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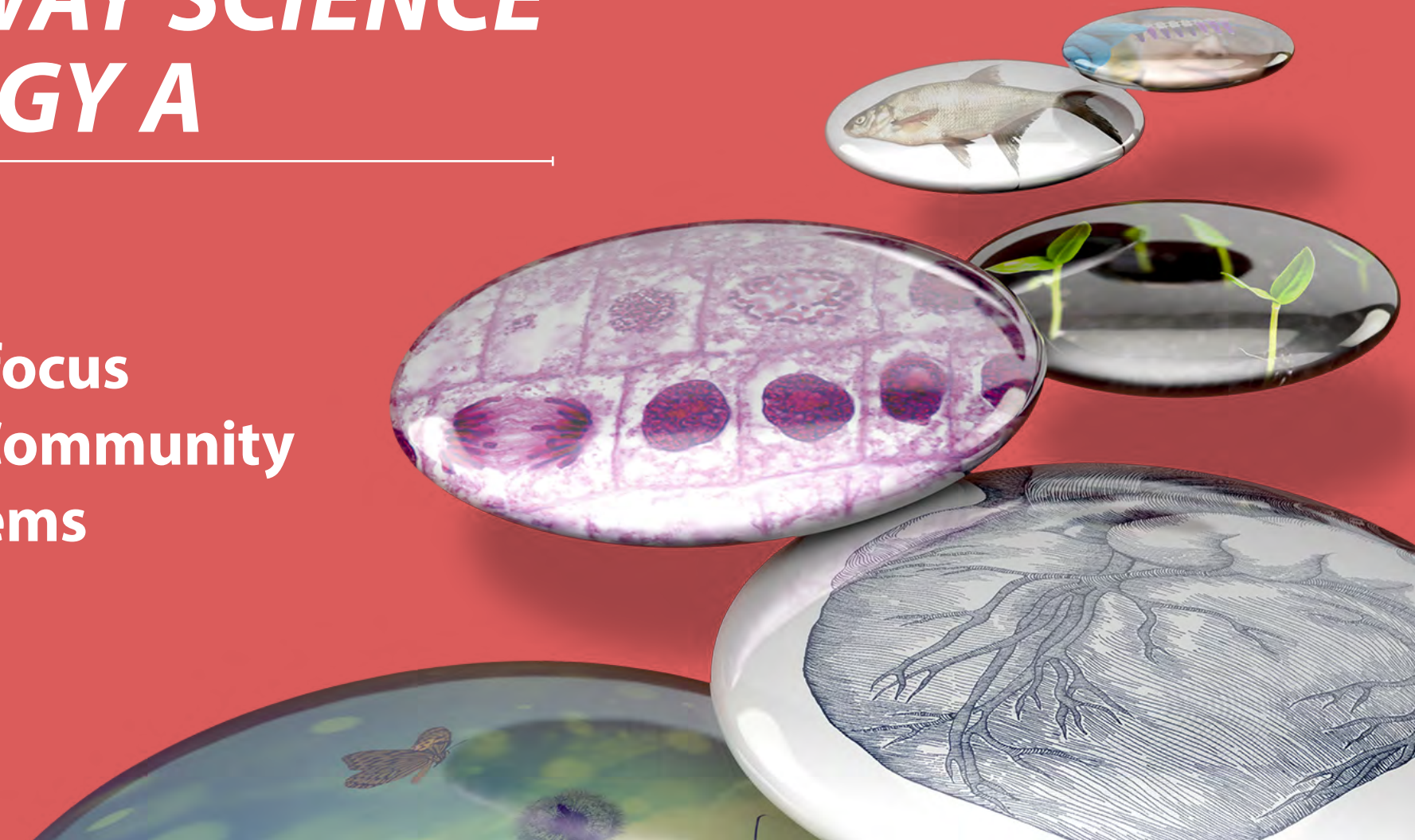
GCSE (9–1)
Transition Guide

GATEWAY SCIENCE BIOLOGY A

J247
For first teaching in 2016

KS3–KS4 focus
Topic B4 Community level systems

Version 1



www.ocr.org.uk/biology

GCSE (9–1)

GATEWAY SCIENCE BIOLOGY A

Key Stage 3 to 4 Transition guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 3 which will help prepare students for progression to Key Stage 4;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 3 and 4 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 3 and assess their 'readiness for progression' to Key Stage 4 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 3 teaching of the topic or by Key Stage 4 teachers to establish their students' conceptual starting point.

Key Stage 3 to 4 Transition Guides are written by experts with experience of teaching at both key stages.

Key Stage 3 Content

- The interdependence of organisms in an ecosystem, including food webs
- How organisms affect, and are affected by, their environment
- The variation between species and between individuals of the same species means some organisms compete more successfully

Key Stage 4 Content

B4.1a - recall that many different materials cycle through the abiotic and biotic components of an ecosystem

B4.1b - explain the role of microorganisms in the cycling of materials through an ecosystem

B4.1c - explain the importance of the carbon cycle and the water cycle to living organisms

B4.1d - explain the effect of factors such as temperature, water content, and oxygen availability on rate of decomposition

B4.1e - describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem

B4.1f - explain how abiotic and biotic factors can affect communities

B4.1g - describe the importance of interdependence and competition in a community

B4.1h - describe the differences between the trophic levels of organisms within an ecosystem

B4.1i - describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels

B4.1j - calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of trophic levels in a food chain

Comment

Difference between the level of demand and KS3 and KS4

Learners should be familiar with food chains, simple food webs, pyramids of numbers and be able to explain the affects removing an organism from a food web at Key Stage 3. At Key Stage 4 this area is built upon by using more complex food webs and interactions between organisms, such as predation, mutualism and parasitism as well as between organisms and abiotic factors in a community. Learners must also be able to describe pyramids of biomass, how biomass is lost at each trophic level and calculating the efficiency of biomass transfers.

The cycling of materials e.g. carbon and nitrogen is likely to be a new concept to learners at Key Stage 4. Although learners should know different parts of each cycle such as photosynthesis, respiration and the basic idea of decomposition, they are likely to have thought about these processes as separate processes independent of each other. The delivery of this at Key Stage 4 should pull these pieces of knowledge together to show how organisms and processes in an ecosystem are interdependent, particularly how microorganisms play a vital role in the continuous cycling of materials.

Common misconceptions:

- Learners often find it easier to explain the consequences on a food web if producers are removed more than if a top predator is removed.
- Learners commonly believe the energy/biomass flow arrows are there to show what animal eats what animal.
- Some learners think that organisms higher in a food web eat everything that is lower in the food web.
- Some may also interpret food webs as being linear, unconnected food chains, with the start of each food chain being prey, not a producer.

To combat this start with basic, small webs with animals they will know e.g. animals living in a forest habitat, then build up. For some classes teachers could read learners 'The Gruffalo' and ask learners to write down the food chains and webs from the story. This can be followed by a discussion about the food chains and webs they wrote and how and why they wrote/drew them the way they did.

Movement of energy can be shown easily by having some learners line up at the front of the class each holding the name of an organism in a food chain. The teacher acts as the sun and passes a large piece of yellow poster paper to the producer telling learners it is energy from the sun. At each stage the learner keeps most of the paper using the energy to grow etc. rips off a piece of the paper and passes it to the next stage as they get eaten. This makes it easier for learners to visualise the movement of energy along the food chain in the direction of the arrows.

- Some learners will believe that varying the size of a population of some species may not affect an ecosystem because some organisms are not important and often think of an ecosystem not functioning as a whole, but simply a collection of organisms who co-exist by 'getting along' with each other.
- A large number of learners will believe predator and prey populations are similar in size
- Many learners believe decomposers release energy that is cycled back to plants rather than them breaking down dead organisms, returning nutrients to the soil so they can be used by the plants.
- Many learners will confuse the terms community and population. Keywords and definitions placed around the classroom in addition to quick quizzes/ games/starters covering the variety of keywords in this topic would be very useful for learners.

Activities

Food chains and food webs: Stem Mom
Resources: http://www.stemmom.org/2012/10/food-chain-activity-worm-unit.html

A set of animal pictures and keywords to print out. Instructions on how to use these cards in different ways from grouping them, making simple food chains and building up links between food chains making a food web.

Food chains for lower ability: Sheppard Software.com
Resources: http://www.sheppardsoftware.com/content/animals/kidscorner/games/foodchaingame.htm

An interactive drag and drop activity making food chains in different habitats. Very good consolidation for lower ability learners.

Interactions within a food web: Ecoshools.org
Resources: http://www.eco-schools.org.uk/assetlibraryfiles/ecoschools_foodweb_ks2_353.doc

A lesson plan to deliver the topic food webs. In particular, the role play instructions on building a food web with wool linking learners/organisms can be very good to show how the removal of one organism affects numerous other organisms either directly or indirectly.

Pyramids: TES
Resources: https://www.tes.com/teaching-resource/pyramids-of-number-and-biomass-6071333

A worksheet that can be used to introduce pyramids of numbers and if teachers want to stretch higher ability learners, pyramids of biomass.

Checkpoint task

The checkpoint task consists of four sections:

- Food chains and food webs - The task sheet for lower ability learners has a more structured framework of questions to support their explanation of how the removal of one organism from a food web affects others.
- Pyramids of numbers - Lower ability learners match the pyramid of numbers to the correct food chain. Higher ability learners draw pyramids of numbers for three given food chains.
- Factors affecting population size - learners complete a concept map with factors that affect population sizes in an ecosystem.
- Toxins in the food chain - Learners complete a cut and stick activity showing the stages of bioaccumulation of pesticides in a food chain.

Learners can work through the tasks independently or in pairs at the end of the topic to check understanding or at the beginning of the B4 topic at Key Stage 4 to aid planning and delivery of subsequent B4 lessons. The task may also be broken up into four separate tasks and completed after the relevant topic area has been delivered

The tasks could also be completed as a carousel of activities placed around the classroom. Learners move from task to task, answers being recorded in their books or on an answer sheet.

Teacher preparation

If completing the tasks independently on the worksheet, teachers will need to photocopy one task sheet per learner.

If learners are to complete the checkpoint task as a carousel of activities, teachers will need to copy and paste the diagrams and questions for each activity to make instruction cards to place around the classroom and/or answer sheets for learners.

If learners are completing the tasks independently, they require only the task sheet most suitable to their ability.

If learners are completing the tasks as part of a carousel, the teacher may want to split the class into four groups, each group starting at a different activity. Learners work individually or in pairs on that activity for a given amount of time e.g. 5 minutes before moving clockwise to the next activity.

It may be useful to have a short task on the classroom whiteboard for learners to complete if they finish any the activities before the given time is up.

Answers to the task sheets can be found on the teacher sheets.

Checkpoint Task:

www.ocr.org.uk/Images/338625-community-level-systems-checkpoint-task-activity.doc

Activities

The Carbon cycle: National Ocean Service
http://oceanservice.noaa.gov/education/pd/climate/teachingclimate/carbon_cycle_game.pdf

A choice of three activities to show the cycling of carbon in the environment between the atmosphere, plants, animals, soil, oceans and fossil fuels. Learners either become a carbon atom and visit stations around the classroom dependent on the throw of a die or play a board game with a similar theme.

The Nitrogen cycle: TES
https://www.tes.com/teaching-resource/nitrogen-cycle-construction-activity-6131470

A card activity to be played in groups of three or four. Learners describe their information cards to others in the group and use the blank nitrogen cycle template to sketch out a nitrogen cycle. There are two versions of the information cards to allow for differentiation within the class.

Interdependence and competition: National Geographic
http://education.nationalgeographic.org/activity/ecological-relationships/

A lesson plan including activities, video clips and discussions focussing on how species interact with one another in a marine ecosystem. The terms symbiosis, mutualism, parasitism and commensalism are introduced and examples of each discussed as a class.

Abiotic and biotic factors: PBSLearning
http://www.pbslearningmedia.org/asset/lsps07_int_ecosystem/

An interactive animation great for lower ability learners to consolidate/check understanding of which parts of given ecosystem are biotic or abiotic.

Predator prey relationships: Wolf Quest
http://www.wolfquest.org/pdfs/Deer%20Me%20Lesson.pdf

A game involving throwing 'wolf' cards onto a table 'forest' to catch deer. . Numbers of predators and prey caught over numerous 'years' can be plotted as a graph to show the changes in population sizes over time.

Activities

Decomposers in different ecosystems

Learners could be given the name of a particular ecosystem e.g. forest, Arctic, lake etc. and research the decomposers (both micro-organisms and larger organisms) found in that ecosystem. Learners then do a 'meet and greet' where they move around the classroom, explaining what they have found to the first learner they meet and vice versa then move on to another learner etc.

Energy in a food chain

Learners could write an argument for or against the statement 'Humans should become vegetarian so that farmers only grow crops'. Specific references need to be made to energy efficiency in the food chain in their argument.

Interdependence

Give learners a habitat and have them design two organisms from the same trophic level that live in similar niches within that habitat. Learners must explain similarities and differences in the niches e.g. predators, food sources, nesting, time of activity etc. They must also include what they think will happen over time to the size of the two populations - the more similar the niches, the more chance one species will out-compete the other. The more differences between the two niches, the more likely they will both survive. Learners may pair share their drawings and information with other learners.

Resources, links and support

Science Spotlight – Our termly update Science Spotlight provides useful information and helps to support our Science teaching community. Science Spotlight is designed to keep you up-to-date with Science here at OCR, as well as to share information, news and resources. Each issue is packed full with a series of exciting articles across the whole range of our Science qualifications: www.ocr.org.uk/qualifications/by-subject/science/science-spotlight/

Find resources and qualification information through our science page: www.ocr.org.uk/qualifications/bysubject/science/

Contact the team: science@ocr.org.uk

Continue the discussion on the science community forum: http://social.ocr.org.uk/

and follow us on Twitter, @ocr_science

To find out more about GCSE and A Level reform please visit: http://www.ocr.org.uk/qualifications/gcse-and-a-level-reform

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