

Organisms and their environment revision notes

Organisms do not live alone. They depend on energy from the Sun and on each other for food. This topic looks at how energy flows through ecosystems along food chains and food webs, how carbon is cycled, and what populations, communities and ecosystems are.

For Cambridge IGCSE Combined Science 0653. **Supplement** is Extended content, only examined on Papers 2 and 4.

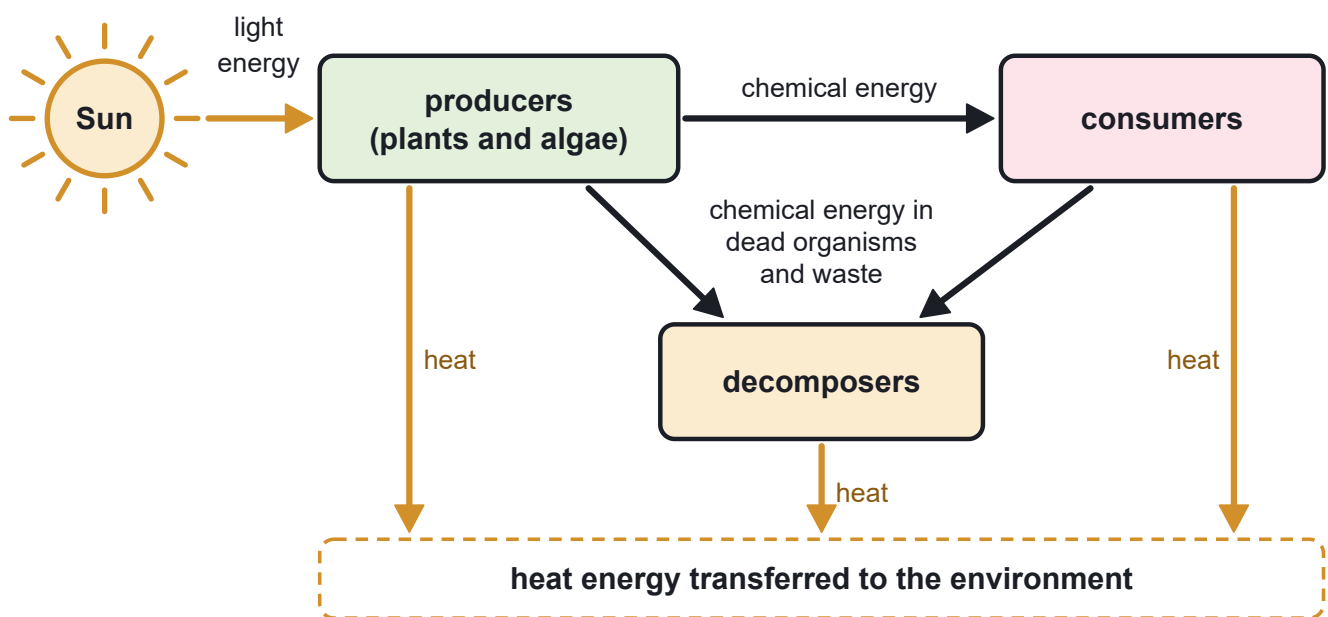
1 Energy flow, food chains and food webs Spec B15.1, B15.2

Energy flow Spec B15.1.1, B15.1.2

The **Sun** is the principal source of energy input to biological systems. Without light from the Sun there would be almost no energy entering living things.

Energy does not go round in a cycle. It **flows through** living organisms in one direction and is eventually transferred to the environment.

1. Light energy from the Sun is absorbed by green plants and algae. They transfer it to **chemical energy** in organic nutrients (such as glucose) by photosynthesis.
2. Chemical energy passes to animals when they eat plants, and to other animals when they eat those animals.
3. Chemical energy passes to decomposers when they feed on dead organisms and waste.
4. At every stage, organisms transfer energy by respiration. Much of it is eventually transferred to the environment as **heat**.



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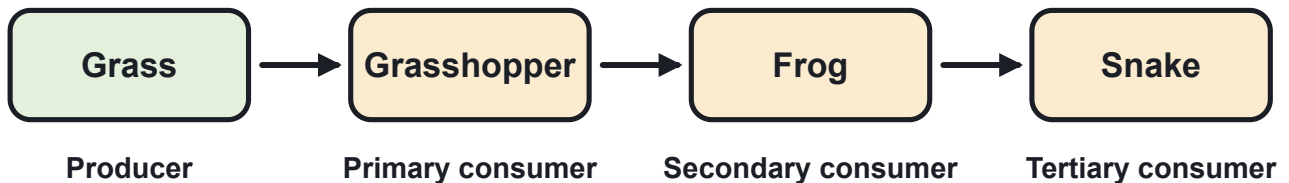
Energy **flows in one direction** through organisms and is not recycled: it ends up as heat in the environment.

Exam tip: Name the forms of energy: light energy from the Sun, chemical energy in organisms, and heat lost to the environment. Do not say that energy is 'used up' or 'destroyed'.

Food chains and food webs Spec B15.2.1, B15.2.2, B15.2.3, B15.2.10

Food chain	Shows the transfer of energy from one organism to the next, beginning with a producer.
Food web	A network of interconnected food chains.

In a **food chain** the arrows show the **transfer of energy**. Each arrow points from the organism that is eaten to the organism that eats it. The chain always begins with a producer.



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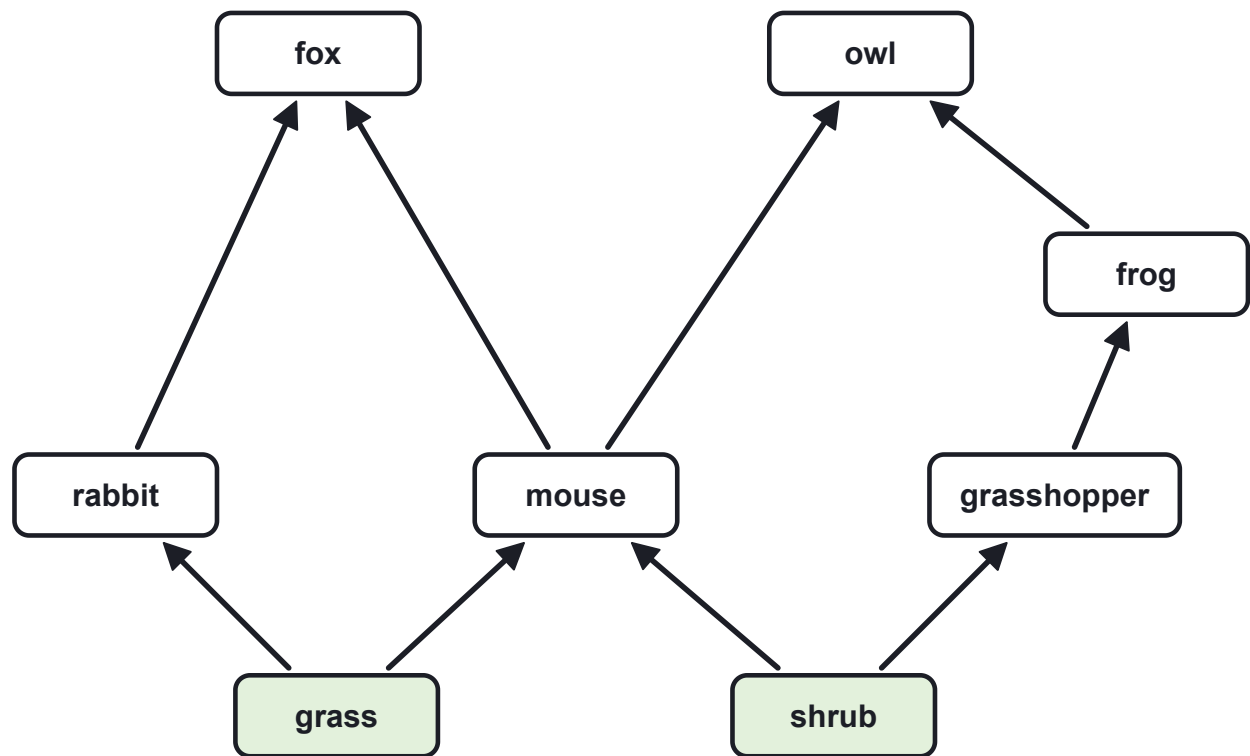
A food chain. The arrows show the **transfer of energy** from each organism to the one that eats it.

Common mistake: Arrows point from the food to the feeder. Grass → rabbit means the rabbit eats the grass and energy passes to the rabbit.

Food webs

Most organisms eat more than one type of food, and are eaten by more than one type of predator. A **food web** shows these links as a network of interconnected food chains.

To interpret a food web, trace each food chain from a producer, following the arrows. You can then say what an organism eats, what eats it, and what might happen if one population changes.



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A food web. Arrows point from the food to the feeder. The owl is a secondary consumer when it eats mice and a tertiary consumer when it eats frogs.

Supplement

Human impact on food chains and food webs

Supplement

Food chains and food webs can be used to describe the impact humans have on an ecosystem.

Supplement

- **Overharvesting** of a food species, such as overfishing, reduces the population of that species. Predators that feed on it have less food, so their populations may fall. Species that the harvested species eats may increase in number.
- **Introducing foreign species** to a habitat adds a new organism to the food web. It may eat native species, so their numbers fall, or compete with them for food, so those species have less food and their populations fall.

Supplement

Exam tip: For 'what happens if' questions, work along the arrows. Say what happens to the organisms that eat it (less food) and to those it eats (fewer eaten, so more of them). Mention that effects can be indirect.

Producers, consumers and decomposers Spec B15.2.4, B15.2.5, B15.2.6, B15.2.7, B15.2.8, B15.2.9

Producer	An organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis.
Consumer	An organism that gets its energy by feeding on other organisms.
Herbivore	An animal that gets its energy by eating plants.
Carnivore	An animal that gets its energy by eating other animals.
Decomposer	An organism that gets its energy from dead or waste organic material.

Consumers are classed by their position in a food chain.

Classes of consumer		
Class	What it eats	Example
Primary consumer	Producers (so it is a herbivore)	Grasshopper
Secondary consumer	Primary consumers (a carnivore)	Frog
Tertiary consumer	Secondary consumers (a carnivore)	Snake
Quaternary consumer	Tertiary consumers (a carnivore)	Eagle

Decomposers, such as bacteria and fungi, feed on dead organisms and waste. They get their energy from dead or waste organic material, and they return nutrients to the soil.

Exam tip: Learn the definitions word for word. A producer makes its own organic nutrients, usually by photosynthesis. Do not just say that it 'makes its own food'.

Quick check

1. State the principal source of energy input to biological systems.
2. What does a food chain show?
3. What is a food web?
4. Define a consumer.
5. Define a decomposer.

2 Nutrient cycles Spec B15.3

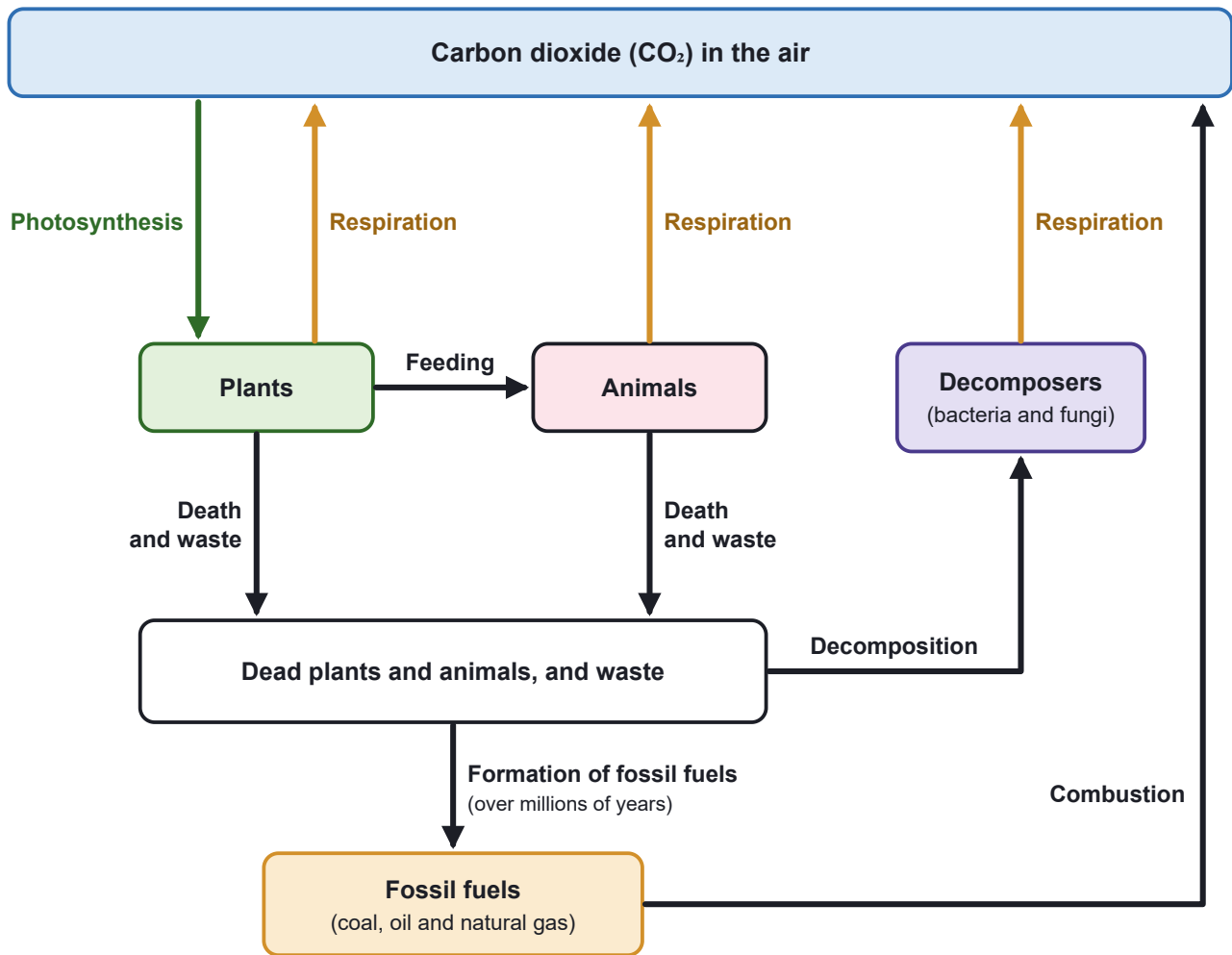
The carbon cycle Spec B15.3.1

All living things are made of carbon compounds, such as carbohydrates, proteins and fats. The carbon cycle moves carbon between the air, living organisms, dead material and fossil fuels. It makes sure carbon dioxide is available for plants to use in photosynthesis again.

1. Plants and algae take carbon dioxide from the air and use it in **photosynthesis** to make carbon compounds such as glucose, starch and proteins.
2. The carbon compounds pass along the food chain by feeding, when animals eat plants and other animals.
3. Plants, animals and decomposers all release carbon dioxide into the air by **respiration**.
4. When organisms die, and when they produce waste, **decomposers** (bacteria and fungi) break down the material. They release carbon dioxide into the air by respiration.
5. Over millions of years, some dead organisms are buried and do not decompose fully. They form **fossil fuels** (coal, oil and natural gas).
6. When fossil fuels, wood or other fuels are burned, **combustion** releases carbon dioxide into the air.

Processes in the carbon cycle

Process	Effect on carbon dioxide in the air
Photosynthesis	Removes carbon dioxide from the air
Respiration (plants, animals, decomposers)	Adds carbon dioxide to the air
Decomposition	Adds carbon dioxide to the air, because decomposers respire
Combustion	Adds carbon dioxide to the air
Feeding	Passes carbon compounds from one organism to the next; no change in the air
Formation of fossil fuels	Locks carbon away in coal, oil and gas



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The carbon cycle. **Photosynthesis** removes carbon dioxide from the air; **respiration**, **decomposition** and **combustion** return it.

Exam tip: Name the process at every arrow. Photosynthesis takes carbon dioxide in. Respiration, decomposition and combustion put it back. Do not write 'breathing' for respiration.

Quick check

1. Which process removes carbon dioxide from the air?
2. Name three processes that add carbon dioxide to the air.
3. How are fossil fuels formed?

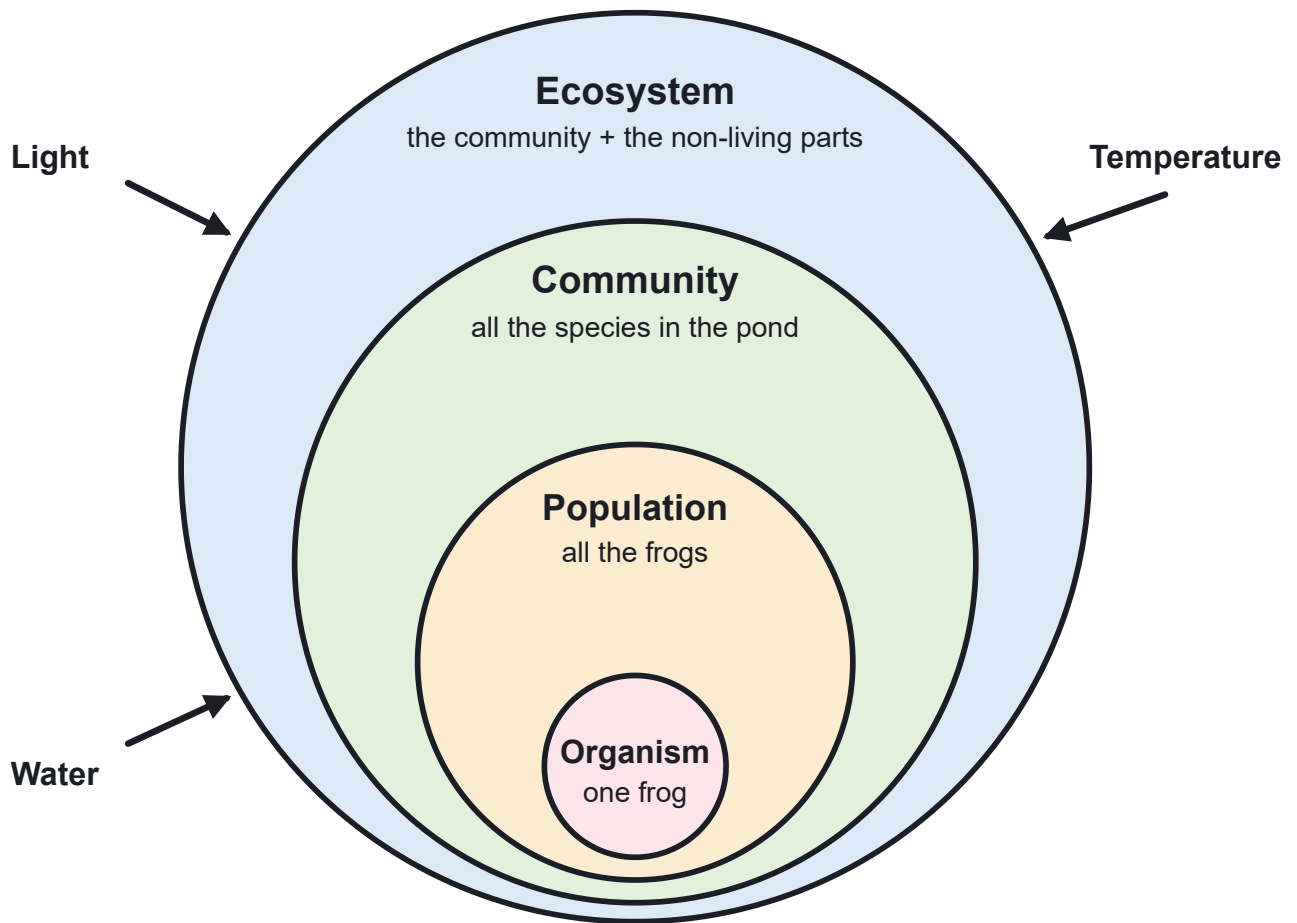
3 Populations Spec B16.1

Populations, communities and ecosystems Spec B16.1.1

Population	A group of organisms of one species, living in the same area, at the same time.
Community	All of the populations of different species in an ecosystem.
Ecosystem	A unit containing the community of organisms and their environment, interacting together.

Levels of organisation, using a pond as the example

Level	Meaning	Pond example
Organism	A single living thing	One frog
Population	One species, in the same area, at the same time	All the frogs in the pond
Community	All the populations of different species in the ecosystem	All the plants, animals and microorganisms in the pond
Ecosystem	The community and its environment, interacting together	The pond community plus the water, light and temperature



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Each level contains the one before it. The **ecosystem** is the community plus its environment.

Quick check

1. Define a population.
2. Define a community.

Quick check answers

Energy flow, food chains and food webs

1. The Sun.
2. The transfer of energy from one organism to the next, beginning with a producer.
3. A network of interconnected food chains.
4. An organism that gets its energy by feeding on other organisms.
5. An organism that gets its energy from dead or waste organic material.

Nutrient cycles

1. Photosynthesis.
2. Respiration, decomposition and combustion.
3. From dead organisms that were buried and did not decompose fully, over millions of years.

Populations

1. A group of organisms of one species, living in the same area, at the same time.
2. All of the populations of different species in an ecosystem.