Scheme of Work 2020-2021
Subject: Biology

Year Group: 12 Summer Term 2
Specification: AQA

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
Continued from Summer Term 1 – Lesson 7	Mutations in the number of chromosomes can arise spontaneously by chromosome non-disjunction during meiosis..	• Explain what a non-disjunction event is and how it occurs. Compare and contrast gene and chromosomal mutations	**Learning activities:** • questioning to recall the principles and events of meiosis • teacher explanation of non-disjunction as a mechanism of chromosomal mutations (supported by animation) and how these differ from gene mutations provide data about the likelihood of non-disjunction and how it increases with age. They could draw conclusions and work out the percentage of cells which do not undergo meiosis correctly. **Skills developed by learning activities:** • MS 0.3 – students could calculate the fraction or percentage of cells in which non-disjunction occurs for different ages, when supplied with appropriate data AO1 – development of knowledge and understanding of non-disjunction events during meiosis leading to chromosomal mutations.		sumanasinc.com/webcontent/animations/content/mistakesmeiosis/mistakesmeiosis.swf	C1,C3,Sp2

8 3.4.4 Genetic diversity and adaptation	The concept of genetic diversity. The principles of natural selection in the evolution of populations (including random mutation, reproductive success, inheritance of the beneficial allele and increasing allele frequency in the next generation). Natural selection results in species that are better adapted to their environment. This included anatomical, physiological or	• Explain what is meant by genetic diversity and allele frequency. • Explain the concept of reproductive success. • Explain the principles of natural selection and how selection and adaptation are major factors in evolution and contributing to species diversity. • Apply knowledge to unfamiliar information to explain how selection produces changes within a population of a species.	**Learning activities:** • teacher explanation of the concept of allele frequency and reproductive success • students model natural selection using one of the activities/models (see resources) eg different paperclips to pick up seeds representing Darwin's finches and natural selection on different islands • ask students what each part of the model represented and relate to real life context eg Darwin's finches • extend teacher explanation to explore how adaptation and natural selection are factors in evolution and also ensure a diversity of species • generate a model answer as a class **Skills developed by learning activities:** • AO1 – development of knowledge around natural selection and adaptation, the principles involved in selection and how this is linked to evolution • AO2 – application of knowledge to explain the evolution of a species in an unknown context (using the information provided)..	**Past exam paper material:** BIOL2 Jan 2011 – Q4 BIOL2 Jan 2011 – Q9a – 9d BIOL2 June 2011 – Q2	**Rich question:** How would selective breeding of animals and plants by humans affect genetic diversity? bbsrc.ac.uk/web/FILES/Resources/natural_selection_teachers.pdf nuffieldfoundation.org/practical-biology/model-natural-selection-%E2%80%93-spaghetti-worms nuffieldfoundation.org/practical-biology/simple-model-natural-selection#node-3217	C1,C3,Sp2

	behavioural adaptations					
9	Directional selection, exemplified by antibiotic resistance in bacteria and stabilising selection, exemplified by human birth weights.	• Explain what is meant by directional and stabilising selection. • Identify types of selection from distribution curves. • Interpret data relating to the effect of selection in producing change within populations. • Apply knowledge of types of selection to explain antibiotic resistance and human birth weights.	**Learning activities:** • ask rich question as a stimulus and gauge student responses • introduce the concept of directional and stabilising selection with examples. Link this to the distribution curves for populations subjected each • card sort – give further examples (eg Australian snakes with big heads being able to eat the poisonous Cane toad, resulting in death of those with large heads; fossilised ferns showing little difference to modern day ferns) and ask them whether each indicates stabilising or directional selection • revisit rich question to reassess responses • exam questions. **Skills developed by learning activities:** • AO1 – development of knowledge and understanding of co-transport • AO2/PS 1.2 – apply knowledge of transport processes to explain data and identify the transport process being used • extended exam answers.	**Past exam paper material:** BIOL2 June 2012 Q2 BIOL2 Jan 2011 – Q6 BIOL2 June 2009 – Q3 (except 3b) BIOL2 Jan 2012 – Q5 (except 5c)	**Rich question:** Fossils indicate that crocodiles and sharks have remained relatively unchanged for millions of years. Does this indicate that they are no longer subject to natural selection?	C1,C3,Sp2
10	**Required practical 6:** Use of aseptic techniques	• Explain the basis of working aseptically and the standard techniques for doing so. • Apply knowledge of types of selection to	**Learning activities:** • train students in aseptic techniques and standard procedures eg aseptic transfer and producing a bacterial lawn	Students could undertake the HBI6T ISA P from 2012.	nuffieldfoundation.org/practical-biology/investigating-anti-microbial-action	Sp7,Sp2

	to investigate the effect of anti-microbial substances on microbial growth.	explain antibiotic resistance. • .	• carry out the method to investigate the effect of antimicrobial substances • measure zones of clearing/measure turbidity of broth • interpret data and draw conclusions. **Skills developed by learning activities:** • AT c – use laboratory glassware apparatus to perform serial dilutions of bacteria to perform a count • AT I – use microbiological aseptic techniques, including the use of agar plates or broth • MS 2.5 – students could use a logarithmic scale when dealing with data relating to large numbers of bacteria in a culture • MS 1.3 – present data in tables and graphs • MS 1.9 – students could select and use an appropriate statistical test to find the significance of differences in the effect of different anti-microbial substances on microbial • PS 4.1/AO1 – understand the reasons for working aseptically • AO3 – make judgements and reach conclusions 8.4.2.1, 8.4.2.2, 8.4.2.3 and 8.4.2.4	**Past exam paper material:** BIOL2 June 2013 – Q5 (except 5aii) BIOL2 June 2010 – Q8	nuffieldfoundation.org/practical-biology/aseptic-techniques nuffieldfoundation.org/practical-biology/making-spread-or-%E2%80%98lawn%E2%80%99-plate nuffieldfoundation.org/practical-biology/making-pour-plate nuffieldfoundation.org/sites/default/files/files/effects-of-antiseptics-on-microbes-87(1).pdf survivalrivals.org/the-x-bacteria/about cleapss.org.uk	
11	The concept of a species. Courtship behaviour as a necessary precursor to successful mating. The	• Explain what a species is. • Appreciate the difficulties in defining the term species. • Explain the role of courtship and why it is necessary.	**Learning activities:** • tacher explanation defining what a species is • show videos from the internet showing different animal courtship behaviour eg Wilson's bird of paradise	**Past exam paper material:** BIOL2 June 2009 – Q7 BIOL2 June 2012 – Q6b BIOL2 June 2013 – Q9	**Rich questions:** • Define what a species is. • What is the difficulty in applying this definition to species such as bacteria?	C1,C3,Sp 2

	role of courtship in species recognition..	• Interpret information and data relating to courtship displays. • .	• teacher explanation of the roles that courtship displays can play, with particular emphasis on species recognition • ask students to come up with a list of potential courtship behaviours, in pairs • discuss the principle of behaviour patterns and work through some examples eg the Mallard duck • provide students with exam questions on courtship and ask them to work through them, applying their knowledge and interpreting data. **Skills developed by learning activities:** • AO1 – development of knowledge and understanding of what a species is and the importance of courtship behaviours AO2/AO3 – application of knowledge to interpret information and data about courtship behaviours.	BIOL2 Jan 2010 – Q10 (except 10f) BIOL2 Specimen paper Q8	• If a mutation were to affect the ability of a group of individuals to perform elements of a courtship display correctly, suggest what this would mean for them and why it might be significant in terms of speciation?	
12	Phylogenetic classification is based on evolutionary origins and relationships. The hierarchical nature of classification into taxonomic ranks. The binomial identification	• Explain the hierarchical taxonomic ranks used in the classification of species. • Interpret phylogenetic trees. • Apply knowledge to identify different taxonomic ranks from information provided.	**Learning activities:** • provide students with some pictures eg CD covers and ask them to group them into groups, becoming ever smaller until they reach CD level. Each group is likely to classify in a different way, underlining the difficulty of constructing a valid phylogenetic classification. This could also be done using a selection of nails, screws, paperclips, hair pins, drawing pins etc • introduce hierarchical system used for classification of organisms. Relate to their CD classification • students develop mnemonics to remember hierarchical taxonomic ranks	**Specimen assessment material:** A-level Paper 1 (set 1) – Q6 AS Paper 1 (set 1) – Q5 **Past exam paper material:** BIOL2 June 2009 – Q6a–6c BIOL2 Jan 2012 – Q3	**Rich questions:** Provide information about the classification of different organisms and ask students to fill in the gaps eg determining the genus from the binomial name.	C1,C3,Sp 2

	of species based on its genes and species.		• provide pictures of organisms and ask them to repeat classification exercise • discuss difficulties in constructing phylogenetic classifications based on external features eg fish and dolphins are very different, why anatomical and physiological features are better to use and why modern day classification is still being refined • exam questions. **Skills developed by learning activities:** • AO1 – development of knowledge and understanding of classification AO2 – application of knowledge to the context of particular species, based on binomial name, to identify genus and species.	BIOL2 Jan 2010 – Q2 **Exampro** BYA4 June 2005 – Q5		
13	Advances in immunology and genome sequencing help to clarify evolutionary relationships between organisms.	• Explain how the results of genetic sequencing and immunological analysis can help us to update our understanding of evolutionary relationships. NB details of methods for sequencing are not required. Interpret results from genetic and immunological analysis, to draw valid conclusions as to	**Learning activities:** • show students a phylogenetic tree and ask them questions requiring them to interpret relationships and discuss common ancestors • explain how changes in evolutionary features must have been mirrored by changes in proteins and therefore in DNA • explain how DNA sequencing and immunological analysis can be used to determine how closely related organisms are. Link to the idea that this is refining our idea on classification and leading to reclassification of some species • provide data from these experiments and ask students to interpret them. **Skills developed by learning activities:**	**Past exam paper material:** BIOL2 Jan 2012 – Q6 BIOL2 June 2011 – Q7	**Rich questions:** • Explain why determining the similarity of DNA sequences for common genes is a valid way of determining evolutionary relationships. • Explain why immunological comparisons are a valid way of determining evolutionary relationships. • Explain why these techniques allow us	So5,Sp2 M

		evolutionary relationships between organisms	• AO1 – development of knowledge and understanding of how the results genomic sequencing and immunological techniques can be used to refine our understanding of evolutionary relationships AO2/AO3 – application of knowledge to interpret data and draw conclusions on evolutionary relationships		to classify more accurately than comparing anatomical features.	
14 **3.4.6 Biodiversity within a community**	The concepts of biodiversity, species richness and index of diversity. Calculation of the index of diversity (d). Farming techniques reduce biodiversity. The balance between conservation and farming.	• Explain what is meant by the terms biodiversity, species richness and index of diversity. • Calculate the index of diversity when supplied with relevant information. • Interpret information and draw conclusions from the index of diversity for different habitats. • Explain how farming techniques impact on biodiversity and the reason why these techniques are used Evaluate conservation techniques and why these must be balanced with farming.	**Learning activities:** • teacher led explanation of the concepts of biodiversity, species richness and the index of diversity • worked examples of how to calculate the index of diversity • students could then research farming methods and suggest what the impact of these methods is • teacher led discussion of examples of conservation where a balance has been struck • exam questions. **Skills developed by learning activities:** • MS 1.5/MS 2.3 – students could be given data from random sampling, from which to calculate an index of diversity and interpret the significance of the calculated value of the index • AO1 – development of knowledge and understanding of biodiversity and the impact of farming AO2 – application of knowledge to the context of question to calculate correctly the index of diversity.	**Specimen assessment material:** A-level Paper 1 (set 1) – Q3 AS Paper 2 (set 1) – Q6 AS Paper 2 (set 1) – Q7 **Past exam paper material:** BIOL2 Jan 2013 – Q7 BIOL2 June 2012 – Q7 BIOL2 Jan 2011 – Q5 BIOL2 June 2013 – Q2 BIOL2 June 2011 – Q8 BIOL2 Jan 2010 – Q7	**Rich questions:** • Define what we mean by the terms: biodiversity; species richness; and index of diversity. • Why is the index of diversity a more useful measure than counting the number of species in an area? • Explain some of the ways in which farming causes a reduction in biodiversity. Biological Sciences Review, November 2007. Tropical rainforests: conservation or preservation.	C1,C3,Sp 2

15 **3.4.7 Investigating diversity**	Genetic diversity within, or between species, can be made by comparing the frequency of characteristics, the base sequences of DNA or mRNA, or the amino acid sequences of proteins..	• Explain how the results of DNA hybridisation and biochemical analysis can be used to suggest relationships between different organisms within/between species. • Interpret data obtained from DNA hybridisation or biochemical analysis. • Explain how gene technology has changed the way in which relationships between organisms are worked out. • Evaluate direct DNA/protein sequencing against methods of measuring the frequency of characteristics. NB Details of methods of, for example, DNA hybridisation, are not required.	**Learning activities:** • teacher explanation about the methods for assessing genetic diversity and how this can be applied to allow revision of the classification system and how some organisms relate to each other • work through some data analysis exercises together to assess genetic diversity and the relationships between organisms • exam questions. • . **Skills developed by learning activities:** MS 0.3 – calculate and understand the use MS 1.3 – Interpret tabular data relating to amino acid sequences or DNA hybridisation of different organisms and draw conclusions about the evolutionary relationships between the organisms.	**Past exam paper material:** BIOL2 Jan 2013 – Q3 BIOL2 June 2012 – Q6 (except 6c) BIOL2 Jan 2011 – Q3 BIOL2 June 2013 – Q1 BIOL2 June 2009 – Q8d BIOL2 Jan 2012 – Q6 BIOL2 June 2011 – Q7 BIOL2 June 2010 – Q6 BIOL2 Jan 2010 – Q10f	hhmi.org/biointeractive/creating-phylogenetic-trees-dna-sequences	C1,C3,Sp2
16	Quantitative investigations of variation within a species involve:	• . Explain how random samples can be obtained. • Explain what standard deviation is and how it is calculated. • Represent raw and processed data clearly using tables and graphs. • Interpret data in terms of means and the overlap of standard deviation bars.	**Learning activities:** Students conduct a quantitative investigation into variation eg the effect of light intensity on leaf size. This should include: • research into methods • designing a practical • carrying out (subject to teacher approval) • processing and presentation of data • evaluation and explanation findings • 2011 ISA Paper BIO3T Q.	BIO3T ISA Q11 **Past exam paper material:** BIOL2 Jan 2013 – Q4 BIOL2 Jan 2012 – Q7 BIOL4 June 2010 – Q7a	cleapss.org.uk nuffieldfoundation.org/practical-biology/recording-variation-ivy-leaves	So5,Sp2M

		• Apply knowledge of, to draw and explain conclusions.
		
		Evaluate the quality of results and reliability of conclusions
			Skills developed by learning activities:
			• AT k:
			  • design methods to ensure random sampling
			  • carry out sampling at random within a single population
			  • use sampling at random to investigate the effect of aspect on leaf growth.
			• PS 4.1 – understand how to use sampling techniques
			• PS3.2, MS 1.2, MS 1.6, M.S 1.10 – calculate and interpret mean values and the standard deviation around the mean
			• 8.4.2.1, 8.4.2.2 and 8.4.2.4
			• AO2 – apply knowledge in a practical context
			
			AO3 – analyse, interpret and evaluate scientific information and evidence to make judgements and reach conclusions and design/refine practical design and procedures.			

17	**Y13 CONTENT TO START IF POSSIBLE**	**Y13 CONTENT TO START IF POSSIBLE**	**Y13 CONTENT TO START IF POSSIBLE**	**Y13 CONTENT TO START IF POSSIBLE**	**Y13 CONTENT TO START IF POSSIBLE**	

17 **3.7.4 Populations in ecosystems**	Populations of different species form a community. Within a habitat, a species occupies a niche governed by adaptation to both abiotic and biotic conditions. An ecosystem supports a certain size of population of a species, called the carrying capacity. This population size can vary as a result of: • the effect of abiotic factors interactions between organisms:	• Define the terms community, biotic, abiotic, ecosystem and niche. • Explain what is meant by the carrying capacity of a population, and the biotic and abiotic factors which determine population size. • Explain how some common abiotic factors could be measured. • Explain why no two species have exactly the same niche.	**Learning activities:** • teacher-led explanation of ecosystems, populations and communities • ask pupils to brainstorm factors which could influence population sizes. Accept feedback and categorise into biotic and abiotic factors • do a card sort matching abiotic factors to the instruments/techniques used to measure them (and the units if appropriate) • teacher-led explanation of niches • use a past exam question to work through data to determine an organism's niche • students attempt further exam questions. **Skills developed by learning activities:** • AO1 – development of understanding relating to forms of natural selection and their effect on allele frequencies • AO2/AO3 – application of knowledge to experimentally derived data (in exam questions) MS 0.1 – recognise and use appropriate units for abiotic measurements.	**Past exam paper material**: BIOL4 Jan 2012 – Q1a and Q1c BIOL4 Jan 2012 – Q4 BIOL4 – June 2012 – Q3	**Rich questions:** • Why do no two species have exactly the same niche? • What happens when niches overlap? • Why is it incorrect to say that no two organisms have the same niche? **<u>Flipped learning opportunity</u>** PiXL Independence: Biology – Student Booklet KS5 – Biodiversity and ecosystem	So5,Sp2 M2

	interspecific and intraspecific competition and predation.					

18	The size of a population can be estimated using randomly placed quadrats, or quadrats along a belt transect, for slow-moving or non-motile organisms	• Describe and explain the techniques of sampling at random using quadrats, and systematic sampling using transects. • Explain when it would be appropriate to use each technique. • Describe the different measures of abundance that can be measured. • Explain how sampling at random can be done to avoid bias. Explain how to ensure that estimates and conclusions are reliable.	**Learning activities:** • questioning about what students recall from GCSE • teacher explanation of the basis of sampling, how to conduct random and systematic sampling and how to ensure validity, reliability and eliminate bias • students conduct practical sampling. They should do sampling at random using quadrats and systematic sampling using transects. This could be done on a school field or as part of a field trip. **Skills developed by learning activities:** • AO1/PS 4.1 – development of understanding relating to sampling using quadrats and transects • AO2/AO3 – application of knowledge to experimentally derived data (in exam questions) • AT k – investigate the distribution of organisms in a named habitat using randomly placed frame quadrats, or a belt transect • AT k/MS 0.3 – use both percentage cover and frequency as measures of abundance of a sessile species • MS 0.4 – make estimates of percentage cover • MS 1.6 – calculate mean, median and mode for measured values from sampling • MS 1.5 – understand the principles of sampling • MS 1.7 – use a scatter diagram to identify a correlation between two measured values	**Past exam paper material**: BIOL4 Jan 2012 – Q3a BIOL4 June 2013 – Q7 BIOL4 June 2010 – Q7 BIOL4 Jan 2010 – Q4 BIOL4 Jan 2010 – Q7 BIOL4 June 2014 – Q8c	nuffieldfoundation.org/practical-biology/observing-patterns-distribution-simple-plant nuffieldfoundation.org/practical-biology/biodiversity-your-backyard	So5,Sp2 M2

			from a belt transect eg light intensity and percentage cover of Dog's mercury • MS 1.9 – select and use an appropriate statistical test PS 1.2/2.1 – understand how to design experiments to avoid bias and ensure a large enough sample size.			

19	The size of a population can be estimated using the mark-release-recapture method for motile organisms. The assumptions made when using the mark-release-recapture method.	• Explain the technique of mark-release-recapture and when it would be appropriate to use this technique. • Use given data to calculate the size of a population estimated using the mark-release-recapture method. • Explain why careful consideration must be given to the method used to mark animals. Explain the assumptions which must be made during mark-release-recapture.	**Learning activities:** • teacher led explanation of mark-release recapture technique, the ethical issues surrounding marking, and the assumptions/limitations of the technique • students conduct practical sampling using humane animal traps. Care should be taken not to harm the animals. This could be done on a school field or as part of a field trip • alternatively, the technique could be modelled using matchsticks, or sweets. Sample 10 matchsticks and mark them, then reintroduce back into the box and shake well. Resample 20 matchsticks and perform calculation as population estimate. Repeat using a different colour mark. Then count matchsticks to gauge accuracy of estimate • exam questions. **Skills developed by learning activities:** • AO1 – development of understanding relating to mark-release-recapture, the ethical issues surrounding it, and its assumptions/limitations • AO2 – application of knowledge, using given data to calculate population estimates • AT k/AT h – use the mark-release-recapture method to investigate the abundance of a motile species MS 2.3/2.4 – substitute numerical values into the mark-release-recapture equation to solve the equation.	**Specimen assessment material**: A-level Paper 3 (set 1) – Q1 **Past exam paper material**: BIOL4 June 2012 – Q1b BIOL4 June 2013 – Q4a and 4c BIOL4 June 2010 – Q2 Questions from BIO6T Q14	**Rich questions:** • Why might it be inappropriate to put a brightly coloured mark on an animal? • Predict the effect on the accuracy of your estimate if: a) some marks were to rub off prior to recapture b) the second sample is conducted within an hour of release. • Assuming that the technique is done correctly, why might all individuals still not be equally catchable? • Could mark-release-recapture be used to sample humans? Explain your answer. cleapss.org.uk	So5,Sp2 M2

20 **Required practical 12:** Investigation into the effect of a named environmental factor on the distribution of a given species.	• Propose a null hypothesis to test. • Design an experiment to investigate the effect of a named factor on the distribution of a given species, taking into account the need for data to be reliable. • Suggest what you will do for variables which cannot be controlled. • Represent raw	**Learning activities:** students design an experiment to investigate the effect of a named variable on the distribution of a given plant/animal species eg light intensity of the percentage cover of Dog's mercury as you move away from a tree. This could include: • researching a method • designing an experiment and risk assessing • carrying out (subject to teacher approval) – this could be done in school or as part of a field trip • processing and presentation of data • calculation and interpretation of statistical tests • conclusion and evaluation. **Skills developed by learning activities:** • AT a and k – use appropriate apparatus and sampling techniques in fieldwork • PS 1.1/1.2/2.4 – apply scientific knowledge to design a sampling	**Learning activities:** students design an experiment to investigate the effect of a named variable on the distribution of a given plant/animal species eg light intensity of the percentage cover of Dog's mercury as you move away from a tree. This could include: • researching a method • designing an experiment and risk assessing • carrying out (subject to teacher approval) – this could be done in school or as part of a field trip • processing and presentation of data • calculation and interpretation of statistical tests • conclusion and evaluation. **Skills developed by learning activities:** • AT a and k – use appropriate apparatus and sampling techniques in fieldwork • PS 1.1/1.2/2.4 – apply scientific knowledge to design a sampling investigation, identifying key variables • PS 2.2/PS 3.1/ MS 1.7 – plot the experimental data on a scatter graph • MS 1.6 – calculate mean, median or mode for measured values from sampling • MS 1.9 – use an appropriate statistical test • MS 1.4 – understand simple probability • AO1/AO2 – application of knowledge to explain trends 8.4.2.1/8.4.2.2/8.4.2.3/8.4.2.4/8.4.2.5.	Marking of experimental write-up	cleapss.org.uk	Sp7,Sp2

	and processed data clearly using tables and graphs. • Select and use an appropriate statistical test and interpret the P value that results in terms of probability and chance. • Apply knowledge to draw and explain conclusions.	investigation, identifying key variables • PS 2.2/PS 3.1/ MS 1.7 – plot the experimental data on a scatter graph • MS 1.6 – calculate mean, median or mode for measured values from sampling • MS 1.9 – use an appropriate statistical test • MS 1.4 – understand simple probability • AO1/AO2 – application of knowledge to explain trends 8.4.2.1/8.4.2.2/8.4.2.3/8.4.2.4/8.4.2.5.				

21	Primary succession from pioneer species to climax community. At each stage, certain species may be recognised which change the environment so that it becomes more suitable for other species. The new species may change the environment in such a way that it becomes less suitable for the previous species. Changes that organisms produce in their abiotic environment can result in a less hostile	• Explain what succession is. • Explain how succession causes changes to ecosystems over time. • Explain the impact of environmental changes on biodiversity. • Apply knowledge to unfamiliar contexts.	**Learning activities:** • look at a family tree of royal family and the succession to the throne. Ask students to define the word • provide students with some plant species cards (eg mosses, lichens and algae, shallow rooted grasses, deep rooted shrubs, rowan trees and oak trees), and some facts cards with information about each species. Ask them to try and put the cards in order of succession from pioneer species to climax community, with reasons • teacher led explanation with examples • group discussion about data showing biomass, species diversity and primary production during succession • exam questions. **Skills developed by learning activities:** • AO1 – development of understanding relating to succession • AO2/AO3 – application of knowledge to unfamiliar contexts and experimentally derived data • AT i – students could use turbidity measurements to investigate the growth rate of a broth culture of microorganisms • MS 2.5 – students could use logarithmic scale in representing the growth of a population of microorganisms extended exam answers.	**Past exam paper material**: BIOL4 Jan 2012 – Q3b BIOL4 Jan 2013 – Q4a and 4b BIOL4 June 2012 – Q1 BIOL4 June 2013 – Q2 BIOL4 Jan 2011 – Q8a BIOL4 Jan 2010 – Q6 BIOL4 June 2014 – Q3a-3b	geowords.org/ensci/imagesbook/04_03_succession.swf **Rich question:** Why does succession begin with a pioneer species?	So5,Sp2 M2

	environment and change biodiversity.					
22	Conservation of habitats frequently involves management of succession	• Use their knowledge and understanding to present scientific arguments and ideas relating to the conservation of species and habitats. • Evaluate evidence and data concerning issues relating to the conservation of species and habitats and consider conflicting evidence. Know that management of succession can involve preventing succession occurring to maintain a desired community.	**Learning activities:** • provide students with materials/web pages regarding conservation of habitat projects. Ask them what they have in common (all managing succession) • teacher led explanation of why conservation frequently involves managing succession • students should be given evidence (some of which should be conflicting) about conservation of habitats, and discuss the relative arguments • provide students with the role of presenting to the environment agency for funding to manage succession. They should present a reasoned, evidence-based case • exam question. **Skills developed by learning activities:** • AO1 – development of understanding relating to conservation and succession management AO2/AO3 – application of knowledge to, and interpretation of, scientific data and evidence to form reasoned arguments.	**paper material**: BIOL4 June 2010 – Q5 **Exampro:** BYA5 Jan 2003 – Q9d BYA5 Jan 2004 – Q2 BYB4 June 2005 – Q4 BYB6 June 2005 – Q2a BYB6 Jan 2005 – Q2 BYB6 Jan – 2004 Q7c.	beep.ac.uk/content/415.0.html rspb.org.uk/ourwork/conservation/advice/wetscrub/managing.aspx **Rich questions:** • What is conservation? • Why does conservation often involve managing succession?	So5,Sp2 M2