

B7 Decay, practical evidence and biomass

Separate Biology Paper 2 extras | AQA 8461 | Core: Foundation + Higher

Supplement to shared content: revise the main topic sheets as well.

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Decomposition and useful decay

Microorganisms secrete enzymes outside their cells to break down dead material and waste. Soluble products then diffuse into the cells.

Factor	Effect on decay
Temperature	Warmer conditions increase enzyme activity up to an optimum; high temperatures denature enzymes.
Water	Needed for chemical reactions and microbial growth. Dry material decays slowly.
Oxygen	Supports aerobic respiration, usually speeding decomposition.

Compost: provide suitable warmth, moisture and oxygen. Aerobic decay releases mineral ions, which can be returned to soil as fertiliser.

Biogas generators: anaerobic decay of waste produces methane-rich biogas used as fuel. Keep suitable temperature and exclude oxygen; organic waste supplies material for microbes.

Matter is recycled. Energy is transferred through organisms and to the surroundings, not recycled in the ecosystem.

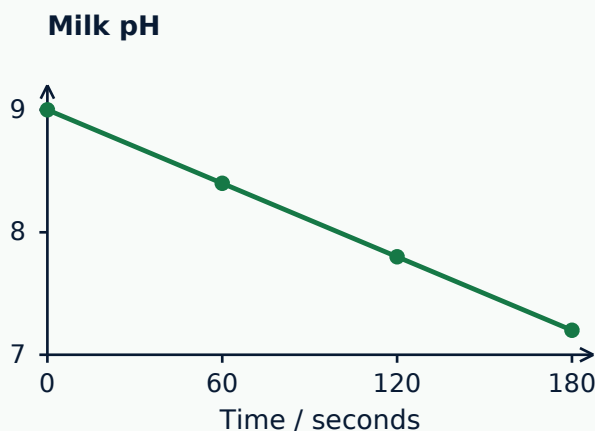
Safety: school supervision, eye protection and care with water baths. Follow approved disposal. Do not taste milk or culture it at home.

Required Practical 10: milk decay

AQA's suggested **model** adds lipase to milk: fatty acids form and pH falls. Natural microbial decay instead produces lactic acid.

Add sodium carbonate and Cresol red to milk. Equilibrate milk mixture and lipase separately at each water-bath temperature. Mix, start timing, then record the time for **purple to yellow** (same pH endpoint).

Keep milk/lipase volumes and concentrations, initial pH and indicator amount fixed. Repeat; compare means. A **pH probe** can record the full curve.

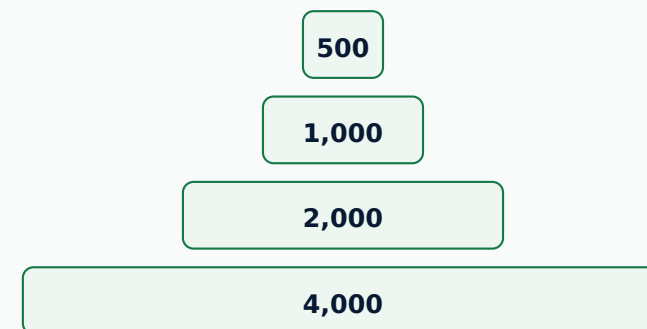


Illustrative lipase model data at 30 C

Rate proxy = $1 / \text{time (s}^{-1}\text{)}$. Shorter time means faster activity. High temperatures may denature lipase. pH is not microbial abundance.

Trophic levels and biomass

Bottom to top: **producers (level 1), primary consumers (2), secondary consumers (3), tertiary consumers (4)**. Apex predators have no predators in the food web considered.



Illustrative dry biomass / g per m2

Use **dry biomass** for comparison. A pyramid of biomass represents mass at each trophic level, not the number of organisms.

Only about 1% of incident light energy is transferred by photosynthesis. Typically only about 10% of biomass transfers to the next trophic level; these are different comparisons.

Biomass transfer efficiency (%)

= biomass transferred / biomass available x 100.

Here: $500 / 1,000 \times 100 = 50\%$.

Losses: uneaten material, faeces, and products of respiration/excretion (carbon dioxide, water and urea). Respiration transfers energy to surroundings; mass does not turn into heat.

B7 Food security and biotechnology

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Securing enough food

Food security means having enough food to feed a population. It depends on reliable supply, not simply producing more in one place.

Pressure	Why it matters
Population growth	Raises food demand.
Changing diets	More demand for scarce resources; meat often needs substantial feed and land.
Pests/pathogens	Damage crops and livestock.
Environmental change	Drought and other changes can reduce yields.
Conflict	Disrupts production and distribution.
Costs	Can make production or access unsustainable.

Evaluate proposals using yield, cost, environmental impacts, welfare, nutrition and sustainability. A local benefit can have a wider cost.

Use the evidence: a high yield is not enough if it cannot be maintained or does not reach the people who need it.

Farming and sustainable fisheries

Intensive farming: restricting livestock movement and controlling temperature reduce energy transfers, so more food can contribute to biomass growth. High-protein feed can support growth.

Benefits include higher yields and lower costs per unit. Balance these against animal welfare, disease transmission, waste and environmental impacts.

Crops can be protected using pesticides and herbicides; fertilisers replace mineral ions. These improve yield but may damage ecosystems if misused.

Maintaining fish stocks

Overfishing removes fish faster than populations replace them. Breeding stocks must remain large enough for sustainable reproduction.

Fishing quotas limit catches. **Larger mesh sizes** allow smaller, immature fish to escape and reproduce before capture.

Management must consider evidence on population size, age structure, illegal catches and effects on other species. Short-term income can conflict with long-term supply.

Biotechnology: all core content

Mycoprotein

The fungus **Fusarium** is grown on glucose syrup under aerobic conditions in a fermenter. Fungal biomass is harvested and purified to make a protein-rich food.

A controlled supply of nutrients and oxygen supports growth; temperature and pH are monitored. The product can substitute for meat.

Useful genetically modified organisms

GM bacteria can produce human insulin. The insulin is harvested and purified for treating diabetes.

GM crops can improve yield or nutritional value. Golden rice produces a substance converted to vitamin A, helping address deficiency where appropriate.

Evaluate benefit, cost, access and possible environmental effects, including transfer of introduced genes to other plants.

Tier boundary: these biotechnology applications are core in AQA 8461 section 4.7.5.4. Detailed genetic-engineering procedures are Higher content elsewhere in B6.

B7 Environmental change and distribution

Separate Biology Paper 2 extras | AQA 8461 | Higher Tier only

Supplement to shared content: revise the main topic sheets as well.

Explain a distribution change

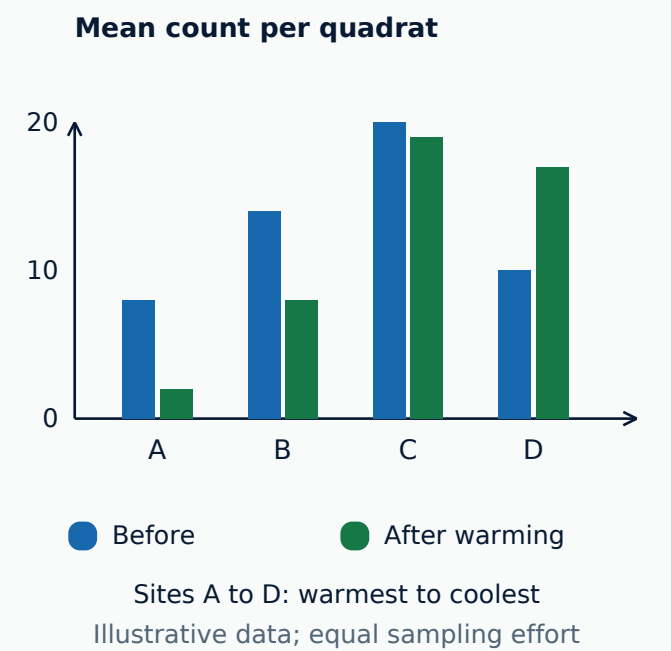
Distribution is where organisms occur. Environmental change may affect survival, reproduction, competition and therefore where a species is found.

Change	Possible effect
Temperature	Shifts suitable conditions; populations may move towards cooler latitudes or higher altitudes.
Water availability	Drought reduces survival of water-dependent species; wetter conditions favour others.
Atmospheric gases	Changes in carbon dioxide can affect photosynthesis; air pollutants can affect sensitive species.

Environmental changes may be **seasonal**, **geographic** or caused by **human activity**. The effect depends on each species and interactions with others.

Causal explanation: identify the changed factor, explain its biological effect, then link that effect to survival/reproduction and distribution.

Read evidence with care



Site	Before	After
A	8	2
B	14	8
C	20	19
D	10	17

Counts fall most at warmer sites A/B and rise at cooler site D. This is **consistent with** a shift towards cooler sites; it does not prove temperature alone caused it.

Evaluate and quantify

At site A: decrease = $8 - 2 = 6$.
Percentage decrease = $6 / 8 \times 100 = 75\%$.
Always divide by the original value.

A larger count at one site is not automatically a larger total population. Sample across the whole range using consistent effort before comparing overall abundance.

Strengthen the evidence

Use repeated sampling over several years, enough randomly located quadrats or a justified transect, and the same season, area and method each time.

Measure the proposed environmental factor. Check alternative explanations such as rainfall, soil pH, pollution, disease, habitat loss and competing species.

Look for a relationship across multiple sites and repeated periods; report variability and uncertainty. Correlation supports a hypothesis but is not proof of causation.

Exam response structure

1. Describe the pattern with figures.
2. Explain a plausible biological mechanism.
3. Identify a limitation or confounding factor.
4. State what further evidence would help.

The dataset on this page is illustrative, not a claim about a named species or a real field study.