Topic 4: Ecology and the environment

Edexcel International GCSE Biology 4BI1 · Section 4 · statements 4.1–4.18B · sheets 4.1–4.2

Four questions ecology asks

Question	**Ideas**
Who lives here?	**population**, **community**, **habitat**, ecosystem
Who eats whom?	food chains, webs, pyramids
What goes round?	the carbon and (B) nitrogen cycles
What are we doing to it?	pollution, greenhouse gases, eutrophication, (B) deforestation

Population, community, habitat, ecosystem

Term	Definition
population	all the organisms of one species in a **habitat**
community	all the populations in a habitat
habitat	the place where organisms live
ecosystem	a community and its non-living surroundings

Use the evidence

Abiotic factors: light, water, temperature. Biotic factors: food, predators, disease, competition.

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Worked example: estimating a population with quadrats

1. **Data** Ten 0.25 m^2 quadrats placed at random in a 200 m^2 field: 2, 4, 3, 0, 5, 3, 1, 4, 2, 6 daisies.
2. **Mean** $30 \div 10 = 3.0$ daisies per quadrat.
3. **Scale up** $3.0 \times 200\ \text{m}^2 \div 0.25\ \text{m}^2 = 2400$ daisies.
4. **Better** More quadrats, placed at random, give a more reliable estimate.

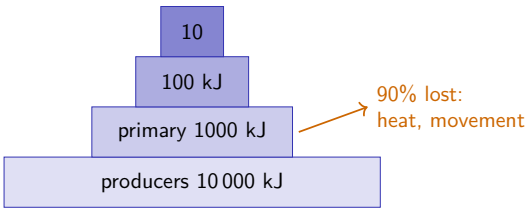
Food chains and trophic levels



Arrows show the direction energy flows, from the eaten to the eater.

- Arrows point from eaten to eater.
- Decomposers break down dead material.

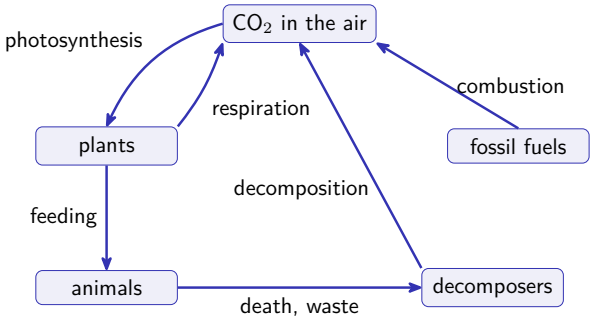
Why pyramids narrow



The rest is lost in **respiration**, movement, excretion and as heat.

- Only about 10% of energy passes to the next level.
- Number pyramids can invert; energy pyramids never do.

The carbon cycle



Four processes: photosynthesis, **respiration**, **decomposition**, **combustion**.

- Photosynthesis removes CO_2 from the air.
- Respiration, decomposition and combustion return it.

(B) The nitrogen cycle

Bacteria	**What they do**
nitrogen-fixing	make nitrogen compounds from N_2 in the air
decomposers	break dead matter and waste into ammonia
nitrifying	convert ammonia into nitrates that plants absorb
denitrifying	return nitrates to N_2 in the air

Air pollution and greenhouse gases

Air pollution

Sulfur dioxide $\rightarrow$ acid rain: damages leaves, lakes and buildings.

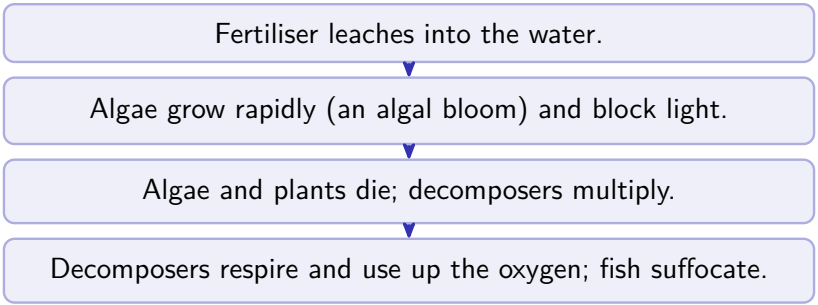
Carbon monoxide binds haemoglobin, so blood carries less oxygen.

Greenhouse gases

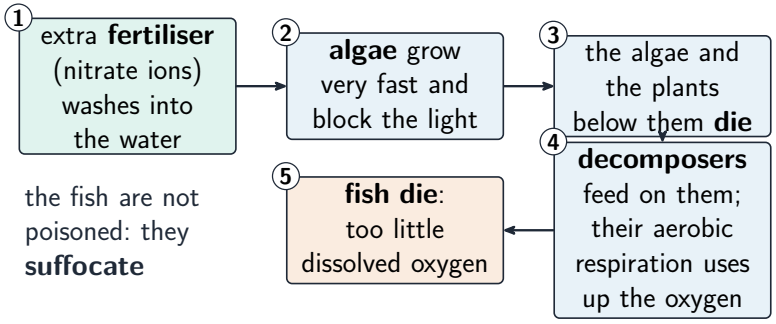
Water vapour, CO_2, nitrous oxide, methane and CFCs trap outgoing radiation.

More from fossil fuels, deforestation and farming: global warming, rising seas.

Eutrophication step by step



Why the fish die



The fish are not poisoned; they suffocate when decomposers use up the oxygen.

(B) Deforestation

Soil and water

Rain leaches minerals; soil erodes without roots.

Less evapotranspiration means less cloud and rain.

Carbon

Fewer trees photosynthesise, so less CO_2 is removed.

Burning or decay returns stored carbon to the air.

Check yourself

Your turn

Answer without notes, then check.

A. Define population, community, habitat and ecosystem.

B. Why does only about 10% of energy pass between trophic levels?

C. Name the four processes of the carbon cycle.

D. Why does carbon monoxide kill?

E. Describe eutrophication in four steps.