UNIT 9: Organisms and Environment

Recommended Prior Knowledge: Students should have knowledge of photosynthesis and respiration, and understand something of energy transfers. They should know the elements from which biological molecules are made, in order to understand nutrient cycles.

Context: This Unit brings together ideas from several earlier Units and lays the foundations for Unit 10.

Outline: It is hoped that students will be able to visit a local habitat, even if only in the school grounds, during this Unit. The Unit begins with the naming and classification of living organisms, with some thought being given to their adaptations to their environment. Keys are used to help to identify them. The flow of energy and cycling of nutrients through ecosystems is covered. This Unit sets the scene for a consideration of how human activities can affect ecosystems, in Unit 10.

	Learning Outcomes	Suggested Teaching Activities	Online Resources	Other resources
I 2	Define and describe the *binomial system* of naming species.	Students will probably already know a few binomials, such as Homo sapiens, and this makes a good starting point for discussing why Latin names are used and how they are constructed. Take care that the name of the genus is always given a capital letter, and that of the species a lower case letter.		
I 2	Classify the five main classes of vertebrates using visible, external characteristic features only.	Photographs or specimens of the five groups of vertebrates can be used to illustrate their external features. Students could be given a blank chart to complete, observing and recording for themselves relevant features for each group, such as body covering. A definitive table can then be built up from their observations.	Species diversity http://www.seaworld.org/infobooks/Biodiversity/speciesbio.html Photographs and descriptions of a range of mammals, reptiles, amphibians and fish.	
I 2	List the main features used in the classification of the following groups: flowering plants (monocotyledons and dicotyledons), arthropods (insects, crustaceans, arachnids and myriapods), annelids, nematodes and molluscs, using visible, external characteristic features only.	A similar approach can be taken here. All of these organisms, with the exception of nematodes, can be easily observed in almost any habitat. It is excellent if students can observe them within an ecosystem, and not just as pictures or preserved specimens. Students should be able to describe features that are characteristic of all arthropods, and also those that distinguish each of the four arthropod	Monocots vs.dicots http://www.csdl.tamu.edu/FLORA/201Manhart/mono.vs.di/monosvsdi.html Understanding arthropod classification and identification http://members.aol.com/YESedu/arthrocl.html	

		groups listed. This is also an excellent opportunity to consider how particular animals are adapted to their environment. Adaptations of plants to different environments have already been considered in Unit 3, so it would be sensible to concentrate on animal adaptations here.	Introduction to the annelida http://www.ucmp.berkeley.edu/annelida/annelida.html	
I 2	List the main features used in the classification of the following groups: viruses, bacteria, fungi, and their adaptation to the environment, as appropriate.	Viruses and bacteria are too small for students to be able to examine real specimens, so they will need to use photographs and diagrams. Fungi, however, are easily visible. Note that here all features that enable the classification of these groups are required, not just externally visible ones.	The Virtual Virus Experience http://library.thinkquest.org/13373/intro/intro.htm	
I 3	Use simple dichotomous keys based on easily identifiable features.	Teachers will need to devise or select simple keys that can be used to identify a range of specimens available to students. It is strongly recommended that this is done with living specimens within a habitat that the students can visit - for example, identifying trees in the school grounds, using keys to their leaves. Extension students could also try devising dichotomous keys of their own.		
IV 1	State that the Sun is the principal source of energy input to biological systems. Describe the non-cyclical nature of energy flow.	Having looked at the range of different types of organisms that live in a habitat, students now consider the relationships between them. The concept of energy is not an easy one, and students who have not met with it in either physics or chemistry courses will need an opportunity to think about what it means. Photosynthesis and respiration have already been dealt with, so what is needed here is a link to be made between the two,		

		plus the idea that animals obtain energy-rich nutrients from plants.		
IV 2	Define the following: *food chain; food web; producer; consumer, herbivore, carnivore, decomposer; ecosystem, trophic level*	If students have an opportunity to visit a habitat, even if only in the school grounds, then they should be able to construct food chains and food webs for themselves. Emphasise that the arrows in a food chain represent the direction of energy flow. Definitions of each of these terms can be built up once students are comfortable with the concept of food chains.		
IV 2	Describe energy losses between trophic levels and the advantages of short food chains. Describe and interpret pyramids of biomass, numbers and energy.	Students who have studied physics may already understand that energy transfers are never 100% efficient, and that some energy is always lost as heat when energy is transferred from one form to another. They will best understand the concept if encouraged to think about a particular example, such as energy transfer from grass in a field and cattle that are eating it. Once energy losses are understood, it should become apparent that food chains cannot go on for ever. Pyramids of numbers, biomass and energy can be drawn for particular food chains or webs. Students can think of them as a kind of graph, in which the areas of the boxes represent values for whatever is being plotted. The concepts being dealt with here are not easy for most students to comprehend, and adequate time should be allocated to ensure that they are not rushed in absorbing these ideas.	Trophic pyramids and food webs http://www.geog.ouc.bc.ca/physgeog/contents/9o.html	
IV 2	Recognise that there is an increased	Extension students can now take the ideas		

	efficiency in supplying green plants as human food and that there is relative inefficiency, in terms of energy loss, of feeding crop plants to animals.	of energy flow and losses between trophic levels a little further, and think of their implications for human populations. They may also like to consider why, if it is inefficient in terms of energy, so many human populations use animals for food.		
IV 3	Describe the water cycle.	This is likely to be revision for many students. The roles of trees and other plants in returning water vapour to the air, through transpiration, should be emphasised.	The water cycle http://wwwk12.atmos.washington.edu/k12/pilot/water_cycle/grabber2.html	
IV 3	Describe the carbon cycle.	Rather than simply presenting students with a complete diagram of a carbon cycle, it can be very useful to build it up together. They will know enough of photosynthesis, respiration and combustion to be able to think of most of the steps that should be included.		
IV 3	Discuss the effects of combustion of fossil fuels and cutting down of forests on the balance between oxygen and carbon dioxide.	Human influences on the carbon cycle are now considered. Fossil fuels and trees contain huge amounts of carbon, and when burnt this is released into the air. Students will probably already be aware that increased amounts of carbon dioxide in the atmosphere are likely to lead to global warming. Take care to avoid confusion between this and the damage to the ozone layer - a common source of confusion.		
IV 3	Describe the nitrogen cycle in terms of the role of micro-organisms in providing usable nitrogen-containing substances by decomposition and by nitrogen fixation in roots; the absorption of these substances by plants and their conversion to protein, followed by passage through food chains, death, decay and the return of nitrogen to the soil or the atmosphere (Names of	The nitrogen cycle is considerably more difficult for students to understand than the carbon cycle. It is important that they understand the different forms in which nitrogen occurs – as nitrogen gas in the air, nitrate ions in the soil and proteins in animals and plants. They also need to realise that nitrogen gas is unreactive, and must be converted to something more reactive before plants can make use of it.		

	individual bacteria are not required).	Avoid using the term 'nitrogen' alone, always specifying the particular compound that is being discussed.		