Zig Zag Education

Biology

GCSE (9–1) | OCR A | J247

Learning Grids

For GCSE (9–1) OCR A Biology

Gateway Science

Topics 4–6: Community Level Systems; Genes, Inheritance and Selection; Global Challenges

Update v1.1, November 2018

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Contents

Teacher's Introduction

These learning grids are designed to help your students independently learn content and will help you to assess their knowledge during teaching of each section of **Sections B4–B6 – Community Level Systems; Genes, Inheritance and Selection; Global Challenges** within the **OCR GCSE Paper 2 Biology** specification. The concept is that your students are assigned a set of pages to read from the relevant book and are then asked to complete the relevant learning grids, possibly for homework or as a refresher for a topic. These activities are particularly useful for students who need more support, but they also contain some thought-provoking reasoning questions which will stimulate highly engaged students.

Each learning grid is closely linked to the OCR 2016 specification and to the approved textbooks. Relevant textbook page numbers are provided at the top of each worksheet, to allow easy cross-referencing.

This resource directly references:

OCR Gateway – GCSE Biology Locke 2016, Oxford University Press
OCR Gateway – GCSE Biology (9–1), Beeby and Pilling 2016, Collins

Each learning grid contains a range of question styles, including:

- **Quick-testing questions** – these may be a phrase, a definition or a numeric response.
- **Labelling questions** – designed to introduce structural and anatomical concepts to the student
- **Missing-information/Match-terms-to-definitions questions** – test key knowledge quickly.
- **Explain-a-process questions** – encourage students to recognise cause and effect in Biological processes.
- **Applied knowledge questions** – challenge students to apply knowledge in unfamiliar situations.
- **Experiment Time** – asks students to analyse a practical, interpret its results and recognise strengths and weaknesses.
- **Quick Quiz** at the end of each topic assesses understanding and can be used to confirm students are ready to move on to the next topic.

Learning grids in this section will on average take 20–30 minutes each. However, this resource includes opportunities to develop mathematics skills, and students who find maths challenging may find that these pages take longer to complete.

These resources can be used to engage students and allow those who have missed lessons to catch up quickly. They can be the basis for a homework exercise, and the answer scheme allows them to be easily used in cover lessons. Students could also use the sheets as an independent learning and revision resource.

All resources can be photocopied into black and white.

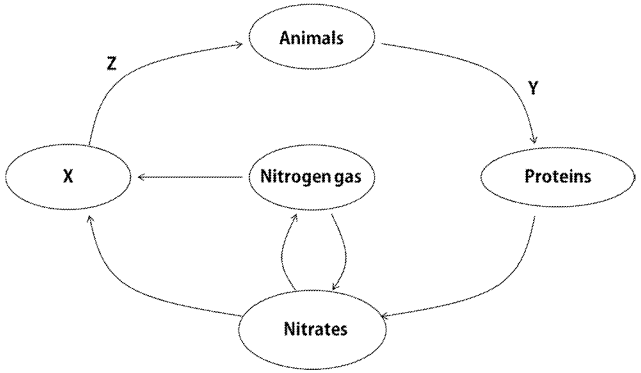
We hope you and your students enjoy this resource!

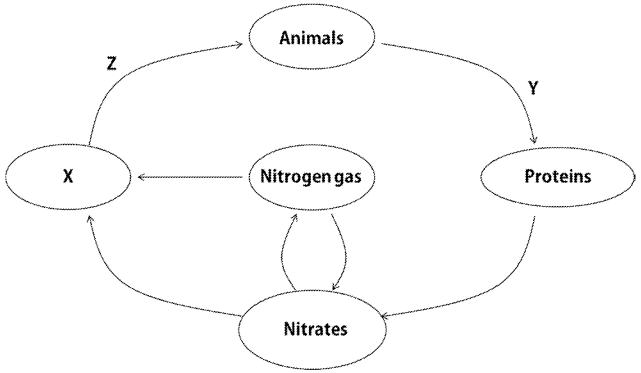
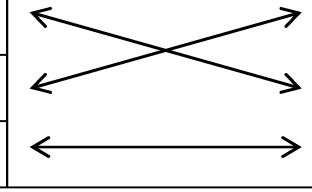
Update v1.1, November 2018

- Added practical skills question on sampling, p. 4
- Added Quick Quiz question on energy efficiency of meat-eating/plant-based diets, p. 10
- Added Experiment Time section covering decomposition, p. 11
- Added Experiment Time section covering microscopy and root nodules, p. 12
- Added Quick Quiz question on sex determination and mutually independent events, p. 21
- Added two questions to cover the Broadbalk experiments at Rothamsted Research facility, p. 41
- Added question on implications of GM for food security, p. 44
- Changed wording and answer to question on immune response to viruses, p. 55
- Changed incorrect answer regarding the meaning of the word 'preclinical', p. 62
- Changed question on potential benefits of the human genome project to make more difficult, p. 67

Selected Question and Answer Pages

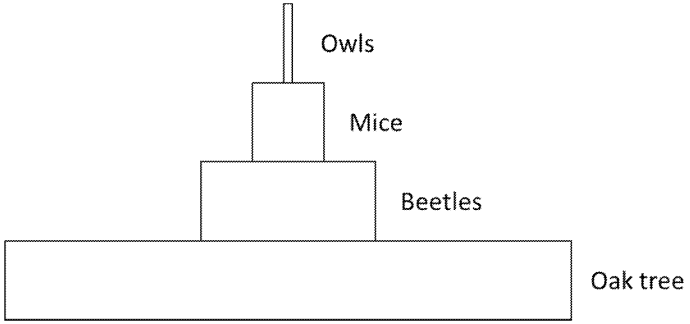
For demonstration only, the sample answer pages immediately
follow their corresponding question pages

	Questions	Answers
4.1a-4.1d Material Cycling (continued)	**The diagram below shows a simple nitrogen cycle.** **Identify the organisms or processes represented by X, Y and Z.**  	
	A chemical spill leads to the death of bacteria in the soil in an area. **How might this affect the amount of plant growth in the region?**	
	What is the importance of the water cycle?	
	Connect these terms about changes in the state of water with their definitions:	**Evaporate** — **Change from clouds to rain/snow** **Precipitate** — **Change from liquid to gas** **Condensate** — **Change from gas to liquid**
	Why is the removal of salt from water essential in desert environments?	

	Questions	Answers
4.1a-4.1d Material Cycling (continued)	**The diagram below shows a simple nitrogen cycle.** **Identify the organisms or processes represented by X, Y and Z.**  	X = Plants Y = Excretion/Death/Decomposition Z = Feeding
	A chemical spill leads to the death of bacteria in the soil in an area. **How might this affect the amount of plant growth in the region?**	Plants will grow more slowly, or maybe not at all, as the amount of available nitrates will be reduced.
	What is the importance of the water cycle?	Water is needed for all processes of life, and is a limited resource on Earth. If water were not cycled, it would not be used by the organisms that need it, and life could not exist.
	Connect these terms about changes in the state of water with their definitions:	**Evaporate** **Precipitate** **Condensate** 
	Why is the removal of salt from water essential in desert environments?	Desert environments have little (or no) water t removal of salt from seawater is needed in ord

	Questions	Answers
4.1h-j Trophic Levels and Energy Transfer (continued)	**How does a decomposer gain nutrients?**	
	Construct a pyramid of biomass to represent a food chain containing: ***Owls, Beetles, Oak tree, Mice***	
	Explain why the biomass of organisms is decreased through trophic levels.	
	What effect does your answer to the question above normally have on the number of organisms at each level?	
	Algae in a rock pool weighs 2000 g. Winkles consume the algae – their combined mass is 400 g. **Calculate the percentage biomass lost between these trophic levels.**	
	An aphid ingests a large amount of glucose from an oak tree. **Why isn't all of this glucose available to the higher trophic levels?**	
	A racehorse needs to consume more plant biomass than a wild horse. Explain why this is the case.	

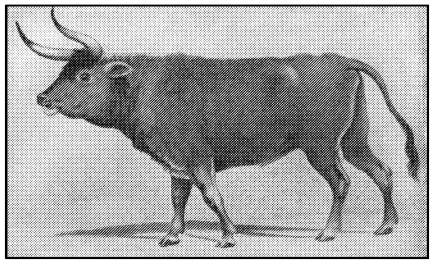
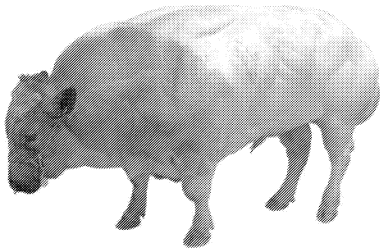
4.1h-j Trophic Levels and Energy Transfer (continued)

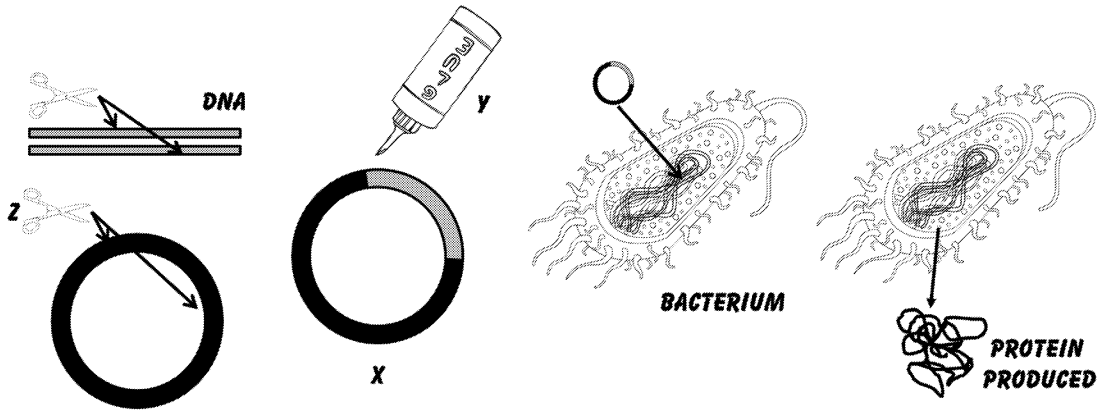
Questions	Answers
How does a decomposer gain nutrients?	Secretes enzymes onto dead and decaying organisms; soluble food molecules then diffuse into the decomposer.
Construct a pyramid of biomass to represent a food chain containing: ***Owls, Beetles, Oak tree, Mice***	
Explain why the biomass of organisms is decreased through trophic levels.	Energy is lost at each trophic level by excretion, heat, respiration. Not enough energy to pass on to next trophic level.
What effect does your answer to the question above normally have on the number of organisms at each level?	Fewer organisms at each trophic level, as there is less energy available.
Algae in a rock pool weighs 2000 g. Winkles consume the algae – their combined mass is 400 g. **Calculate the percentage biomass lost between these trophic levels.**	Percentage loss = $\frac{\text{Mass before – mass after}}{\text{mass before}} \times 100$ 2000 – 400 = 1600 $\frac{1600}{2000} \times 100 = 80\ \%$
An aphid ingests a large amount of glucose from an oak tree. **Why isn't all of this glucose available to the higher trophic levels?**	It is used by the aphids for respiration.
A racehorse needs to consume more plant biomass than a wild horse. Explain why this is the case.	The racehorse uses a lot more energy and, th power its muscles.

	Questions	Answers
6.3w-x – Future of medicine	Fill in the gaps in this description of gene therapy:	It is hoped that gene therapy will be able to treat many different types of _____. By using gene technology, the _____ in a cell are changed, either to attack a cell type in the body or to produce a _____ that is needed within the body in order to treat a disease. Diseases that have been _____ can sometimes be treated with gene therapy by inserting a normal version of an _____ into cells. Some difficulties face gene therapy, including correctly _____ the therapy, and making the results of the therapy last long enough.
	Identify one ethical objection to gene therapy.	
	Identify which of the following are potential benefits of using the human genome project in medicine: • Identifying the location of disease-linked genes • Developing drugs to target particular genes • Developing gene therapy • Developing personalised medicine	
	Put these steps for gene therapy in the correct order: • Many copies of the healthy allele are produced • Virus used to carry gene • The diseased gene is cut from DNA • Gene inserted into DNA	
	Suggest a possible difficulty in using gene therapy.	

	Questions	Answers
6.3w-x – Future of medicine	**Fill in the gaps in this description of gene therapy:**	**It is hoped that gene therapy will be able to treat many different types of disease. By using gene technology, the genes in a cell are changed, either to attack a cell type in the body or to produce a protein that is needed within the body in order to treat a disease. Diseases that have been inherited can sometimes be treated with gene therapy by inserting a normal version of an allele into cells.** **Some difficulties face gene therapy, including correctly targeting the therapy, and making the results of the therapy last long enough.**
	Identify one ethical objection to gene therapy.	• Religious objection to changing DNA • Not well understood and can cause unforeseen effects • Can be used to change embryos, which might be against human rights • Other valid ethical reason
	Identify which of the following are potential benefits of using the human genome project in medicine: • **Identifying the location of disease-linked genes** • **Developing drugs to target particular genes** • **Developing gene therapy** • **Developing personalised medicine**	All of these are potential benefits.
	Put these steps for gene therapy in the correct order: • **Many copies of the healthy allele are produced** • **Virus used to carry gene** • **The diseased gene is cut from DNA** • **Gene inserted into DNA**	• The diseased gene is cut from DNA • Many copies of the healthy allele are produced • Virus used to carry gene • Gene inserted into DNA
	Suggest a possible difficulty in using gene therapy.	• Unable to target allele to particular cells • Unable to direct where the healthy allele is inserted • Treatment might be short-lived

Additional Selected Question Pages

	Questions	Answers
6.2c Selective breeding	**Define 'selective breeding'.**	
	Consider these two pictures of cows – the first, an ancestral cow (aged 15), and the second, a modern beef cow (aged 2):   **How has selective breeding changed the cow?**	
	True or false? Artificial selection is only seen in a small number of organisms in the population.	
	A crop is found to grow twice as quickly with much less water. **How can this crop be used in selective breeding?**	
	The Broadbalk experiments at Rothamsted Research facility have tested the effects of artificially crossing different varieties of wheat, as well as using different fertilisers and crop rotation patterns. **What qualities might researchers want to breed for in wheat plants?**	
	Why was an area of the Rothamsted farm grown without using fertiliser or new wheat varieties?	

	Questions	Answers
6.2d-e Genetic engineering	What is 'genetic engineering'?	
	Desert animals have many genes that enable them to cope with very little water. What benefit might engineering plants with these genes present?	
	Explain how bacteria can be genetically engineered to treat diseases.	
	(HT only) The figure on the right shows some of the main steps in the process of genetic engineering. Identify the factors labelled X, Y and Z.	

	Questions		Answers
6.2d-e Genetic engineering (continued)	HT	Why are bacteria often used for genetic engineering over animal cells?	
	HT	Fill in the gaps in this description of the genetic engineering process:	Using _____, a target gene is cut from the donor DNA molecule. The _____ enzyme leaves _____ on the DNA – sites of single-stranded DNA that stick to other DNA molecules. The cut out DNA is inserted into a _____, being glued together with a _____ enzyme. The vector is inserted into _____, along with a gene for _____ resistance. When treated with _____, only the bacteria carrying the new gene will survive – all others will be killed.

	Questions	Answers
6.2f-g Debating use of biological techniques	Fill in the gaps to complete this description of biological techniques:	When genes are inserted into the DNA of another organism, that organism is said to be _____. An example is golden rice. In this example, the _____ that codes for β-carotene is inserted into rice. This produces a rice crop that produces rice with a _____ β-carotene content. β-carotene is used by our bodies to make _____. Another example is soya. Genes for herbicide resistance have been inserted into soya. This means a farmer can apply _____ to a crop, and the soya will be unaffected. This reduces _____ in the crop.
	Why is it advantageous to a farmer to engineer a gene for insecticide into a plant crop?	
	List two objections that people might have to using gene technology in agriculture.	
	Gene technologies are estimated to have caused a 30 % increase in the yield of soybeans, per km^2 of land. Many of these soybeans are used to produce feed for a growing global population of farmed pigs. Using this information, explain why gene technologies <u>may</u> or <u>may not</u> lead to increased food security.	