Sewage, nutrients and eutrophication

Student activity • observation and reasoning

YEAR 11 / LESSON 111 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

How can added nutrients or organic matter reduce oxygen availability?

Use the supplied examples, record your reasoning and correct it using evidence.

Equipment

- Student booklet, pencil and ruler
- Nutrient-pollution sequence cards and river diagram

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Shared Biology / Double Award: 4.16–4.17. Water pollution and eutrophication.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Build a sequence from nutrient enrichment to increased algal growth, shading and changes in aquatic plants.

2. Explain how dead organic material supports decomposers whose aerobic respiration consumes dissolved oxygen.

3. Distinguish sewage organic matter increasing oxygen demand directly from mineral nutrients stimulating additional growth.

4. Explain that algae also respire and oxygen can vary between day and night.

5. Evaluate a hypothetical river survey using upstream/downstream samples, timing, flow and other confounders.

6. Propose source reduction and monitoring measures without claiming clear-looking water must be safe.

Cleanup

- Return models and keep the corrected work.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Excess nitrogen/phosphorus can stimulate growth. Oxygen depletion can follow respiration and decomposition; it is not simply fertiliser chemically consuming all oxygen. Sewage can also introduce pathogens and organic matter. This is a paper analysis; pupils do not collect or handle sewage. Fictional one-time survey: upstream dissolved oxygen is 8 mg L^{-1} and downstream is 3 mg L^{-1}, with an intervening nutrient input suspected. Sampling times, temperature and flow are not recorded. Explain why repeated matched measurements and nutrient evidence are needed; these values are invented, not safety thresholds.

Example / trial	Observation / evidence	Explanation / limit
Evidence / comparison		
Explanation		
Limit / correction		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What can excess mineral nutrients stimulate?

2. Why can shading affect submerged plants?

3. Which decomposer process consumes oxygen?

4. Can algae consume oxygen?

5. How can sewage act differently from mineral fertiliser?

6. Does one downstream measurement establish the cause?