Year 10 2020-2021

Half Term 5 (Summer 1)

GCSE Biology B6 Preventing and Treating Disease			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
Ways in which we can prevent the spread of certain disease – and how to treat them if an organism is infected. Understanding how drugs have been developed and the use of drug trials in developing treatments for infections.	**Knowledge** • Define vaccination and explain what it contains • Identify when an antibiotic should be used • Identify the steps to the discovery of penicillin • State some drugs that have been developed from plants and microorganisms • Give the procedures of a new drug trail in the correct order **Understanding** • Explain the use of antibodies and antigens in vaccines • Explain why antibiotics cannot be used on viral infections • Analyse data to conclude the effectiveness of drugs • Explain why it is important for scientists to keep developing drugs from living organisms • Explain each stage in drug trialling – explaining placebos and double blind trials **Skills** • Compare references on validity, reliability and bias • Pattern described with reference to both variables • Estimate values of data between known values • Identify simple trends and patterns within data • Giving examples from the data to support patterns and trends seen • Evaluate whether the data is sufficient to decide if the hypothesis is supported. (considering validity) • Calculate a simple percentages • Calculate a percentage increase or decrease	Identify what 'herd immunity' describes and explain how vaccinations can eventually lead to the eradication of a disease Research the development of MRSA – and explain how this links to antibiotic resistance Able to analyse data from a double blind trial and describe the effectiveness of the study Explain why results of drug trials are published in journals – research medical journals and the discovery of certain drugs Create a speech giving scientific facts on vaccination and use persuasive techniques to explain to parents why their children should be vaccinated Research the eradication of smallpox and how vaccination impacted this	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform World Health Organisation website NHS website

Scheme of Work 2020-2021

Subject: GCSE Science: B6: Preventing and Treating Disease

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 1d, 13h and I, 14, 25k and l

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
B6.1 Vaccination	**Aiming for Grade 4 LOs:** • Describe why people are vaccinated. • State that vaccines contain dead or inactive forms of a pathogen. **Aiming for Grade 6 LOs:** • Explain how vaccination works. • Describe what an antibody and an antigen are. **Aiming for Grade 8 LOs:** • Explain why, if a large proportion of the population is vaccinated, the spread of the pathogen is reduced. • Apply ideas about specificity of antibodies.	What is herd immunity? Should you be fined if you do not vaccinate your children? Why do you have to have more vaccinations if you travel abroad?	**Lesson Overview** **Starters** **Vaccination** (5 min) Show the class an image of someone having a vaccination. Ask them what is happening, and ask why people have vaccinations. Ask students to name any vaccinations they have had. **Antigens and antibodies** (10 min) Draw a diagram of a pathogen surrounded by antibodies attached to antigens and ask students to copy it, or provide them with the unlabelled diagram. Then ask them to label and annotate as many key features as they can. **Mains** **How do vaccinations work?** (30 min) Students use information in the student book to create a storyboard to explain how vaccinations work. Students' storyboards should include the following stages in the process of vaccination: • Vaccine contains dead or inactive forms of pathogen.	Class discussion Q & A between students and teachers. Concept map on vaccination Group work on how vaccination works	Learn the Keywords for the topic: Vaccination immunity white blood cell antibodies antibiotic infection resistance disinfectant virus bacteria fungus	SO3 SO9 SP1 SP2 SP5 SP9 C2

			• Vaccine injected into body. • White blood cells produce antibody against pathogen. • (Several years later) live pathogen infects body. • White blood cells make antibody quickly, pathogen is destroyed. Higher-tier students should include information on the specificity of antibodies. **Vaccination** (10 min) Bump up your grade worksheet where students analyse the ethics of vaccination, why people may choose not to have a vaccination, and potential impacts this could have on the wider population in terms of herd immunity. **Plenaries** **Vaccination** (5 min) Use the interactive in which students match key words on the subject of vaccination to their definitions. **Smallpox** (10 min) Tell the class that smallpox is a viral disease that has been eradicated. This was achieved by means of a worldwide vaccination programme. Ask students to read the information on herd immunity in the student book and then write down how this works.		pain killer septicaemia allergy placebo, effectiveness double blind, efficacy toxicity Doddle: Vaccination and medication presentation	
B6.2 Antibiotics and Painkillers	**Aiming for Grade 4 LOs:** • Describe what an antibiotic is. • State that viral infections cannot be treated with antibiotics. • Decide when a painkiller or antibiotic should be used to treat an illness. **Aiming for Grade 6 LOs:** • Describe how antibiotics work. • Describe what is meant by antibiotic-resistant bacteria.	Are you more likely to survive a bacterial infection than a viral one? Are all drugs the same? Is it morally responsible to sell drugs that	**Lesson Overview** **Starters** **Deaths from maternal septicaemia** (10 min) Show students Figure 2 in the student book. Reveal how the graph shows the impact of the introduction of antibiotics on deaths from maternal septicaemia. **Key words** (5 min) Write the words antibiotics, antiseptics, antibodies, analgesics, and disinfectant onto the board. Ask students to suggest what these key words for the lesson mean.	Class discussion on difference between antibiotics and pain killer Q & A between students and teachers. Exam style questions	Doddle: Resistance bacteria presentation	SO3 SO9 SP1 SP2 SP5 SP9 C2

	• Explain why it is difficult to develop drugs to treat viral infections. **Aiming for Grade 8 LOs:** • Suggest a reasoned explanation for a pattern in data. • Explain in detail how antibiotic-resistant bacteria arise. • Explain why scientists are constantly developing new antibiotics.	do not cure you? What can you do to help beat antibiotic resistance?	**Mains** **How do antibiotics work?** (20 min) Explain that antibiotics are drugs used to treat bacterial infections. Ask students to answer a series of questions to find out more: • How do antibiotics work? • Why won't your doctor give you antibiotics for 'flu? • Why is it difficult to treat viral infections? • Why are antibiotics becoming less useful? Students can use the student book to find the answers. **Doctor, doctor** (20 min) Ask students why we use painkillers, and ask them to name some examples. Discuss that painkillers are used to treat the symptoms of a disease, for example, to stop a headache if you have a cold, but they cannot cure the disease. Ask the class to work in groups. Provide each group with patient cards that contain symptoms. Students take part in a role-play exercise where a doctor must prescribe various patients with either antibiotics or paracetamol depending on their symptoms. **Plenaries** **Antibiotic or painkiller?** (5 min) State a list of illnesses, for example, cold, salmonella, measles, gonorrhoea, and migraine. Ask students if they would treat each illness with painkillers or antibiotics.			
B6.3 Discovering Drugs	**Aiming for Grade 4 LOs:** • Name some drugs based on extracts from plants or microorganisms. • Order the events that led to the development of penicillin. • Draw a simple conclusion using data.	Does Fleming deserve the credit for his 'discovery?' Where do drugs come from?	**Lesson Overview** **Starters** **Making connections** (10 min) Show the class images of a willow tree, a foxglove, mould, and a beaver tail. Ask students what these have in common. After a quick discussion, ask them to read the first page of this topic in the student book, then ask for their ideas again. Discuss	Q & A between students and teachers. Exam style questions	Doddle: Monoclonal antibodies presentation	SO3 SO9 SP1 SP2

	Aiming for Grade 6 LOs: • Describe how new antibiotics are tested for effectiveness. • Discuss the advantages and disadvantages of looking for new drugs from living organisms. • Analyse data to draw conclusions on the effectiveness of new antibiotics. **Aiming for Grade 8 LOs:** • Suggest why mould naturally produces antibiotics. • Discuss how effective herbal remedies are. • Analyse data to evaluate the effectiveness of new antibiotics and make a reasoned decision on which one to develop further.	Why is it important to protect our rainforests? Should the government invest more money in discovering new drugs?	that the images all represent sources of substances that modern drugs are based on. **Rainforest problem** (5 min) Show the class an image or video that shows part of a rainforest being destroyed. Ask students to discuss in pairs why this could hinder the search for cures for diseases. **Mains** **The discovery of penicillin** (20 min) Provide pairs of students with cards showing the events/stages in how penicillin was discovered and developed into a useful drug. Students put them into the correct order. Present students with the statement: *If Fleming was a tidier scientist we would not have any antibiotics.* *Ask pairs to write down one argument that supports this statement, and one that refutes it.* **Drug development** (20 min) Students analyse data on the effectiveness of plant and microorganism extracts on the growth of bacteria. They use the data to decide which extract is the best option to go on to the next stage of drug development. **Plenaries** **Matching drugs** (5 min) Call out plants or microorganisms for students to the name of the drug that was developed from it. **Discovering drugs** (10 min) Interactive activity where students match the drug to the plant it was originally extracted from. Students then answer a multiple choice question about the discovery and development of	Mind map on discovery of penicillin Class discussion Exam questions		SP5 SP9 C2
B6.4 Developing Drugs	**Aiming for Grade 4 LOs:** • State that new medical drugs have to be tested to check that they are safe and effective. • Give the procedures used to trial a new drug in the correct order.	The power of your mind – can you really think yourself better?	**Lesson Overview** **Starters**	Q & A between students and teachers	Doddle: Drug development presentation, drug	SO3 SO9 SP1

	• Describe what is meant by a placebo. **Aiming for Grade 6 LOs:** • Explain why each procedure in drugs testing and trialling is used. • Describe how a double blind trial is carried out. • Explain why a placebo is used during drug trialling. **Aiming for Grade 8 LOs:** • Describe in some detail how new medical drugs are tested and trialled for safety, effectiveness, toxicity, efficacy, and dose. • Critically analyse the results from a double blind trial. • Explain why the results of drug trials are published in journals.	Is it right that drug companies make so much money? Should drug testing be nationalised	**Would you volunteer?** (5 min) Ask students who would volunteer to have a new drug tested on them. Discuss why new drugs need to be tested on humans. **Costs of drug development** (10 min) Tell the class that it costs around £1700 million to bring a new medicine from first tests to readiness to be prescribed. Ask students to work in pairs to list as many of the costs that they can think of associated with this process. **Main** **Carrying out a double blind test** (40 min) Discuss that before a new drug is given to the public, it is necessary to ensure that it is safe and effective. Students use information from the student book to create a flow chart that outlines the stages involved in a drug trial, what happens at each stage, and the time and money spent on each stage. Students then work in pairs and carry out a double blind trial to test if a type of exercise can improve memory. Collate the results as a class and discuss what they show. Use the results to talk about what is meant by a double blind test, what placebos are, and where/why these are used in drug trials. **Plenaries** **Check your understanding** (10 min) Students complete the questions at the end of this topic in the student book (not Question 2a). **What happens during a drug trial?** (5 min) Interactive where students decide the correct order for the stages in developing a new drug. They then suggest the words to fill the gaps to complete a paragraph outlining what happens during a double blind trial.	Group discussion between students Mind map on developing new drugs Exam style questions	development quizzes	SP2 SP5 SP9 C2

GCSE Chemistry C14 The Earth's Resources			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
The limitations of Earth's resources	**Knowledge** • Definition of finite, renewable, potable water, life cycle assessment, copper rich ores and low grade ores • Examples of finite and renewable resources • List the stages in creating a life cycle assessment **Understanding** • Analysing changes in the amount of finite sources available • Describe the stages of creating potable water and how these differ around the world • Describe the treatment of waste water and sewage • Evaluate the methods to extract copper from high and low grade ores. • Compare the life cycle assessments of different products such as paper and plastic bags • Evaluate recycling **Skills** • Provide references • Use discrete and continuous data • Identify trends and patterns within results • Critically evaluate sources and synthesis information to draw conclusions	Independently applying the principles learnt in this topic to everyday life and implements reduce, reuse and recycle ideals. Extended scientific writing describing and evaluating the processes of generating potable water, extracting copper or recycling. Independent research on another finite resource and evaluate its use – such as helium. Independent organisation of information into thinking tools or mind maps. Critically evaluate considering validity of claims made in investigations / statistics generated	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: C14 The Earth's Resources

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus:

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
C14.1 Finite and Renewable Resources	**Aiming for Grade 4 LOs:** • List some human uses of the Earth's resources. • Give examples of a finite and a renewable resource. • State an example of a natural product that is supplemented or replaced by agricultural or synthetic products. **Aiming for Grade 6 LOs:** • Describe and classify a resource as finite or renewable when information is given. • Explain the use of natural, sustainable, and finite resources. • Interpret information from different formats including graphs, charts, tables, and prose.	Can the world run out of resources?	**Lesson Overview** **Starters** **What's the connection** (5 minutes) Show students a sheep skin top, a woolly jumper, and a polyester jumper. Ask students to suggest the connection and what they will be studying this lesson. **Sorting resources** (10 minutes) Students use the interactive to sort a list of resources according to whether they are finite or renewable. Then provide students with information about resources in prose format. Students have to interpret the information to identify finite and renewable resources. **Main** **Crude oil timeline** (40 minutes) Explain to students that in some parts of the world crude oil pools on the surface. In the early 1900s this was set on fire, and then the tar-like substance was removed and used as a fuel. The process became industrialised using fractional distillation to	QnA between teachers and students Written responses to questions Class discussion Order of magnitude questions	Doddle: Sustainable use of resources presentation	So3 C3 Sp1 Sp2 Sp9 C5 So7

	Aiming for Grade 8 LOs: • Understand data and interpret information using orders of magnitude to compare. • Explain the role of chemistry in improving agricultural and industrial processes. • Draw conclusions consistent with information provided from graphs, charts, tables, and prose and evaluate the validity of the data.		separate the crude oil into fractions and now the fractions undergo further processing to make polymers that have replaced natural fibres in fabrics. Ask students to research the development of the exploitation of crude oil and how chemists have developed techniques to allow products of crude oil to replace natural renewable resources. Students should make a timeline showing the development, including information about finite, renewable, natural, and synthetic resources. Their timeline should also include how the uses of crude oil have changed over time. **Plenaries** **Orders of magnitude** (5 minutes) Ask students to express the following numbers in standard form: 6 billion, 1800, 805, 100 million. **Fossil fuels** (10 minutes) Ask students to look at the graphs in Figure 2 of Topic C12.1 of the student book and explain what they show. Students should evaluate the usefulness of this data and suggest limits to the predictions.			So3 C3 Sp5 Sp2 Sp9 C5 So7
C14.2 Water Safe to Drink	**Aiming for Grade 4 LOs:** • Describe why potable water is important. • List the key processes to make drinking water. • Safely distill salty water **Aiming for Grade 6 LOs:** • Explain why the method of obtaining potable water depends on the local conditions. • Explain reasons for filtration and sterilisation in water treatment. • Describe and explain in detail how to safely distil salty water.	How can water be made safe to drink in different parts of the world?	**Lesson Overview** **Starters** **Water purification** (10 minutes) Show students a diagram of a simple distillation set-up. Ask students to label the equipment. Then introduce the four methods of water purification from the specification. Students match each method with its description. **Pie chart** (10 minutes) Explain to students that 97% of the water on Earth is in the oceans and seas, with the remaining 3% being fresh water. Ask students to use this data to draw a pie chart. Then ask students to consider how drinking water could be made from the water supplies. **Main** **Analysis and purification of water samples** (40 minutes) Ask students to write an outline method of how to use	QnA between teachers and students Written responses to questions Completed method for practical Class discussion	Doddle: Water distillation animation	

	Aiming for Grade 8 LOs: • Explain the difference between pure water and potable water. • Justify the choice of potable water supply in a given scenario. • Explain in detail why desalination is not often used to generate safe clean drinking water and justify when it is used.		distillation to make pure water from salt water. Then allow students to complete the practical. Higher-tier students should devise and carry out a method to determine the concentration of the original salt solution. **Plenaries** **Making drinking water** (5 minutes) Show students a pictorial flow chart of how drinking water is made in the UK. Ask students to label the key parts of the procedure. **Compare and contrast** (10 minutes) Ask students to complete a three column table with the following headings: Process How it works Potable? The table allows students to compare and contrast distillation, desalination, filtering, and sterilising.			
C14.3 Treating Waste water	**Aiming for Grade 4 LOs:** • List what is removed from waste water before it can be released. • State the main processes in sewage treatment. • State uses of sewage slurry. **Aiming for Grade 6 LOs:** • Explain why waste water should be treated before it is released into the environment. • Describe the main processes in sewage treatment. • Explain uses of sewage slurry.	Is the water safe to drink?	**Lesson Overview** **Starters** **Waste water** (5 minutes) Students order sentences to describe the process of water treatment. They then identify what the water may contain that means it needs to be treated before it can be released into the environment. **How much water do you use?** (10 minutes) Use an online water calculator to calculate how much water each student uses on average. **Mains** **Sewage treatment** (40 minutes) Model water treatment by using 'pond water' made of water, flour, sand, stones, and pond weed. Filter the water, collecting the filtrate, and show how it is still cloudy. Leave the filtrate to stand, then syphon off the water from the top. Treat this water with a water purification tablet. Use question and answer as well as the diagram in the student book to explain the	C8: Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation = 8.2.8, 4.10.1.2, C10.3 QnA between teachers and students Written responses to questions Class discussion	Doddle: AQA Water purification practical quiz AQA Water treatment mini quiz	So3 C8 C3 Sp1 Sp2 Sp9 C5 So7

	Aiming for Grade 8 LOs: • Evaluate the ease of obtaining potable water from waste, ground, or salt water. • Explain in detail how and why waste water is processed before it is released into the environment. • Evaluate the uses of sewage slurry.		processes in water treatment. Then ask students to create a flow chart to explain how waste water is treated. They should include uses of sewage slurry and explain its usefulness. **Plenaries** **Finish the sentences** (5 minutes) Ask students to complete the following sentences: • Waste industrial water contains... • Sedimentation produces... • Anerobic digestion is used... **Questions** (10 minutes) Ask students to write two questions about sewage treatment in the UK, using the student book and specification excerpt to guide them. Then ask students to swap the questions with a partner who should answer them as fully as possible.			
C14.4 Extracting metals from ores	**Aiming for Grade 6 LOs:** • Describe the processes of phytomining and bioleaching. • Write balanced symbol equations to explain metal extraction techniques. • Explain the need for new ways of extracting metals (in particular copper). **Aiming for Grade 8 LOs:** • Explain in detail how phytomining and bioleaching extract metals. • Write ionic equations to explain metal extraction techniques and identify the species being oxidised or reduced. • Evaluate biological methods of metal extraction.	Where do metals come from?	**Lesson Overview** **Starters** **Copper** (5 minutes) Show students images of copper being used, for example, cooking pans, electrical wires, and plumbing supplies. Ask students to suggest the properties of copper. **Malachite** (10 minutes) Allow students to look and feel samples of real malachite. Explain that the main compound in this mineral is copper(II) carbonate and ask students to write the formula for this compound. Explain that typically for metal carbonates it can undergo thermal decomposition. You may wish to show students a simulation of this and then ask students to write an equation for this reaction. **Mains** **Extracting copper from malachite** (40 minutes) Split the class in half. Ask one group to extract the copper from	QnA between teachers and students Written responses to questions Class discussion	Doddle: Extracting metals mini quiz Extracting aluminium animation	So3 C3 Sp1

			malachite using the displacement method and the other group to extract it using the electrolysis method. Whilst the boiling tube is cooling and then the displacement reaction is occurring, students should summarise the extraction process and for each stage they should write an equation. **Plenaries** **Extracting metals** (10 minutes) Students choose the correct words to complete a paragraph on the extraction of copper. They then sort statements according to whether they describe bioleaching or phytomining. **Ambassador for extraction** (10 minutes) Ask students to work in pairs, where each student has used a different method for extraction of copper from malachite. Each student should explain the method they used, whilst the other student takes notes.			Sp2 Sp9 C2 C5 So7
C14.5 Life cycle assessments	**Aiming for Grade 4 LOs:** • State the different stages of an LCA in the correct order. • Carry out an LCA for shopping bags made from plastic or paper with support. **Aiming for Grade 6 LOs:** • Explain the importance of LCA and how it can be misused. • Carry out LCAs for different products when data is supplied.	What is a life cycle assessment and why do they matter?	**Lesson Overview** **Starters** **Life Cycle Assessment** (5 minutes) Show students the stages of the Life Cycle Assessment and ask them to put them in the correct order. **Evaluating shopping bags** (10 minutes) Give each table a selection of shopping bags – different sizes, long-life, reuseable, paper, card, plastic, biodegradable plastic, and so on. Ask each student to choose their favourite bag and justify why. Using question and answer, write a list of things to consider when choosing a shopping bag (e.g., price, size, durability, aesthetics, environmental impact). **Mains** **Paper or plastic?** (40 minutes) Show students a plastic shopping bag and a paper shopping bag. Students complete a simple LCA for each product. Initially, they can	QnA between teachers and students Written responses to questions Class discussion Completion of LCA worksheets	Doddle: Life cycle assessment worksheet How is biodegrable plastic made from corn animation	

	Aiming for Grade 8 LOs: • Explain the limits of LCAs. • Evaluate products in detail using LCAs.		list the inputs and outputs in terms of raw materials, energy, and environmental impacts. Then they should give each factor a subjective rating on a scale of 1 to 10. Students then conclude which is the best bag. Then show students a patient information leaflet from a packet of drugs. Focus on the key sections: what it is, how to take it, expected outcomes, and possible side effects. Ask students to use this as inspiration to make an instruction sheet to explain what an LCA is, how to perform one, and the expected outcomes, and drawbacks to this system of evaluating products. **Plenaries** **Voting for shopping bags** (5 minutes) Collect data from the class to show the LCA values for each bag. Ask students to calculate the mean from the data and decide which bag the class thinks is best. **Evaluating the LCA** (10 minutes) Ask students to evaluate this as a method of determining whether a product should be brought to market. Suggest some ways that the system could be made more robust.			
C14.6 Reduce, reuse and recycle	**Aiming for Grade 4 LOs:** • List some products that can be reused or recycled. • Describe how metal can be reused and recycled. • Describe how glass can be reused and recycled. **Aiming for Grade 6 LOs:** • Explain the importance of reusing and recycling products. • Explain why some recycling can be difficult. • Evaluate ways of reducing the use of limited resources when information is given.	What could we do to reduce our impact on the planet?	**Lesson Overview** **Starters** **Bottled water** (5 minutes) Students use the interactive to identify the definitions of used, reused, and recycle, and then match these key terms to an example relating to bottled water. They then match a piece of packaging with the material it is made of and a common use. **Where does it come from?** (10 minutes) Ask students to make a list of materials that are used on most days of our lives in the UK. Then ask students to briefly state where these materials have come from, for example, wood from trees, copper extracted from ores and purified, glass from sand and recycled. **Mains** **Recycling metals** (40 minutes) Ask students to consider the recycling	QnA between teachers and students Written responses to questions Class discussion	Complete a leaflet informing people of the importance of recycling	

	Aiming for Grade 8 LOs: • Evaluate the environmental, economic, and social impacts of reusing and recycling products. • Evaluate ways of reducing the use of limited resources. • Suggest ways of minimising the environmental impact of exploiting raw materials.		of aluminium drinks cans. Split the class into two groups to prepare for a debate on the motion: 'Aluminium drinks cans should not be recycled'. Each group of students could have an 'expert' with viewpoints that they could question in the debate. Students should develop an expert character such as a research chemist to be used as an expert in the debate to sway the arguments. Give each group a profile of the expert and an overview of their thoughts. Then run the debate. **Plenaries** **Use, reuse, and recycle** (10 minutes) Show students a selection of objects made of different materials, such as a metal drinks can, plastic milk bottle, glass milk bottle, bottle of water, and a can of beans. Using sticky notes, students work in small groups to state what type of material is mainly in the product, which raw materials are needed to make it, and how to reuse/recycle it. **What do you think?** (10 minutes) Ask students to summarise their thoughts on aluminium recycling, justifying their opinion and stating whether they have changed their mind.			So3 C3 Sp1 Sp2 So8 Sp9 C5 So7

GCSE Physics P12 Wave Properties			
What are we learning?	What knowledge, understanding and skills will we gain?	What does excellence look like?	What additional resources are available?
The types of waves and how they behave.	**Knowledge** • List properties of all waves • Know the names of wave types such as transverse, longitudinal, mechanical and electromagnetic. • Identify amplitude, wavelength, compressions, rarefaction, on wave diagrams **Understanding** • Compare the similarities and differences between different types of waves • Relate structure of waves to the energy that is delivered • Apply wave equation to calculate missing values • Construct scientific diagrams to show reflection and refraction and explain these wave behaviours **Skills** • Write a detailed method which clearly identifies variables • Identify causes of uncertainty and calculate this mathematically • Use a model to represent the abstract • Apply mathematical principle of standard form to convert numbers and use standard form in multiplications and divisions.	Detailed comparison of the properties of difference waves and how these relate to their function and behaviour. Detailed topic links to radioactivity and electromagnetic wave topics – sound and light topics from KS3 Confident use of standard form to use very large and very small numbers in equations Manipulation of wave properties find solutions to unseen problems, such as reflection maze, ensuring a signal is reached in a mountainous area. Individual research on how diffraction of waves is overcome to ensure communication services across the nation	BBC Bitesize Doddle – power points and quick quizzes You tube: 'Free science lessons' Seneca learning platform

Scheme of Work 2020-2021

Subject: GCSE Science: P12 Wave Properties

Year Group: 10 /11

Specification: AQA Combined Science Trilogy

Skill focus: 2,5, 15,17 and 25f and g

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
P12.1 The Nature Of Waves	**Aiming for Grade 4 LOs:** • State that waves can transfer energy and information without the transfer of matter. • Identify waves as either transverse or longitudinal. • Identify waves as either mechanical or electromagnetic. **Aiming for Grade 6 LOs:** • Investigate wave motion through a spring model. • Compare transverse and longitudinal waves in terms of direction of vibration and propagation. • Compare electromagnetic and mechanical waves in terms of the need for a medium. **Aiming for Grade 8 LOs:** • Explain the features of a longitudinal wave in terms of	How can we transfer information without matter? Why can we see the sun but we can't hear it? / Does the sun make a noise? What is a sonic boom?	**Lesson Overview** **Starters** **Aftershock value** (5 min) Use video clips of tsunami and recent earthquakes to demonstrate the power of an 'uncontrolled' wave. Point out the regular vibration in earthquakes – shaking buildings and so on. **Wave** (10 min) Ask students to list as many types of wave as possible. Check through a few lists with the class and then ask the students to explain what a wave actually does. Use some of the examples to get them to realise that waves transfer energy but not material. **Main** **Observing mechanical waves** (40 min) Demonstrate mechanical waves in a wire and ripples in water to discuss the movement of particles. This will lead to the students exploring waves in a slinky spring through the practical. Use a light source to discuss electromagnetic waves. The waves act as a pathway to transfer energy (e.g., they can heat surfaces), but they are not transferring material and there are no particles vibrating. Discuss particle behaviour	Q & A, Use of mini white boards, exam style question, Mexican brain wave.	Properties of waves presentation, AQA Waves Practical Quiz, Transverse and Longitudinal Waves Presentation Properties of waves worksheet, investigating waves animation	C1, Sp3,C3

	compressions and rarefactions by using a particle model. • Discuss the features of a transverse wave in terms of particle or field behaviour. • Compare mechanical waves and their particulate nature with electromagnetic waves and their field oscillations.		in springs, ropes, and ripples, ensuring that the students can visualise the movement of the particles clearly. Using the spring model again to discuss particle behaviour in longitudinal waves. Make sure that the students understand that forces are acting between the particles causing these vibrations. **Plenaries** **The same but different** (5 min) Interactive where students match key words from the lesson to their definitions, complete a description of longitudinal and transverse waves, then identify true and false statements about longitudinal and transverse waves. **Mexican brain wave** (10 min) Put the students into three or four rows all seated. Select one student to be the questioner in each row and give them a set of questions and answers about waves. The student asks the first person in the row a question – if they get the answer right, then all of the people who have answered correctly so far stand up, wave, sit down, and the questioner moves on.			
P12.2 The properties of Waves	**Aiming for Grade 4 LOs:** • Identify the wavelength and amplitude of a wave from a simple diagram. • Describe how the frequency of a wave is the number of waves produced each second and is measured in hertz. • Measure the speed of a water wave. **Aiming for Grade 6 LOs:** • Outline the derivation of the wave speed equation. • Calculate the period of a wave from its frequency. • Calculate the wave speed from the frequency and wavelength.	How do we know how much energy has been transferred? Why some are sounds louder than others/ some waves more dangerous than others? How do black holes and neutron stars relate to this topic?	**Lesson Overview** **Starters** **Up to speed** (5 min) Students use the interactive to perform some simple speed calculations to remind them of this work from KS3. Make sure that they are using the correct units for speed, distance, and time. **Spotlight on knowledge** (10 min) Students need to list the properties of light and any other facts that they know about it. They should be able to produce a range of facts from KS3. **Main** **Describing waves** (20 min) Remind students of the basic shape of a transverse wave through a simple demonstration with a rope, and then each of the measureable or identifiable characteristics can be discussed. Particular attention should be paid to the amplitude because this is commonly mislabelled. Continue	Q & A, Use of mini white boards, exam style question, wave taboo.	BBC Bitesize You tube: 'Free science lessons' Seneca learning	C1, Sp3,C3

	Aiming for Grade 8 LOs: • Explain how the wave speed equation can be derived from fundamental principles. • Perform calculations involving rearrangements of the period equation and the wave speed equation. • Perform multi-stage calculations linking period, frequency, wave speed, and wavelength. • Describe the features of neutron stars and black holes.		the analysis by looking at changing the frequency and showing the number of waves passing a fi xed point per second on the rope. The relationship between frequency and period needs to be discussed, and the students should perform an example calculation. **Measuring the speed of ripples** (20 min) The wave speed equation can then be introduced, ideally using a ripple tank. Demonstrate that changing the frequency has an effect on the wavelength whilst the speed stays the same. Model a calculation and then ask students to try their own. The students can then use the ripple tanks to investigate the wave equation. **Plenaries** **Wave taboo (5 min)** Split the students into groups and assign each students a key word (e.g., transverse, longitudinal, reflect, speed) and a list of words they cannot use to describe it. Students take it in turns to describe their key word. How many can the group get in a set time limit? **Kinaesthetic maths challenge (10 min)** Provide students with cards labelled 'wavelength', 'wave speed', 'frequency', '×', and '='. Each card has a number on it too. The students must form themselves into 'living equations' by standing in groups of five to make a correct equation.			
P12.3 Reflection and Refraction	**Aiming for Grade 6 LOs:** • Describe refraction at a boundary in terms of wavefronts. • Describe refraction including the reflected rays. • Explain partial absorption as a decrease in the amplitude of a wave and therefore the energy carried. **Aiming for Grade 8 LOs:** • Use a wavefront model to explain refraction and reflection.	Why do things appear in different places under the water? How to wave breakers protect beaches? Why can't we see around corners but we can hear around them?	**Lesson Overview** **Starter** **It's just a broken pencil (5 min)** Place a pencil in a beaker of water. Can the students produce an explanation of why the pencil looks broken? This is quite difficult – make sure that the students see the effect clearly (show a big photograph on the interactive whiteboard if needed). **Ray diagram (10 min)** Ask students to draw a ray diagram showing how they can see a non-luminous object such as the writing in their books. Make sure that the students are	Q & A, Use of mini white boards, exam style question, wave maze.	BBC Bitesize You tube: 'Free science lessons' Seneca learning	Sp7,Sp2

	• Describe the relationship between the angle of incidence and angle of refraction • Explain refraction in terms of changes in the speed of waves when they move between one medium and another.		using a ruler to draw rays of light and that the rays are reflecting cleanly from the surface. **Main** **Investigating reflection and refraction** (25 min) Demonstrate the operation of the ripple tank focusing on reflection. The students can then introduce the barrier during the practical and find out about the reflection of the wavefronts at different angles. Link this to the simple light reflection experiments that students will have studied in KS3. Some students can also investigate the effect of changing the depth of water in a ripple tank and note the changes in speed of the wavefronts. Students should be able to see that speed changes during the refraction whilst the frequency does not change. **Explaining reflection and refraction** (15 min) Discuss the use of wavefronts and wavelets to explain reflection using a series of diagrams or a simulation. Use simulations or the ripple tank to show the behaviour of wavefronts during refraction, altering the angle of incidence to show the changing effect. **Plenaries** **Reflect or refract?** (10 min) Interactive where students summarise the differences between reflection and refraction. They then identify correct ray diagrams showing reflection and refraction. **Mirror maze** (5 min) Check students' understanding of the law of reflection by asking them to add mirrors to a simple maze diagram so that a light ray can pass through it to the centre.			
P12.4 Move about waves	**Aiming for Grade 4 LOs:** • Measure the speed of a wave in water. • Describe how sound waves travel more quickly in solid than they do in gases. • State that sound waves require a medium to travel in.	How are blue whales able to communicate with each other over such great distances?	**Lesson Overview** **Starters** **Sound facts** (5 min) Give the students a set of 'facts' about sound and let them use traffic light cards to indicate whether they agree (green), don't know (amber), or disagree (red).	Q & A, Use of mini white boards, exam style question, wave taboo. Required Practical assessments,	BBC Bitesize You tube: 'Free science lessons' Seneca learning	Sp7,Sp2

	Aiming for Grade 6 LOs: • Measure the speed of a wave in a solid (string). • Describe the effect that changing the frequency of a wave has on its wavelength in a medium. • Calculate the speed of waves using the wave speed equation. **Aiming for Grade 8 LOs:** • Evaluate the suitability of apparatus for measuring the frequency, wavelength, and speed of waves. • Explain why the wavelength of a wave in a particular medium changes as the frequency changes with reference to the wave equation. • Evaluate data from speed of sound experiments to discuss the range of possible speeds for sound.	How do we know how fast invisible waves are travelling? What is an ultrasound and how does it really work?	**Good vibrations** (10 min) How do different instruments produce sound waves? Students should describe what is going on for five different ways of producing a sound. Demonstrate a drum, guitar, flute or recorder, loudspeaker, and singing. This should show that vibrations are needed to produce sound waves. **Main** **Investigating waves** (40 min) Students should briefly examine the behaviour of sound waves in air and how a medium is required for these waves to travel. They then move on to investigate waves in solids and liquids using the two practical tasks as outlined. The practicals can be carried out simultaneously. The first practical relies on producing stationary waves which allow the wavelength to be measured. Students do not need to know the details of how these form; they only need to measure their wavelength. The second practical uses simple ripples which can be produced with a ruler or with a vibrating bar in a ripple tank. **Plenaries** **Oscilloscope solutions** (5 min) Students use the interactive to match a set of problems encountered when using the oscilloscope to appropriate solutions, for example, a trace where the waves' peaks are too close together – the solution is to reduce the time base. **Let's hear your ideas** (10 min) Students need to design a simple experiment that will show that sound travels faster in solid materials than it does in air. This could be either a basic plan or a more detailed one.	End of module test		