Year 11 2020-2021

Half Term 5 (Summer 1)

Includes Review of P13 due to Covid-19 school closure

CGCSE Biology B14 Variation and Evolution			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
How are all humans different, how did this form of variation occur? Understand the processes of natural selection in creating variation. Exploring genetic engineering and selective breeding as a human interruption of evolution.	**Knowledge** • Identify some examples of variation within animals and plants • State whether an example has a genetic or environmental cause • Define the term mutation • Identify some useful adaptations • Describe the theory of evolution by natural selection • Give an example of where selective breeding has been used • State what is meant by selective breeding • Order the stages of genetic engineering • State one concern about growing GM crops **Understanding** • Explain why identical twins show variation as they grow older • Apply the theory of evolution by natural selection to suggest how a specific organism evolved. • Explain why a mutation rarely leads to a new phenotype • Explain the process of selective breeding and why it has been used – consider inbreeding • Explain why selective breeding and genetic engineering leads to a reduction in variation • Explain the process of genetic engineering • Evaluate the potential benefits and risks of genetic engineering • Analyse the potential economical and ethical implications of genetic engineering **Skills** • Synthesis and evaluate a range of conclusions from secondary sources to use in debate (considering validity) • Suggest further lines of enquiry based on your conclusions • Link a conclusion / investigation to the amendment of a scientific idea • Create a own model or analogy to represent the abstract • Evaluate: use the information supplied, as well as their knowledge and understanding, to consider evidence for and against when making a judgment.	Research the TEDS (twins early development study) to analyse the differences between genetic and environmental variation Able to produce a detailed timeline for the process of genetic engineering and selective breeding Identify mutations within the human population and how these lead to variation Research Darwin's trip to the Galapagos islands and how this influenced his theory of evolution Compare and contrast the uses of selective breeding and genetic engineering in the production of food Evaluate the use of genetic engineering in food production in poor economical countries – including stating why people may disagree	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: B14: Variation and Evolution

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: : 14h and i, 16b, 17f and 20f

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
B14.1 Variation	**Aiming for Grade 4 LOs:** • List some examples of human variation. • Categorise some human traits as being due to genetic causes, environmental causes, or both. • Describe why identical twins share the same genes. **Aiming for Grade 6 LOs:** • List some examples of variation in plants and categorise these as being due to genetic causes, environmental causes, or both. • Suggest reasons why identical twins will start to show variation as they get older. Use data to explain why studying identical twins helps scientists investigate which traits have genetic causes.	Would it be better if we were all the same? Are identical twins really identical?	**Lesson Overview** **Starters** **Twins** (10 min) Show the class images of identical twin babies. Ask students to write down a scientific explanation as to why they look identical. Discuss the fact that identical twins are genetically identical to each other and were formed when a fertilised egg split in half. Ask students to explain why the twins will not look exactly identical as they get older (due to environmental changes). **Human variation** (5 min) Ask the students to write down a list of variations in humans. They should think about both traits that can be seen and those that can't. Allow pairs or small groups to discuss their answers so that all students have a list of at least 10 examples. **Mains** **What causes variation?** (15 min) Use Starter 2 here if not already used. Students use information from the student	Class discussion Q & A between students and teachers Exam style questions Mind map- Categorising inherited and environmental variation	Learn the Keywords for the topic: Variation trait genetic variation environmental variation. Mutation evolution. adaptation selective breeding, natural selection, artificial	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 8 LOs: • Explain why some traits are only due to genetic causes. • Explain why it is so hard to get valid results from identical-twin studies. • Discuss some of the issues scientists face when conducting twin studies.		book on inherited and environmental causes of variation to categorise the causes of each example of human variation in the list generated in Starter 2. Ask students to repeat the activity using variation in plants. **Twin studies** (25 min) Tell students to imagine that identical twins are each adopted by different families. They meet up 25 years later. Ask students to discuss in small groups how similar they think the twins would be and why, giving specific examples of traits. After hearing their thoughts, direct students to the student book. They should work alone to study Table 1 and write down conclusions from the data. **Plenaries** **Inherited or environmental?** (10 min) Give students a range of examples of human traits – some inherited, some environmental, and some due to both. Ask them to categorise the examples. **Effects of the environment** (5 min) State one example of a lifestyle choice that a person can make (e.g., living in a hot country, smoking, eating fatty food, working hard at school). Choose students to name one example of variation that might be affected by each choice.		selection, DNA. Genetic engineering, genes, GM crops, enzymes Doddle: variation presentation	
B14.2 Evolution by Natural Selection	**Aiming for Grade 4 LOs:** • Describe a mutation as a change in the DNA code. • Describe the theory of evolution by natural selection as a process by which living things have evolved from simple life forms. • State some useful adaptations. **Aiming for Grade 6 LOs:** • Explain how a mutation may lead to a new phenotype. • Describe the steps that take place during evolution by natural selection.	How can it be true that all life evolved from one organism? Are humans still evolving? Is extinction just natural selection at work?	**Lesson Overview** **Starters** **Albinism** (5 min) Show the class a range of albino animals. Tell them that albinism is due to a mutation. Ask students to suggest whether this mutation is an advantage or a disadvantage, and explain why they think this. **Adaptations** (10 min) Ask students to list the adaptations that result in the lion being such a successful predator. Listen to their suggestions and ask them what would happen to a lion cub born without these adaptations. **Main**	Group discussion on adaptation and natural selection Written work on evolution by natural selection	Doddle: What is natural selection animation?	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Analyse data from an activity modelling natural selection. **Aiming for Grade 8 LOs:** • Explain why it is rare that a mutation leads to a new phenotype. • Apply the theory of evolution by natural selection to suggest how a specific organism evolved. • Explain how a change in a model can make it useful for explaining something else.		**Modelling natural selection** (20 min) Students play a game to model natural selection. After the game, question students about how they think this relates to real life. Discuss why there is variation in a population, and why this means some organisms are better adapted then others. What happens to the organisms that are poorly adapted? Why does the number of the best-adapted organisms increase? **Real-life examples** (20 min) Introduce evolution as a process by which living things change over time, and natural selection as a theory that explains how this happens. Ask students to read through the stages of natural selection in the Student Book. They then use this to create an explanation of how a mouse evolved to have very good hearing, or how a cheetah evolved to be fast. **Plenaries** **Describing natural selection** (5 min) Students use the interactive to complete a description of the process of natural selection by filling in the gaps. **Evolution** (10 min) Set students a past exam question on natural selection to complete. Provide the mark scheme to self-assess.			
B14.3 Selective Breeding	**Aiming for Grade 4 LOs:** • Describe selective breeding as a process where humans choose which plants or animals to breed together. • Give one example where selective breeding has been used. • Choose organisms to breed together to result in desired traits in the offspring. **Aiming for Grade 6 LOs:** • Explain the process of selective breeding. • Explain why humans have used selective breeding. Explain what inbreeding is, and why it is a problem in dog breeding.	Is it time that Crufts was banned? Could selective breeding solve world hunger? What could be the consequences if we controlled all breeding?	**Lesson Overview** **Starters** **Dog breeds** (5 min) Show students an image of different dog breeds. Explain that they are all one species because they can breed with each other to produce fertile offspring. Choose examples and ask students to suggest how the features of that breed make it useful for specific tasks, for example, greyhound is fast so it is good for racing, mastiff is large so it makes a good guard dog. **Then and now** (10 min) Show the class images of ancient and modern wheat. Ask them to list the similarities and differences. Tell the class that over the thousands of years that people have been farming they have kept seeds from	Peer discussion on dog breeding Group work on plants and animal breeding Students' responses to question from AQA biology book	Doddle: Altering organisms presentation and mini quiz Selective breeding presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 8 LOs: • Compare and contrast natural and artificial selection. • Explain in detail how the variation of alleles in a population is reduced through selective breeding. Explain in detail why the reduction of variation in a population through selective breeding is a problem.		the best wheat plants to grow the following year. Introduce this as an example of selective breeding. **Main** **Developing dog breeds** (40 min) Use Starter 1 now if not used already. Tell students that all modern dogs are descended from one species – the wolf. Students work in groups to research and develop an item for a TV programme about the selective breeding of dogs. They should explain to a general audience how people used selective breeding to make all the modern dog breeds, and also discuss the problems inbreeding has caused some breeds. They can choose which breeds to focus on and produce an engaging verbal or computer presentation to present to the rest of the class. **Plenaries** **Wolf to greyhound** (10 min) Students use the interactive to order a set of sentences so they describe how people developed greyhounds from wolves by selective breeding. **Artificial selection** (5 min) Tell the class that selective breeding is also called artificial selection. Ask them to suggest why.			
B14.4 Genetic Engineering	**Aiming for Grade 4 LOs:** • Describe GM organisms as containing a gene from another organism, and order the stages of genetic engineering. • Give examples of GM organisms and describe why they are useful to humans. **Aiming for Grade 6 LOs:** • Describe the steps used in genetic engineering to produce GM organisms.	Should genetic engineering be allowed? What could the consequence of designed babies be? Are genetic disorders	**Lesson Overview** **Starters** **GM opinion** (5 min) Show the class an image showing a food that contains GM ingredients. Ask them for their immediate thoughts and feelings – would you eat it, and why? **Glow-in-the-dark mouse** (10 min) Show an image of the genetically modified fluorescent mouse. Ask students to discuss in small groups how they think the mouse could have been produced. Explain that the mouse's genome	Group discussion on GM food Mind map on genetically modified animals Exam questions	Doddle: DNA and genome presentation Genetic engineering presentation	SO3 SO9 SP1 SP2 SP5

	• Analyse data to describe why growing GM crops may be beneficial to a farmer. **Aiming for Grade 8 LOs:** • Explain the process of genetic engineering using technical vocabulary (e.g., plasmid, vector, restriction enzymes, marker genes, recombinant DNA). • Explain how genetic engineering could be used to cure people with inherited disorders, and discuss the limitations.	something we should try and eliminate or are they natural?	now contains the gene for a glowing protein from a jellyfish. **Main** **Genetic engineering** (40 min) Explain what is meant by genetic engineering. Ask students to use information from the student book to write a list of examples of genetically engineered organisms. Discuss as a class why scientists have produced GM organisms. Provide students with data that show how crop yields of GM corn and normal corn compare. Ask them to analyse the data and write a letter to a farmer explaining what it shows, and whether they would recommend growing it. Introduce another function of genetic engineering, such as making GM bacteria that produce human insulin. Provide students with an unlabelled diagram showing the principles of genetic engineering and ask them to go through the diagram as a pair, working out between them how the process is carried out. Allow them to use a labelled diagram to check their understanding. Then ask them to write down the stages of how GM corn is produced. **Plenaries** **Advantages and disadvantages** (5 min) Use the interactive where students sort a series of statements, which are either advantages or disadvantages of genetic engineering, by dragging and dropping the statements into one of two boxes. **Genetic engineering for people** (10 min) Remind students that genetic engineering could be used to help cure inherited disorders such as cystic fibrosis. Ask students to suggest how this could be done.			SP9 C2
B14.7 Ethics of Genetic	**Aiming for Grade 4 LOs:** • Give one concern people may have about growing GM crops. • Describe why some people are against the cloning of animals.	Should we play 'God?' Do we understand the	**Lesson Overview** **Starters** **Definitions** (5 min) Ask students to work in pairs. One student should define genetic engineering and the other	Group debate on benefits and risks of cloning.	Doddle:	SO3 SO9 SP1

Technologies	**Aiming for Grade 6 LOs:** • Outline the potential benefits and risks of genetic engineering. • Describe economic and ethical concerns that people may have about cloning animals. **Aiming for Grade 8 LOs:** • Evaluate the potential benefits and risks of genetic engineering. • Explain in detail the significance of events in the field of genetics.	technology enough to use it or should there be a ban on it? If we become able to clone humans is there any going back? (Once we know we can do it can we then never use the technology again / /can't be undiscovered, atomic bomb) Is it ok to see if we can clone a human?	should define cloning. Ask them to read out their definitions to each other and suggest changes until they are happy with their definitions. **Black and white** (10 min) Read out the following statement to the class: *Some people agree with genetic engineering and cloning and some* *People do not.* Discuss as a class whether students think opinions are always as black-and-white as this. Talk about the grey areas (e.g., the genetic engineering of bacteria to produce human insulin is generally seen to be a good use of the technology, but the genetic modification of mammals is not). **Main** **Cloning concerns** (10 min) Present the class with a range of numerical facts about cloning: The process that produced Dolly in 1996 used 277 fertilised eggs, which formed 29 viable embryos, which produced three lambs at birth, one of which lived. Dolly died young (at 6 years old – most sheep live until they are 12). She had lung problems and arthritis. In 2001 it took 188 attempts to make Cc, the first cloned cat, producing 87 cloned embryos, only one of which resulted in a kitten. You can clone your dog for £60 000. Ask students to use these figures to present data to support the argument against the use of adult cell cloning. **Benefits and risks of genetic engineering** (30 min) Provide students with resources that outline arguments for and against genetic engineering in agriculture and medicine. Students may have their own resources, having completing the homework in Topic B14.4. Ask them to write a balanced article for a newspaper or news website on genetic engineering. **Plenaries**	Exam questions	Cloning presentation, cloning worksheet	SP2 SP5 SP9 C2

			Peer assessment (10 min) Ask students to peer assess each other's articles from Main 2, giving one positive comment about the work and one comment giving suggestions on how it could be improved.			

GCSE Biology B15 Evolution and Genetics			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Evolution, extinction and classification	**Knowledge** • Definition of evolution • List of ways in which species become extinct • Classification systems **Understanding** • Explain the mechanisms in which evolution occurs • Describe the process of fossilisation • Compare classification systems and give strengths and limitations of each • Evaluate the use of antibiotics and recommend guidelines for future use • Give the evidence for and against evolution **Skills** • Give references • Suggest further lines of enquiry • Understand how scientific ideas change over time • Evaluate and critically evaluate claims	Combining secondary sources, and critiquing these to evaluate these the current use of antibiotics nationally and world wide. Detailed explanation of the mechanisms of evolution with scientific terminology. Using 'How Science Works' to explain how investigations and the conclusions drawn from these have led changes in scientific understanding.	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: B15: Evolution and Genetics (Changing Organisms)

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: : 1,14, 16, 20, 21

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
B15.5 **Evidence for Evolution**	**Aiming for Grade 4 LOs:** • Describe what a fossil is and give an example. • Recognise that fossils are evidence for evolution by natural selection. • Order geological events. **Aiming for Grade 6 LOs:** • Describe how fossils are formed. • Describe how fossils are evidence for evolution by natural selection. Explain why the fossil record is not complete. **Aiming for Grade 8 LOs:** • Evaluate the use of fossils as evidence for evolution by natural selection and how life first formed. • Use standard form to discuss the large timescales used when considering the evolution of life. Create a geological timeline to scale.	How do we know that evolution is real?	**Lesson Overview** **Starters** **What is it?** (10 min) Set up a display of fossils around the classroom, ideally some real and some photographs. They should be a range of different types of fossils (e.g., those in rock/ice/ash, footprints, burrows). Number each one for referencing. Ask students to try and identify each fossil. Make sure you talk through the incorrectly identified fossils. **Frozen mammoth** (5 min) Show the class an image of a mammoth preserved in ice (see Figure 1 in the student book). Discuss what scientists could learn from studying the mammoth. **Main** **Fossil evidence** (10 min) Show a series of images to show how fossils form in rock (Figure 2 in the student book). Discuss what can be learnt about evolution from studying fossils. Ask students to read through the section *An*	Class discussion Q & A between students and teachers Students' responses to questions from AQA biology book	Learn the Keywords for the topic: Fossil evolution natural selection extinction atmospheric oxygen endangered animals antibiotic resistant bacteria binomial naming strain	SO3 SO9 SP1 SP2 SP5 SP9 C2

			incomplete record in the student book and to write down three reasons why the fossil record is not complete. **History of the Earth timeline** (30 min) Provide students with some major events in the evolution of life on Earth. Ask them to use the Internet to research when they happened and to place them into the correct order: Earth formed (4.6 billion years ago), oceans and continents start to form (4.4 billion years ago), first evidence of life (3.5 billion years ago), atmospheric oxygen forms (2.4 billion years ago), evolution of eukaryotic life (1.8 billion years ago), plants move on to land (450 million years ago), animals move on to land (430 million years ago), Permo-Triassic mass extinction (251 million years ago), evolution of mammals (195 million years ago), extinction of the dinosaurs (65 million years ago), evolution of humans (200 000 years ago), extinction of the woolly mammoth (10 000 years ago). **Plenaries** **Fossil evaluation** (10 min) Ask students to write down why fossils are evidence for evolution by natural selection. **Fossil formation** (5 min) Students use the interactive to put the stages of fossil formation into the correct order.		asteroid comment, meteoroids taxonomy carl Linnaeus, three domain evolutionary tree Doddle: Evolution presentation Fossil presentation	
B15.6 **Fossils and Extinction**	**Aiming for Grade 4 LOs:** • Describe what is meant by extinction. • Describe one way that an animal could become extinct. • Order fossil diagrams to show the evolution of the horse. **Aiming for Grade 6 LOs:** • Describe how other organisms can cause an animal or plant to become extinct. • Suggest a hypothesis for why an organism became extinct. Explain how fossil diagrams show how the horse has evolved.	What evidence do we have that other organisms lived here before we did?	**Lesson Overview** **Starters** **Least favourite way to go** (10 min) Ask the class to work in small groups to discuss and list the ways in which organisms become extinct. Go through their ideas and produce the following list – asteroid impact, climate change, competition with other species, new diseases, new predators. Highlight the causes associated with other organisms and tell the class that this is what they will be focusing on in this lesson. **Fossil review** (5 min) Students use the interactive to complete a series of statements on fossils. they then sort statements about fossils according to whether they are true or false.	Mind map on extinction Class discussion Q & A between students' and teachers Exam style questions	Doddle: Extinction presentation How were animal fossil formed? Animation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 8 LOs: • Suggest alternative hypotheses for why an organism became extinct. • Evaluate in detail the need to conserve endangered plants. • Apply knowledge of speciation to explain why dodos were only found on one island.		**Main** **Fossils and extinction** (40 min) Give students a set of pictures showing the evolution of the horse, but with no labels and in an incorrect sequence (Figure 1 from the student book). Ask students to put them into the correct sequence and explain what they show. They can then use the student book to check their work. Then introduce students to the extinct bird, the dodo. (A video clip from the Internet may be useful here.) Discuss what scientists can deduce about the bird using its skeleton. Tell them that the dodo became extinct when humans and their livestock settled for the first time on the island of Mauritius, where they lived. Ask groups to work together to propose several hypotheses for why the dodo became extinct. **Plenaries** **Endangered animals** (10 min) Give groups of students a set of images of different endangered animals (e.g., polar bear, black rhino, orangutan, giant panda), and ask them to discuss the reasons why they are endangered. **Plant extinction** (5 min) Ask students to suggest what could cause the extinction of a plant species.			
B15.7 **More about extinction**	**Aiming for Grade 4 LOs:** • Describe what a mass extinction is. • State that environmental change and a catastrophic event are two possible causes of mass extinction. • Describe one theory that explains why the dinosaurs became extinct. **Aiming for Grade 6 LOs:** • Suggest the effects of an asteroid, comet, or meteorite strike on Earth. • Explain how environmental change can cause mass extinctions. • Identify strengths and weaknesses in two different theories of mass extinction.	What causes extinction?	**Lesson Overview** **Starters** **Human extinction** (5 min) Ask students to discuss whether they think humans will become extinct. and, if so, when and how. Introduce the term mass extinctions and use Figure 2 in the student book to show when these have occurred. **Deep impact** (10 min) Show students the trailer for the movie *Deep* *Impact* and discuss what effects an asteroid, comet, or asteroid strike would have on Earth. Explain that this happened at Chicxulub in Mexico at the end of the Cretaceous period, and that the crater formed was 180 km in diameter and 10 km deep.	Class discussion Q & A between students and teachers Students' responses to questions from AQA biology book	Doddle: How were animal fossil formed? Animation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	Aiming for Grade 8 LOs: • Link ideas to give a scientific explanation of why an asteroid could have caused the dinosaurs to become extinct. • Suggest why mass extinctions are important for the evolution of life on Earth. • Evaluate two theories to come to a conclusion about which is more believable, and explain why scientists are not sure what caused the extinction of dinosaurs or mammoths.		**Main** **Extinction** (40 min) Show the class a graph that shows how average temperatures on Earth have varied. Ask students to use Figure 2 in the student book to see whether there is a link between changes in temperature and mass extinctions. They can then use the information in the student book to explain why there is a link. Then ask students to read through the section *What destroyed the dinosaurs* in the student book, which outlines popular theories. Ask them to evaluate the evidence and to identify strengths and weaknesses in each case. They then discuss their ideas in small groups, and then as a class. Discuss the fact that theories are ideas supported by evidence that become accepted, and are then often superseded over the years. Explain why scientists are not sure what caused the extinction of the dinosaurs. **Plenaries** **What do you think?** (5 min) Introduce to the class the opinion that, in the long term, mass extinction is beneficial to the development of life. Discuss thoughts as a class. **Extinction causes** (5 min) Students use the interactive select the correct cause of extinction for different creatures			
B15.8 **Antibiotic resistant bacteria**	**Aiming for Grade 4 LOs:** • Describe what is meant by an antibiotic resistant bacteria. • Describe why scientists want to slow down the rate of development of new strains of antibiotic resistant bacteria. • List some ways in which scientists can slow down the development of new strains of antibiotic resistant bacteria. **Aiming for Grade 6 LOs:** • Describe how antibiotic resistant bacteria evolve.	What could happen to our population if all antibiotics became resistant?	**Lesson Overview** **Starters** **Please wash your hands** (5 min) Show students images of antibacterial hand gel for public use in hospitals or hand-washing stations for medical professionals. Ask them why these are important. Introduce the fact that some strains of bacteria are especially dangerous because they cannot be controlled by antibiotics. **How many?** (10 min) Ask students to calculate how many bacteria would be present after one day if a colony of 100 bacteria reproduced once every hour (224 × 100 = 1 677	Class discussion Q & A between students and teachers Students' response to questions from AQA biology book	Doddle: Resistance bacteria presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Explain why scientists need to develop new antibiotics. • Create an information sheet outlining important facts about antibiotic resistant bacteria to the public. **Aiming for Grade 8 LOs:** • Explain how a fast reproduction rate is linked to the development of antibiotic resistance strains of bacteria. • Explain how antibiotic resistant bacteria are evidence for evolution. • Summarise the reasons why the development of new antibiotics is unlikely to keep up with the emergence of new strains of antibiotic resistant bacteria.		721 600). As a class, use this information to discuss why bacteria evolve much quicker than animals. **Main** **Public information** (40 min) Provide students with images that show how bacteria become antibiotic resistant, but put these in the wrong order (see Figure 1 in the student book). Ask students to rearrange them and then describe to a partner what they show. After checking their ideas by using the student book, they can stick the diagrams into their books and write down what each shows. Then ask students to use information from the student book to summarise their top three things the public should understand about how to reduce the rate of development of antibiotic resistant bacteria. Students then share their lists with a partner before deciding on a shared list. Ask students to then create an information sheet for the general public outlining these. **Plenaries** **Order the stages** (5 min) Give students the interactive with the stages of the development of antibiotic resistant bacteria in the wrong order. Ask them to arrange them correctly. **Evidence for evolution** (10 min) Ask students to write an explanation for how antibiotic resistant bacteria are evidence for evolution.			
B15.9 **Classification**	**Aiming for Grade 4 LOs:** • Describe what classification is. • Classify animals into groups based on their shared characteristics. • Write an organism's name correctly using the binomial system. **Aiming for Grade 6 LOs:** • Describe the classification system developed by Carl Linnaeus, to include the order of the taxonomic groups.	How do we know which organisms have common ancestors?	**Lesson Overview** **Starters** **Name that species!** (5 min) Tell the class that they need to name the species of animal that you are going to show them. Show them images of a lion, a tiger, and a liger or tigron. Discuss that lions and tigers are different species but they can breed to produce infertile offspring. **Classify** (10 min) Give groups of students a range of images of different animal species. Ask students to classify	Group activity on classifying animals and plants based on similarities Class discussion Q & A between students and teachers	Doddle: classification presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Identify genus and species from a scientific name. • Explain why a binomial naming system is useful. **Aiming for Grade 8 LOs:** • Use the Linnaean system to name the groups that given organisms belong to. • Suggest why hybrids are not assigned scientific names using the binomial system.		them into groups based on their shared characteristics. Allow groups to share their method with the class and use this as a basis for a discussion about why it is a good idea for everyone to use the same system. **Main** **Linnaeus** (20 min) Introduce students to the work of Carl Linnaeus. Ask students to read through the section *How are organisms classified*? in the student book on his classification system, and write down at least five key points in their own words. **Classifying animals** (20 min) Provide pairs of students with cards that contain the Linnaean classification for some different animal species. For example, for a lion there would be seven cards stating: Kingdom – Animalia (animals), Phylum – Chordata (vertebrate), Class – Mammalia (mammals), Order – Carnivora (meat eaters), Family – Felidae (all cats), Genus – Panthera (great cats), Species – Leo. Students should correctly order the cards and suggest the common name of the animal. You can provide different pairs with different animals, each pair with several animals, or all pairs doing the same animal. Go through the correct answers and introduce the term binomial system, including why it is useful to scientists. **Plenaries** **Classifying humans** (10 min) Students use the interactive to put the taxonomic groups in the correct order. They then put the classification of humans into the correct order. **Why use the binomial system?** (5 min) Ask students to write down why this system is useful for scientists.	Students' responses to questions from AQA biology book		

B15.10 New Systems of Classification	**Aiming for Grade 4 LOs:** • Name the three domains. • Recognise that ideas about classification have changed over time. • Draw a conclusion from a simple evolutionary tree. **Aiming for Grade 6 LOs:** • Describe how organisms are divided in the three-domain system. • Describe why the three-domain system was proposed. • Draw several conclusions from a simple evolutionary tree. **Aiming for Grade 8 LOs:** • Compare and contrast the Linnaean system with the three-domain system. • Outline how ideas about classification have developed over time. • Draw conclusions from a more complex evolutionary tree.	How do modern day systems of classification compare to the previous ones?	**Lesson Overview** **Starters** **The tree of life** (10 min) Print out copies of an example of a tree of life from an Internet search. Let pairs study the diagram and discuss what they think it shows before opening it up as a class discussion. **Extreme organism** (5 min) Tell the class that a single-celled organism has been found living in a hydrothermal vent on the ocean floor at pressures of more than 200 atmospheres and temperatures above 85 °C. It survives without oxygen and produces methane as a product of its metabolism. Tell students that scientists cannot place it into any of the five kingdoms proposed by Linnaeus, and suggest why. **Main** **The three-domain system** (20 min) Ask students to use information from the student book to draw a simple diagram to show how the three-domain system is subdivided up into six kingdoms. Students should also give an example of a species that belongs to each kingdom, and explain the common characteristics of each. **Evolutionary trees** (20 min) Allow students to use the Internet to research what evolutionary trees show, and print off an example. Allow them to share these examples with other students in a group and explain what they show about evolution. **Plenaries** **Which kingdom?** (10 min) Students use the interactive to classify a list of organisms as archaebacteria, eubacteria, protista, fungi, plants, or animals. **Thumbs up** (5 min) Review the evolutionary tree shown in Figure 2 in the student book. Ask students questions to check their understanding (e.g., Do the giant and red panda have a common ancestor? How long ago did it live? Did this ancestor have 'wrist thumbs?' Why have both species evolved to have them?).	Group work on modern day of classification compares to previous ones Q & A between students and teachers Students, responses to questions from AQA biology book	Doddle: AQA classification min quiz	SO3 SO9 SP1 SP2 SP5 SP9 C2

Scheme of Work 2020-2021

Subject: GCSE Science: P13: Electromagnetic Waves Review

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 19, 25, 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
P13 Summary 1 **Electromagnetic Spectrum and Properties**	**Aiming for Grade 4 LOs:** • State that electromagnetic (EM) waves transfer energy without transferring matter. • Identify the position of EM waves in the spectrum in order of wavelength and frequency. • State that all EM waves travel at the same speed in a vacuum. **Aiming for Grade 6 LOs:** Describe the relationship between the energy being transferred by an electromagnetic • wave and the frequency of the wave. • Calculate the frequency and the wavelength of an electromagnetic wave. • Explain why the range of wavelengths detected by the human eye is limited.	What is the electromagnetic spectrum?	**Lesson Overview** **Starters** **The visible spectrum** (10 min) Ask students to outline their prior knowledge of the electromagnetic spectrum by asking them to show how light is reflected, transmitted, or refracted. **Light speed** (5 min) Ask the students to use the following data to determine the speed of light. It takes 1.3 s to travel from the Earth to the Moon, a distance of 390 000 km [300 000 km/s or 300 000 000 m/s]. **Main** **Introducing electromagnetic waves** (25 min) Recap the nature of electromagnetic radiation compared with mechanical waves. Focus on the wide range of wavelengths of the waves, linking this to the effects. Show the link between frequency and wavelength. Students need to attempt a few calculations of wavelength and frequency.	Q & A, Use of mini white boards, exam style question. P10: Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. **Colins 6.15 6.12**	Doddle Electromagnetism Presentation, Doddle AQA Electromagnetism Mini Quiz, AQA Doddle Types of electromagnetic waves Mini Quiz,	C1, Sp3,C3

	Aiming for Grade 8 LOs: • Apply the wave model of electromagnetic radiation as a pair of electric and magnetic disturbances that do not require a medium for travel. • Use standard form in calculations of wavelength, frequency, and wave speed. Explain the interactions between an electromagnetic wave and matter.		Outline the link between frequency and energy. Students then carry out the practical. They can either rotate through all of the experiments, or each group carries out one experiment and then they share and discuss results. **EM waves and matter** (15 min) Recap absorption, reflection, and transmission using visible light as an example and ask students if this behaviour will be the same for all electromagnetic waves and materials. **Plenaries** Experiment summary and write up			
P13 Summary 2 Types of waves and uses	**Aiming for Grade 4 LOs:** • Describe how white light is a part of the electromagnetic spectrum and is composed of a range of frequencies. • List some simple examples of the uses of EM waves • State that the higher the frequency of a wave, the greater the rate of data transfer possible. • State that high-frequency electromagnetic radiation is ionising. • Describe the uses and dangers of radiation. **Aiming for Grade 6 LOs:** • Describe how a range of electromagnetic waves are used in a variety of scenarios. • **Explain why a particular wave is suited to its application.** • Compare the rate of information transfer through optical fibres and radio signals • Compare X-rays and gamma radiation in terms of their origin.	How dangerous are our mobile phones? How have optical fibres improved our lives?	**Lesson Overview** **Starters** **Radio gaga** (5 min) Give the students a set of mixed-up sentences about radio waves and ask them to sort the words into the right order to produce correct sentences. **Colour filters** (10 min) Shine a bright white light through a series of filters and ask the students to explain what is happening with a diagram. Ask the students if they think that there will be a similar effect for the non-visible parts of the spectrum. This leads into the absorption of electromagnetic energy as it passes through materials. **Main** **Electromagnetic radiation** (20 min) Remind students of the different parts of the electromagnetic spectrum and introduce wave types and uses. • IR radiation – emphasise the relatively low energy of the waves but explain that high intensity (relate to 'brightness') can mean that large amounts of energy can be delivered by electric heaters and so on. • Microwaves – describe the uses of microwaves, ideally with a phone and a microwave oven as props. Students should note that microwaves are absorbed by water and	Q & A, Use of mini white boards, exam style question.	BBC Bitesize You tube: 'Free science lessons' Seneca learning Work booklets and learning material provided for lockdown working from home	Sp7,Sp2

	Aiming for Grade 8 LOs: • Describe the interactions between a range of waves and matter, including the effect of absorption. • **Describe in detail how carrier waves are used in the transfer of information.** • **Describe the structure of a radio communication system, including the effect of a radio wave on the current in the receiver.** • • .		fat molecules, and this absorption produces the heating effect. • Radio waves – Demonstrate a radio to show that radio waves can penetrate walls. Bluetooth devices such as console game controllers can also be shown. Moving the device gradually further away from its partner will allow the students to check the maximum range. They should use the student book (and other resources if available) to produce a revision summary of the uses of the different parts of the electromagnetic spectrum. **Radio waves and mobile phones** (20 min) Discuss the various regions of the radio spectrum, with a particular emphasis on the position of microwaves within it. Link this to the rate at which data can be transmitted – microwaves provide the greatest rate. Discuss the transmission of signals, particularly the need for transmission towers – the phones do not communicate directly. An older, broken phone may be useful here to show the aerial. No link between mobile phone use and brain effects has so far been found – the intensity of the signals are very low and are unlikely to cause damage. Students then complete the Bump up your grade worksheet to consolidate their understanding of the electromagnetic spectrum and how microwaves and radio waves are used in communication. **Optical fibres for communication** (20 min) Demonstrate a simple transition of light pulsed through a fibre with a torch and convoluted path for the cable. Remind students that visible light and IR are much higher frequency than radio and so fibres will transmit data at a higher rate. Students can compare energy and information transfer through a fibre to that in radio transmissions. Higher-tier students also need to discuss signals and carrier waves. The process here is quite complex and students need to be led through the stages carefully. **UV, X-rays, and gamma rays** (40 min) Start by demonstrating the effect of UV radiation on a range of materials to show that it exists using the practical outlined. Emphasise the damage it can cause, particularly to the eyes. Images of skin damage are readily available on the Internet.			

			Move to higher-frequency/higher-energy waves, emphasising the penetrating power through different materials. A few simple non-medical X-ray photographs can be used to outline a use for X-rays, because medical photographs will be used in Topic P12.5. Outline the key uses of gamma radiation, all of which are linked to high energy causing ionisation and damage to living cells. Describe the process of ionisation and, in particular, the damage to DNA. The students should understand that the greater the exposure, the more damage is likely. Various control procedures should be discussed, including reducing exposure, protective clothing, and dose measurement. The students should be provided with some data about the risks associated with radiation exposure to analyse. **Plenaries** **RMIVUXG?** (5 min) The students may know a mnemonic to give the order of the visible spectrum. Can they think up a method of remembering the regions of the electromagnetic spectrum? **EM calculations** (10 min) Students complete the interactive where they are given further calculations of wavelength or frequency for electromagnetic waves.			

GCSE Physics P15 Electromagnetism			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Force of magnetism and its properties	**Knowledge** • Definitions of induces magnetism, magnetic fields, solenoids, flux density and electromagnets • Rules of attraction for magnets • List magnetic materials **Understanding** • Explain why magnetism is a non-contact force • Explanation of how to induce magnetism in a metal • Links between magnetic fields and electric current • Confident use of practical equipment to create demonstrations that evidence the learning points **Skills** • Writing scientifically to explain • Drawing scientifically • Consider with control variables and effectively managed during a practical	Application of electromagnets Detailed description of Flemmings left hand rule and how this links magnetic fields, force and current Description of how magnetism can be used to generate electricity in the generators Application of transforms including calculations on efficiency and potential difference Application of previous study on electricity including use of electrical symbols for components	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: P15: Electromagnetism

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 20, 26, 15

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
P15.1 Magnetic Fields	**Aiming for Grade 4 LOs:** • State the names of the poles of a magnet. • Describe the interaction of magnetic poles (attraction and repulsion). • List some magnetic and non-magnetic metals. **Aiming for Grade 6 LOs:** • Sketch the shape of a magnetic field around a bar magnet. • Describe how the shape of a magnetic field can be investigated. • Compare the Earth's magnetic field to that of a bar magnet. **Aiming for Grade 8 LOs:** • Describe the regions in a magnetic field where magnetic forces are	If the force is invisible – how do know it's there? How are we cable to navigate around the world?	**Lesson Overview** **Starters** **Force fields** (10 min) Interactive where students categorise a list of the various forces they have studied into contact and non-contact forces. **Lost** (5 min) Show the students a compass (or a compass application for a mobile phone) and ask them how it works in terms of magnetic fields and poles. **Main** **Investigating bar magnets** (15 min) Students test the properties of magnets using the practical. Discuss the interaction of the bar magnet with the Earth's magnetic field, comparing the two. Demonstrate that only some metals are magnetic. **Plotting a magnetic field** (25 min) Demonstrate the existence of a magnetic field around a bar magnet using iron filings and then allow the students to plot the field	Q & A, Use of mini white boards, exam style question.	Doddle Electromagnetism Presentation Doddle AQA Electromagnetism Mini Quiz	C1, Sp3,C3

	greatest using the idea of field lines. • Explain in detail how magnetism can be induced in some materials. • Plan in detail how the strength of a magnetic field can be investigated.		pattern with the plotting compasses. Discuss regions where the field lines are closer together as regions where the force would be strongest. Show induced magnetism by lifting a paperclip with a strong bar magnet. A second clip will attach to the first even though the original clip was not magnetic. Explain the effect using the figure in the student book. **Plenaries** **Stronger fields** (10 min) Show the students a horseshoe magnet and ask them to discuss the shape the field might be. **Applications** (5 min) Ask the students to list as many applications of permanent magnets as they can. Would these applications be improved if the magnetism could be turned off and on?			
P15.2 Magnetic Fields of Electric Current	**Aiming for Grade 4 LOs:** • State that the magnetic field produced by a current-carrying wire is circular. • Describe the effect of increasing the current on the magnetic field around a wire. • Describe the effect of reversing the direction of the current in the wire. **Aiming for Grade 6 LOs:** • Use the corkscrew rule to determine the direction of the field around a current-carrying wire. • Describe the shape of the field produced by a solenoid. Describe the factors that affect the strength or direction of the magnetic field around a wire and solenoid. **Aiming for Grade 8 LOs:** • Determine the polarity of the ends of a solenoid from the direction of the current.	What is the interaction between the magnetic field and electricity?	**Lesson Overview** **Starters** **Electricity and magnetism recap** (10 min) Complete the interactive with a set of electricity questions to establish the students' prior knowledge. **Current effect** (5 min) Students should describe the factors which affect the current in a wire and the physical effects a current has in, and around, the wire. **Main** **Fields around a current-carrying wire** (20 min) Demonstrate the magnetic effect of a wire with the practical, or let the students find it. Discuss and then test the effect of reversing the current and/or increasing it. Ensure that students can apply the corkscrew rule (also known as the right-hand grip rule) to determine the direction of the field around the wire. **Fields around a solenoid** (20 min) Show a solenoid and compare it to a bar magnet. Connect it to a power supply and show the deflection on a plotting compass as the compass is moved around the coil. Students then plan an investigation into the factors which would affect the strength of this field.	Q & A, Use of mini white boards, exam style question.	Doddle Coil in a magnetic field Interactive	Sp7,Sp2

	• Sketch the shape of the field surrounding a solenoid relating this to the direction of the current through the coil. • Plan a detailed investigation into the factors that affect the strength of the magnetic field around a solenoid.		**Plenaries** **More power** (10 min) Ask the students to outline a test to see what affects the strength of the field around a solenoid. They should choose one possible factor (current, number of loops in coil, type of core) and form a plan to see if there is a qualitative or quantitative relationship that can be determined. **Space boots** (5 min) In space, astronauts are weightless but need some way of walking around the outer surface of a space station. Can the students describe a system to do this?			
P15.4 The Motor Effect	**Aiming for Grade 6 LOs:** • Describe how the force acting on a wire due to the motor effect can be increased. • Apply Fleming's left-hand rule to determine the direction of the force acting on a conductor. • Calculate the force acting on a conductor when it is placed in a magnetic field. **Aiming for Grade 8 LOs:** • Describe and explain in detail the operation of a motor. • Perform calculations involving rearrangements of the equation $F = BIl$. Investigate the factors that affect the rotation of an electric motor.	What is the motor effect?	**Lesson Overview** **Starters** **Magnetic magic** (5 min) Some magicians use magnetic effects to levitate objects. Show some footage of this levitation and ask the students to explain the 'magic' to see if they realise there is a scientific principle behind the mystery. **Motor demonstration** (10 min) Demonstrate an electric motor lifting a small load from the floor. Ask the students to explain what can be done to increase the force the motor can provide. They should be able to identify increasing the current. **Main** **The motor effect** (40 min) Demonstrate the motor effect and discuss the factors that affect the size and direction of the force. Show how Fleming's left-hand rule can be used to determine the direction of motion for the wire. Recap the idea of strong or weak magnetic fields and then introduce the equation, describing how this links to the earlier demonstration. The students should try some example calculations to embed the equation. Discuss how this force could be applied to produce continual movement. Allow the students to construct a motor or investigate the operation of one. If time permits, the students can construct small model motors from standard kits.	Q & A, Use of mini white boards, exam style question. End of module test	BBC Bitesize You tube: 'Free science lessons' Seneca learning	Sp7,Sp2

			Plenaries **The motor effect** (10 min) Students use the interactive to complete a paragraph to describe the motor effect. They then carry out some calculations using the equation $F = B I l$. **Motor competition** (5 min) The students should select the motor that is smoothest and most stable as the winner and give a prize.			