

**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. It also consolidates knowledge of photosynthesis and the topics on respiration and excretion. The seasons should be considered when teaching this unit as It may be appropriate to teach it immediately after Unit 3 when work on food chains and webs can be investigated outside.

**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 can begin with a review of the naming and classification of living organisms studied in Unit 1 although some teachers may prefer to teach Unit 1, Section 1 I and 2 before food chains and food webs at the beginning of this unit. with some thought being given to their adaptations to their environment. . 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	Resources
IV 1	Relationships of organisms with one another and their environment. Energy flow <ul style="list-style-type: none"> <li>State that the Sun is the principal source of energy input to biological systems.</li> <li>Describe the non-cyclical nature of energy flow.</li> </ul>	Having looked at the range of different types of organisms that live in different habitats, students now consider the relationships between them. The concept of energy is not an easy one, and students who are not studying physics or chemistry will need an opportunity to discuss what it means. There is an important link to be made between photosynthesis and respiration including the concept that animals obtain energy-rich nutrients from plants. Section 2 in this unit. All organisms directly or indirectly get their energy from the Sun. Energy given out by organisms is lost to the environment.	
IV 2	Food chains and food webs Define the terms: <ul style="list-style-type: none"> <li><i>food chain</i> as a chart showing the flow of energy (food) from one organism to the next, beginning with a producer e.g. mahogany tree → caterpillar → song bird → hawk</li> </ul>	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. The Sun should not be included in a food chain or food web. Emphasise that the arrows in a food chain represent the direction of energy flow, towards the eater. Definitions of each of these terms can be built up once students are comfortable with the concept of food chains.	Past exam papers can give students practice with question on food webs.

	Learning Outcomes	Suggested Teaching Activities	Resources
IV 2	<ul style="list-style-type: none"> <li>• <i>food web</i> as a network of interconnected food chains showing the energy flow through part of an ecosystem</li> <li>• <i>producer</i> as an organism that makes its own organic nutrients, usually using energy from sunlight through photosynthesis</li> <li>• <i>consumer</i> as an organism that gets its energy by feeding on other organisms</li> <li>• <i>herbivore</i> as an animal that gets its energy by eating plants</li> <li>•</li> <li>• <i>carnivore</i> as an animal that gets its energy by eating other animals</li> <li>• <i>decomposer</i> as an organism that gets its energy from dead or waste organic matter</li> <li>• <i>ecosystem</i> as a unit containing all of the organisms and their environment, interacting together, in a given area e.g. decomposing log or lake</li> <li>• <i>trophic level</i> as the position of an organism in a food chain, food web or pyramid of biomass, numbers or energy.</li> </ul>		

	Learning Outcomes	Suggested Teaching Activities	Resources
IV 2	<ul style="list-style-type: none"> <li>Describe energy losses between trophic levels</li> <li>Draw, describe and interpret pyramids of biomass and numbers.</li> </ul> <p>Supplement</p> <ul style="list-style-type: none"> <li>Explain why food chains usually have fewer than five trophic levels</li> <li>Explain why there is an increased efficiency in supplying green plants as human food and that there is a relative inefficiency, in terms of energy loss, in feeding crop plants to animals.</li> </ul>	<p>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.</p> <p>To understand the concept of heat lost from food chains and webs, students should discuss a particular example, such as energy transfer from grass in a field and cattle that are eating it.</p> <p>Once energy losses are understood, it should become apparent that food chains cannot go on for ever.</p> <p>Pyramids of numbers, biomass and energy can be drawn for a particular food chain or web.</p> <p>Students can think of them as a kind of graph, in which the areas of the boxes represent values for whatever is being plotted.</p> <p>Students can understand that producers have the largest numbers and access to a field, wood will illustrate this.</p> <p>Pyramids of numbers should be drawn with accurate horizontal bars.</p> <p>Exceptions should be shown, a single tree for example.</p> <p>Pyramids of biomass represent the amount of living material.</p> <p>Emphasise that short food chains are more efficient in providing energy to the top consumer. Emphasise that approximately 90% of energy is lost to the environment between each trophic level.</p> <p>Students studying the supplement can now take the ideas of energy flow and losses between trophic levels a little further, and think of their implications for human populations.</p> <p>Some farmers keep their animals in pens to restrict the loss of energy from the animals.</p> <p>Students could consider why, if it is inefficient in terms of energy, that so many human populations use animals for food. Links with Unit 2 and Unit 8 III.3.6.</p>	