

## IGCSE Co-ordinated Sciences 0654

### Unit 8: Organisms and environment

#### Recommended Prior Knowledge

Students should know about photosynthesis, and have an understanding of the concept of energy transfer.

#### Context

This Unit covers Topics B16 and B17. It brings together ideas from many other areas of the syllabus, including several Chemistry Topics, especially C10 and C11 which link with the nitrogen cycle; the production of sulphur dioxide from fossil fuels in C14; and the uses of chemicals from plants in C3, extraction of metal ores from the Earth in C4, the use of petrochemicals in C3 and the use of alternative energy resources in P18.

#### Outline

The Unit begins by looking at some fundamental ecological concepts and terminology. Various effects of humans on the environment are considered, and how these can be reduced or ameliorated.

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
B16	Know that an ecosystem is the habitat and the community considered together.	Take students outside to look at an ecosystem in the school grounds or nearby; for example a pond, the edge of a playing field. They can search for animals and plants in the habitat, and learn their names; this is an opportunity to revise the construction and the use of identification keys.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 159
	Know that organisms are adapted to their environment.	If possible, use animals and plants that live in the ecosystem studied. Assign different organisms to each group, and ask them to list at least five adaptations and how they help the organism to survive.	Examples of adaptations of animals <a href="http://www.students.dsu.edu">http://www.students.dsu.edu</a>
		They can try designing an organism adapted to live in an extreme environment – e.g. on Mars.	

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	<p>Know that the growth of a population of organisms may be limited by environmental factors such as food supply or predation.</p> <p><b>Be able to interpret population growth curves with respect to one or more limiting environmental factors.</b></p>	<p>Provide a scenario, for example rabbits introduced to a small grassy island where there are no predators; ask pupils to predict what might happen to their population over time and why.</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 166–168</p> <p>Clear description of some limiting factors and their effects on populations:  <a href="http://www.nhptv.org">http://www.nhptv.org</a></p> <p>More examples of factors limiting population growth:  <a href="http://homestudy.ihea.com">http://homestudy.ihea.com</a></p>
	<p>Understand that energy enters an ecosystem in sunlight, which is transferred to energy in plants by photosynthesis and that this energy is then passed along food chains.</p> <p>Know the role of producers, consumers and decomposers in food chains and webs.</p>	<p>Pupils can construct food chains relating to the ecosystem they have visited.</p> <p>If pupils are already very familiar with food chains, they might enjoy researching the very unusual food chains associated with deep sea vents (black smokers).</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 160–162</p> <p>An animation of a food web amongst fresh water organisms in the Amazon, including detritivores:  <a href="http://earth.rice.edu">http://earth.rice.edu</a></p>
	<p>Understand that energy losses occur along a food chain.</p> <p><b>Be able to interpret pyramids of numbers and biomass and relate these to the loss of energy along food chains.</b></p>	<p>Pool the food chains suggested in the previous activity. Ask students to sketch pyramids of biomass for each one.</p>	<p>Trophic pyramids and food webs  <a href="http://www.geog.ouc.bc.ca/physgeog/contents/9ohtml">http://www.geog.ouc.bc.ca/physgeog/contents/9ohtml</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 161–162</p>
	<p><b>Be able to discuss the advantages of eating plant products rather than animal products, in terms of the</b></p>	<p>Ask the class for a quick list of ideas relating to eating plant or animal products. Use the ideas to draw up a concept map, or use them as the basis of</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 162</p>

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	<b>amounts of energy available in a food chain.</b>	a debate on the topic 'Should we eat animals?'	
B17	<p>Understand the carbon cycle.</p> <p>Understand how deforestation and the burning of fossil fuels can increase the amount of carbon dioxide in the atmosphere and appreciate that this may lead to global warming.</p> <p>Understand the nitrogen cycle, including nitrogen fixation, the importance of soil nitrates and denitrification and why farmers may use nitrogen fertilisers.</p> <p><b>Be able to discuss the advantages and disadvantages of using nitrogen fertilisers.</b></p> <p><b>Understand how leaching of excess nitrogen fertilisers may damage aquatic ecosystems and suggest alternatives to the use of nitrogen fertilisers.</b></p> <p>Understand the water cycle and how it may be affected by deforestation.</p>	<p>Provide pupils with two sets of cards, plus several arrows cut from card. The first set contains names of places where carbon is found (e.g. carbon in trees, carbon dioxide in the air) and the second set contains processes (respiration, combustion and so on). Provide a large flat space, and ask students to arrange them into a carbon cycle. (It may be helpful to have some spare, blank cards which they can add to their cycle.)</p> <p>Use questioning to build up a nitrogen cycle with the involvement of the whole class. For example, ask: In what form is nitrogen in the air? How do farmers add nitrogen to the soil? Where do plants get their nitrogen from? What do they need it for? and so on. Students should already have some knowledge from their chemistry work.</p> <p>Provide data on changes in the quantity of nitrogen fertilisers used worldwide; pupils can plot graphs and discuss the implications of the increases.</p>	<p>An excellent downloadable booklet for 15–16 year olds covering many aspects of air pollution:  <a href="http://www.ace.mmu.ac.uk/">http://www.ace.mmu.ac.uk/</a>  Find and download the booklet headed 'Air Pollution'.</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 163</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 163–164, 176–177</p> <p>Information about the classic experiments carried out at Rothamsted into the effects of fertiliser use on crop yield:  <a href="http://www.rothamsted.ac.uk">http://www.rothamsted.ac.uk</a></p> <p>Data about the use of nitrogen fertilisers:  <a href="http://www.defra.gov.uk">www.defra.gov.uk</a>  Data about the use of nitrogen fertilisers</p> <p>The water cycle:  <a href="http://www.k12.stmos.washington.edu/k12/pilot/water_cycle/grabber2.html">http://www.k12.stmos.washington.edu/k12/pilot/water_cycle/grabber2.html</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones</p>

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	<p>Appreciate that farmers may need to use pesticides but that this may endanger other living organisms.</p> <p><b>Be able to discuss the advantages and disadvantages of using pesticides.</b></p> <p><b>Know the harmful effects of one pesticide on other living organisms and be able to discuss alternative methods of pest control, with reference to one example.</b></p> <p>Know that sulphur dioxide is produced by burning fossil fuels.</p> <p>Understand the harmful effects of sulphur dioxide on living organisms, including the effects of acid rain.</p> <p>Appreciate the need to conserve endangered species and their natural habitats.</p>	<p>Pupils could use the internet to research the debate on the use of DDT for mosquito control. Ask some groups to take the side of the WHO (keep using it) and others to take the stance of the WWF (stop using it) and debate the issues involved. They should come to understand that there are no neat answers to these questions.</p> <p>They could also research one example of biological control, trying to find one that has worked (e.g. nematode worms to destroy slugs in European gardens) and one that has gone wrong (e.g. cane toads in Australia).</p> <p>Provide students with data relating to an air pollution incident and associated respiratory problems and deaths; ask them how the two appear to be linked.</p> <p>Ask a person working locally in some form of conservation activity to talk to the class about their work.</p>	<p>G page 165, 175–176</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 178–179</p> <p>A very accessible description of the problems caused by the introduction of cane toads into Australia as a form of biological control:  <a href="http://www.fdrproject.org/pages/toads.htm">http://www.fdrproject.org/pages/toads.htm</a></p> <p>Data relating to the Great London Smog:  <a href="http://www.ace.mmu.ac.uk">http://www.ace.mmu.ac.uk</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 173–174</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 179</p>