction. **Mains** **Investigating the mass of reactants and products** (30 minutes) Allow students to complete the investigation as outlined and get students to record the experiment in the form of word and balanced symbol equations. Then ask students to plan an experiment to investigate how mass changes in a chemical reaction. Once the plan has been checked you may wish to allow the students to complete the activity. **Molymod** (10 minutes) Ask students to make molecular models of hydrogen, chlorine, and hydrogen chloride. Ask them to write a word equation for this reaction that connects all of these chemicals. Explain that atoms are not made or lost in chemical reactions but are re-arranged and this is why symbol equations are balanced. Task students with balancing the atoms by making the appropriate models and then writing equations to represent the reaction. **Plenaries** **Steps to success** (5 minutes) Ask students to write a list of successive steps for balancing an equation. Then to balance an equation using the steps to act as a worked example.	QnA between teachers and students Written responses to questions Class discussion Assessment on the practical task completed	Doddle: Introducing chemical equations mini quiz	So3 C3 Sp2 Sp9 C5 So7 Sp5

			Balancing equations (10 minutes) Students balance combustion equations of increasing difficulty.			
C1.3 Separating Mixtures	**Aiming for Grade 4 LOs:** • Define the word mixture. • Identify a mixture and a compound. • List different separation techniques. **Aiming for Grade 6 LOs:** • Explain the difference between a compound and a mixture. • Explain how the chemical properties of a mixture relate to the chemical it is made from. Describe different separation techniques. **Aiming for Grade 8 LOs:** • Use experimental data to explain the classification of a substance as a compound or mixture. • Suggest an appropriate separation or purification technique for an unfamiliar mixture. Explain in detail how multi-step separation techniques work.	Are mixtures more or less useful than compounds? (changing properties and ease of separation) Are we able to tell by looking at something whether it is a compound or a mixture? How can we see the invisible? (how do we know whether bonds are present between the molecules or not)	**Lesson Overview** **Starters** **Separating mixtures** (5 minutes) Use the interactive to show students a list of key words from the lesson and their definitions. Students match them up. **Sorting** (10 minutes) Ask students to read the student book spread and classify every chemical as an element (hydrogen, oxygen and sulfur), a compound (sand, sodium chloride, salt, water, xylene and sodium nitrate) or a mixture (sand and salt and sea water). **Mains** **Flow chart** (10 minutes) Ask students to write a flow chart to summarise how filtration, crystallisation, and simple distillation can separate a mixture and how to use melting or boiling point to show if a substance is a compound or a mixture. **Sea water** (30 minutes) Give students a sample of 'sea water' (a mixture of sodium chloride, water, sand, and small plant material). Ask students to use a series of separation techniques to separate out each part of the sea water and leave a sample of water that is safe to drink. Students should summarise their method and results in a table headed with mixture, separation technique, and outcome. Students should NOT drink the water. (Sieve then filter the sea water to remove any insoluble material (sand and plant material). Collect the filtrate solution and distil. Collect the distillate that boils at 100°C as this will be pure water.) **Plenaries** **Match** (5 minutes) Ask students to match the separation technique to the mixture. • Solution (where the solvent is to be collected) – simple distillation	QnA between teachers and students Written responses to questions Class discussion Marks assessment on completing the practical task	Doddle: AQA mixtures quiz	So3 C3 Sp2 Sp9 C5 So7 C8

			• Solution (where the solute is to be collected) – crystallisation • Insoluble compound from a liquid – filtration **Separation** (10 minutes) Ask students to write an outline method of how they would extract carbon from copper sulfate crystals. (Add the mixture to water and filter. The residue is the carbon which could be washed by rinsing with distilled water and then dried in an oven. Evaporate off the water from the filtrate to form copper sulfate crystals.)			
CC1.4 Fractional Distillation and Paper Chromatography	**Aiming for Grade 4 LOs:** • State when fractional distillation would be used. • Safely make a paper chromatogram. **Aiming for Grade 6 LOs:** • Describe the process of fractional distillation. • Explain the main processes occurring in paper chromatography. **Aiming for Grade 8 LOs:** • Explain in detail how fractional distillation can separate miscible liquids with similar boiling points. • Evaluate separation or purification techniques for a given mixture.	How are we able to separate mixtures? What are the real life applications of separation methods? How essential is the separation of mixtures to your daily lives?	**Lesson Overview** **Starters** **Key words** (5 minutes) Use the interactive to give students the definitions of the key words miscible, condenser, fractionating column, simple distillation, and fractional distillation and ask them to suggest the key words. **Distillation** (10 minutes) Ask students to explain the use of distillation and how it works. Ask a few students to share their ideas. **Mains** **Fractional distillation** (25 minutes) Show students the equipment for fractional distillation and, if possible, demonstrate the separation of ethanol from water. Ask students to draw a diagram of the equipment and label each piece of equipment with its function and explain what is occurring. For example, round bottom flask containing the mixture of water and ethanol. Anti-bumping granules are added to ensure smooth boiling. **Paper chromatography** (15 minutes) Ask students to complete a paper chromatogram as detailed in the practical box. **Plenaries** **Interpreting** (5 minutes) Give students a chromatogram to study. Ask them to suggest which chemicals are pure (only have one spot), are mixtures (have more than one spot),	QnA between teachers and students Written responses to questions Class discussion Assessment on completed paper chromatogram produced during the practical	Doddle: AQA Chromatography mini quiz Using chromatography to identify a mixture animation The process of fractional distillation interactive	So3 C3 Sp2 Sp9 C5 So7

			contain x dyes (have x spots), contain the same dyes (spots rise to the same height above the baseline). **Reflection** (10 minutes) Ask students to think about one fact or skill that they revised in the lesson, and one			
C1.5 History of the Atom	**Aiming for Grade 4 LOs:** • State the relative charges and masses of sub-atomic particles. • State that atoms have no overall charge (are neutral). • Label the sub-atomic particles on a diagram of a helium atom. **Aiming for Grade 6 LOs:** • Describe atoms using the atomic model. • Explain why atoms have no overall charge. • Use atomic number and mass numbers of familiar atoms to determine the number of each sub-atomic particle. **Aiming for Grade 8 LOs:** • Use the Periodic table to find atomic number and mass number data and use it to determine the number of each sub-atomic particle in any given form. • Recognise and describe patterns in sub-atomic particles of elements listed in the Periodic Table. • Explain why we can be confident that there are no missing elements in the first 10 elements of the Periodic Table.	How do atoms differ from each other? Are there elements still waiting to be discovered?	**Lesson Overview** **Starters** **Explain** (10 minutes) Ask students to work in pairs: one person verbally describes the nuclear model of the atom; the second person tries to draw the diagram. Then hold up the diagrams to show the class and vote on the best one and why. **Prose** (10 minutes) Give students the excerpt from the specification as detailed, but with the key words missing. Ask students to copy and complete the prose. **Mains** **Table** (20 minutes) Ask students to draw a table for the first 10 elements with the following column titles: Element, Symbol, Atomic number, Number of protons, Number of electrons, Number of neutrons. Demonstrate how to complete this for lithium and then encourage students to use the periodic table in the student book to complete the table. Students should then add another column titled “Mass number” and use their table to complete this column. **Model of an atom** (20 minutes) Students create a model of an atom of either ^{4}He, ^{7}Li, ^{12}C, ^{19}F, $1^{6}O$, or ^{23}Na. Students should add mass and charge information and label the nucleus. They should then evaluate their models. **Plenaries** **Atomic structure** (5 minutes) Interactive where students label an atom then complete sentences on protons, neutrons, and electrons. **Think, pair, square** (10 minutes) Ask students to think about the most important fact or skill they have learnt today. Then ask them to compare and agree with a	QnA between teachers and students Written responses to questions Class discussion Completion of table for the first 10 elements	Doddle: What is the history of the atom interactive	So3 C3 Sp2 Sp9 C5 So7 Sp1

			neighbour and finally as a whole table. Get each table to report back to the class.			
C1.7 Ions, atoms and Isotopes	**Aiming for Grade 4 LOs:** • State what an ion is. • Define an isotope. • State the relative sizes of an atom and its nucleus. **Aiming for Grade 6 LOs:** • Describe isotopes using the atomic model. • Explain why ions have a charge. • Use atomic number and mass numbers of familiar ions to determine the number of each sub-atomic particle. **Aiming for Grade 8 LOs:** • Use the Periodic table to find atomic number and use it to determine the number of each sub-atomic particle in an ion. • Use SI units and prefixes to describe the size of an atom and its nucleus in standard form.	Why is the mass of chlorine a half number? Can you have half an atomic particle? How big is an atom? Or how tiny? Radioactive rocks - How likely are you to find them?	**Lesson Overview** **Starters** **Definitions** (5 minutes) Ask students to use the student book to define the following key words: • Ion – charged atom or molecule. • Isotope – an atom with the same number of protons but a different number of neutrons. • Atom – the smallest particle that can exist on its own. **Size** (10 minutes) Give students a selection of images and sizes, using SI units and prefixes. Ask students to group the information. For example: • electron microscope image of gold atoms, 0.1 nm, 1×10^{-10} m • alpha radiation, helium nuclei, 1/10 000 of an atom, 1×10^{-14} m. Using question and answer, ensure that students appreciate that electron microscopes can capture images of single atoms and that atoms are very small. **Mains** **Hydrogen isotopes** (20 minutes) Show the atomic models of the three isotopes of hydrogen. Add information about the size of the radius of the atoms and the nuclei. Ask students to list the similarities (number of electrons, number of protons, electron arrangement, same atomic number, same atomic radius) and differences (number of neutrons, mass number). Then show students how to use the convention to detail atomic number, mass number, and symbol of an element for one isotope and ask them to draw it for the other isotopes. Students could then complete the Maths skills interactive for further practice in calculating the number of sub-atomic particles in atoms and ions.	QnA between teachers and students Written responses to questions Class discussion Match up key words and definitions task	Doddle: AQA Atomic mass and electronic structure mini quiz	So3 C3 Sp2 Sp9 C5 So7

			Ideas about ions (20 minutes) Ask students to make a flow chart to explain how you can use the atomic number and mass number to determine the sub-atomic particles in an ion. Then ask students to swap their flow charts with another student and they should use it to determine the sub-atomic particles in a variety of examples given on the activity sheet. Develop the flow chart by adding additional branches to explain how to determine the sub-atomic particles in a negative ion, positive ion, and an isotope. **Plenaries** **Example** (5 minutes) Show students the definitions of the key words and ask them to give an example to illustrate the key word. • An atom with the same number of protons but a different number of neutrons (isotope – hydrogen, deuterium, and tritium). • A charged atom (ion, e.g., O^{2-}). • A sub-atomic particle found in the nucleus of most atoms (neutron). **Ions, atoms, and isotopes** (10 minutes) Interactive where students identify the mass number and atomic number of lithium, oxygen, and sodium. They then complete a paragraph on isotopes.			

GCSE Physics P7 Radioactivity			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
The type of radiation, the dangers and the uses of these.	**Knowledge** • Describe types of radiation, alpha, beta and gamma • Be able to list properties of different types of radiation • Define half life • Give some uses of radiative substances • List the safety precaution that should be taken when dealing with radioactive substances **Understanding** • Link the structure of the radiation to its properties and uses • Evaluate whether the benefits of radioactive substances outweigh the associated risks (e.g. use of nuclear power stations and medicine) • Link properties of radiation and half-life to evaluate the danger of a given radioactive substance • Explain how the Rutherford scattering experiment led to the development of the atomic structure **Skills** • Use of symbols in chemical equations to predict reactants/products • Compare: describe the similarities and/or differences between things • Suggest: apply knowledge and understanding to a new situation.	Being able to link and relate several ideas together in order to determine the appropriate hazard of a given radioactive material. Own research project on the use of radioactive substances (such as Chenobyl) and considering the social, economic and environment impact of its use before and after a meltdown Detail timeline and description of how scientific experiments have changed our understanding of atomic structure over time including consideration of how these ideas came to accepted as scientific truths.	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: P7: Radioactivity

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 18, 20d and e

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
P7.1 Atoms and Radiation	**Aiming for Grade 4 LOs:** • Name the three types of nuclear radiation. • Name the three sub-atomic particles found in an atom (proton, neutron, and electron). • Identify some sources of background radiation. **Aiming for Grade 6 LOs:** • Describe some safety precautions used when dealing with radioactive materials. • Describe how a Geiger counter can be used to detect radiation. • Identify natural and man-made sources of background radiation. **Aiming for Grade 8 LOs:** • Describe in detail the decay of an unstable nucleus.	How likely are you to find a radioactive rock? Should experiments with radioactive substances be conducted? What happened when atoms become unstable?	**Lesson Overview** **Starters** **Look alike** (5 min) Ask students to draw and label an atom and discuss whether it is a realistic model. Show the students some caricatures of famous people to see whether these capture the essence of each person. **Atom models** (10 min) Ask students to draw some simple atomic models. Ask them to note any of the properties of the sub-atomic particles that they already know, for example, from studying electricity or from atomic structure in chemistry. **Main** **Investigating radioactivity** (40 min) Discuss the discovery of nuclear radiation, outlining the initial evidence and the efforts made to explain it. Show how the Geiger counter can be used to detect nuclear radiation, starting with a background count. Some sample rocks or salts can be used to show that natural substances are radioactive.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** What are the sources of background radiation? Why do they change depending on location? **Doddle task:** How was radioactivity discovered? (animation)	C3 C3

	• Explain the similarities and differences between nuclear radiation and visible light. • Describe the relative penetrating powers of the three types of nuclear radiation.		Introduce the explanation of the source of the radiation – radioactive decay. Outline that there must be changes to the nucleus itself to produce these particles. Discuss some of the sources of background radiation, differentiating between natural sources and some man-made ones, particularly medical sources. **Plenaries** **Murder mystery** (5 min) The body of a press photographer has been found in a sealed room, and all of the film in her camera has gone black even though it hasn't been used. Students explain what they think happened and how they know. **Comparing locations** (10 min) Interactive where students are provided with some data about the sources of background radiation in different locations in a pie chart. They use the pie chart to answer questions that compare the risks in each of the locations.			
P7.2 Discovery of the Nucleus	**Aiming for Grade 4 LOs:** • Identify the Rutherford (nuclear) model of an atom. • Identify the locations of protons, neutrons, and electrons in the nuclear model. • State that electrons can move between fixed energy levels within an atom. **Aiming for Grade 6 LOs:** • Describe the plum pudding model of the atom. • Describe the evidence provided by the Rutherford scattering experiment. • Describe the properties of protons, neutrons, and electrons. **Aiming for Grade 8 LOs:** • Compare the plum pudding model, Rutherford model, and Bohr model of the atom in terms of the evidence for each model.	How do we know about the structure of an atom when we can't see it? Should we investigate with radioactive sources? Who was responsible for the discovery of the atom? Is it fair to credit one person with a discovery?	**Lesson Overview** **Starters** **What's in the tin?** (5 min) Peel the label off a tin of sponge pudding. Show the unmarked tin to the students and ask them to describe ways they could find out what's inside without opening it. **Believe it or not?** (10 min) What does it take to change the students' minds about something? How much evidence would be needed to convince them that NASA has sent men to the Moon? Discuss how difficult it is to change people's strongly held beliefs, and point out that scientists also find it difficult to change ideas that they may have been working with for many years. **Main** **The Rutherford model of the atom** (25 min) Discuss the atomic model that students will have used in KS3 and ask them what evidence there is for it. Outline Rutherford's work and allow the students to discuss the idea of discovery by firing particles.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Why do models need to change? **Doddle task:** The story of Ernst Rutherford (animation)	C3 C3

	• Explain how Rutherford and Marsden's experiment caused a rejection of the plum pudding model. • Describe how the initial evidence for the nuclear model was processed and how the model came to be accepted.		Emphasise Rutherford's mathematical analysis of the Geiger and Marsden experiment that confirmed the model and how the model matched the behaviour observed during nuclear decay. Compare the Rutherford model briefly with the plum pudding model. **Further changes to the model of the atom** (15 min) Show the students the typical electron arrangement diagram used in Chemistry lessons, and discuss the nature of energy levels using the Bohr model. Ensure the students know that electrons can move between these levels when the electron's energy changes. Explain the need for a neutron as a component of most nuclei, and outline its discovery. The students should now know the key properties of all three sub-atomic particles. **Plenaries** **Not like a solar system** (5 min) The students should make a list of similarities and particularly differences between atomic models and solar systems. **I don't believe it** (10 min) Interactive where students choose the missing words to complete a paragraph summarising the evidence that led to the plum pudding model being replaced. Students then use this summary to write a letter to an unconvinced scientist who wants to hold on to the plum pudding model.			
P7.3 Changes at the Nucleus	**Aiming for Grade 4 LOs:** • Identify the mass and atomic number by using nuclear notation. • Identify the type of decay taking place from a nuclear equation. • Describe how isotopes are atoms of the same element with different mass numbers. **Aiming for Grade 6 LOs:** • Calculate the number of neutrons in an isotope by using nuclear notation. • Describe the differences between isotopes.	What happens when an atom becomes unstable? Why isn't chlorine's mass number a whole number? How can we recognise the type of decay through nuclear equations?	**Lesson Overview** **Starter** **Fact or fiction** (5 min) The students use red, amber, and green cards to decide whether a series of statements about radioactivity and atoms are false, they don't know, or are true. **Chemical change** (10 min) Give the students a demonstration of a chemical reaction (magnesium + oxygen → magnesium oxide). Ask the students to describe what is happening in terms of particles and see if they understand basic conservation of particles in chemical reactions.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** What causes an element to have isotopes? **Doddle task:** Radioactive decay (presentation)	C3 C3

	• Complete decay equations for alpha and beta decay. **Aiming for Grade 8 LOs:** • Explain why particles are ejected from the nucleus during nuclear decay. • Describe the changes in the nucleus that occur during nuclear decay. • Write full decay equations, for example, nuclear decays.		**Main** **Nuclear notation** (10 min) Show some examples of nuclear notation, ensuring the students can identify the atomic number (proton number) and mass number (nucleon number). Students should calculate the number of neutrons in some examples. Discuss isotopes, showing some in nuclear notation and noting the difference in mass numbers. **Alpha, beta, and gamma emission** (30 min) Describe an alpha decay and the changes it causes in a nucleus. The students should look at an example and then try to construct a few additional equations by using a periodic table. Move on to beta emission, focusing on the change of a neutron to a proton and how this affects the decay equation. Show a few examples and ask the students to complete a few more. Discuss gamma emission, pointing out that there is no change in the particle structure of the nucleus and so no decay equations are needed. Students then calculate changes in atomic number and mass number of an atom after it emits alpha and beta radiation. **Plenaries** **Name that isotope** (5 min) Students use the interactive to complete a table describing various isotopes. They need to fill in missing details such as element name, proton number, mass number, and number of electrons. **Definitions** (10 min) The students must give accurate definitions of the terms 'proton', 'neutron', 'electron', 'ion', 'mass number', 'atomic number', 'alpha particle', 'beta particle', and 'gamma ray'.			
P7.4 More about alpha, beta and	**Aiming for Grade 4 LOs:** • Rank the three types of nuclear radiation in order of their penetrating power. • Rank the three types of nuclear radiation in order of their range through air.	Why type of radiation is the most dangerous?	**Lesson Overview** **Starters** **Too many symbols?** (10 min) Scientists use a lot of symbols in their work. Students use the interactive to match some symbols they have met so far with what they	Question & Answer, Mini white boards,	**Rich question to research:** What are the effects of ionising radiation on the body?	C3

gamma radiation	• State that all three types of nuclear radiation are ionising. **Aiming for Grade 6 LOs:** • Describe how the penetrating powers of radiation can be measured. • Describe the path of radiation types through a magnetic field. • Describe the process of ionisation. **Aiming for Grade 8 LOs:** • Describe in detail how the thickness of a material being manufactured can be monitored by using a beta source. • Compare the ionisation caused by the different types of nuclear radiation. • Evaluate in some detail the risks caused by alpha radiation inside and outside the human body.	Should we investigate with radioactive sources? Should nuclear energy be banned?	represent (e.g., elements, equations, the names of things, etc.). Discuss the reasons that scientists use symbols. **X-ray flashback** (5 min) The students should explain why X-rays can be harmful and the precautions used to reduce exposure. **Main** **Radiation in action** (40 min) Describe how the penetrating power of radiation can be measured by using a Geiger counter. Discuss the safety measures that must be used when measuring radiation. Introduce the different penetrating powers of the three types of radiation – alpha, beta, and gamma. Students suggest how the penetrating power could be used to measure the thickness of a material and how this can be applied to controlling thickness. Students complete the Working scientifically sheet to examine the results from an investigation on beta radiation through cardboard and link it to the measurement and control of cardboard manufacture. Discuss the damage caused by ionisation and some of the precautions that can reduce exposure, emphasising that keeping the sources at a distance is one of the most effective methods. The concept of sharing data about radiation effects should be covered here. **Plenaries** **Local rules** (10 min) The students should make a plan for a poster or booklet explaining how the radioactive sources should be stored and handled and explaining how these precautionary rules reduce harm. They can then produce this booklet as homework. **Protect and survive** (5 min) Ask students to suggest what would need to be done if one of the radioactive sources was dropped and lost.	Exam style question	**Doddle task:** Dangers of ionising radiation (animation)	C3

P7.5 Activity and Half Life	**Aiming for Grade 4 LOs:** • Define half life • Be able to plot half-life data and determine the half-life from the graph **Aiming for Grade 6 LOs:** • Be able to use the half-life to calculate the count over a set period of time **Aiming for Grade 8 LOs:** • Use information on half-life to compare and determine the relative danger of radioactive materials	How dangerous are radioactive atoms? Are radioactivity substances always dangerous?	**Lesson Overview** **Starters** Ask students what they can remember about the type of radioactive decay. Challenge the students to consider whether it is now safe to return to the area of Chernobyl. Challenge students to consider when a material is no longer radioactive – watch out for the misconception that students believe it is when all the protons and neutrons have been expelled from the nucleus. **Main** MnM/ Dice decay. Separate students into small groups and give them a set of 20 dice each. Ask them to roll all the dice and then record all of those which have landed with an even number and record this in a table – these dice represent the remaining radioactive material – all those that have landed with an odd number should be removed at these represent atoms which have now decayed. Continue until there aren't any dice left and plot the results on a line graph – they can now use the graph to find the half- life of the dice. Provide students with a variety of graph and calculation questions which ask them to work out the half-life or a radioactive substance or the time needed to pass until the substance is safe to handle **Plenaries** Real world applications – give students examples of when radioactive tracers and trackers are used in medicine, ask them to think about why the half-lives of these materials is so short.	Question & Answer, Mini white boards, Exam style question	**Rich question to research:** Are irradiated objects radioactive? **Doddle task:** Investigating the rate of decay (animation) AQA Radioactivity and half-life (mini quiz)	C3 C3 C3

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 focus on the rate of flow of charge, leading to the	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.		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 metal wire, such as the current	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. Different groups of students can be given wires of differ diameters or materials to show that the pattern is the	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

	through it, length, cross-sectional area, and metal used.		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. **Plenaries** **What's in the box?** (5 min) An electrical component has been placed inside a black box with only the two	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

			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 resistors in a circuit by constructing a circuit containing fixed value resistors. **Plenaries**	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

			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 provided by the new branch whilst the old current loop still exists. **Plenaries**	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

			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.			