Waste management

4.7.3.2 · Biology · revision notes

A growing human population with a rising standard of living uses more resources and makes more waste, which can pollute water, air and land. Expect questions on the sources of pollution and how pollution reduces biodiversity, often with data.

Key facts

- More people + higher standard of living → more resources used → more waste
- Air pollution: smoke, acidic gases
- Pollution kills plants and animals → lower biodiversity
- Grade 7+ only Fertiliser in water → algae grow → light blocked → plants die → decomposers respire → oxygen used up → fish die
- Water pollution: sewage, fertiliser, toxic chemicals
- Land pollution: landfill, toxic chemicals
- Acidic gases (e.g. sulfur dioxide) → acid rain

Notes

Why there is more waste

- The human population is growing rapidly and the **standard of living** is increasing.
- So more resources are used and more waste is produced.
- If waste and chemicals are not dealt with properly, pollution increases.

Where pollution happens

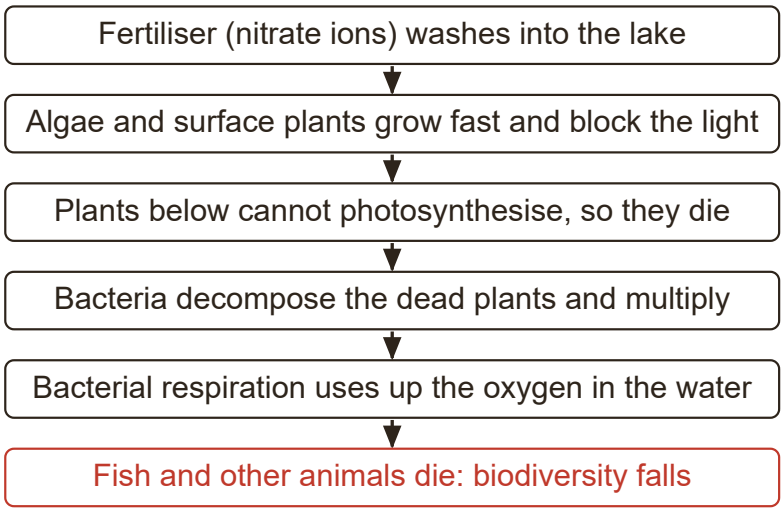
- **Water**: from sewage, fertiliser and toxic chemicals.
- **Air**: from smoke and acidic gases.
- **Land**: from landfill and toxic chemicals.
- Pollution kills plants and animals, which can reduce biodiversity.

Examples of the effects

- **Acidic gases**, such as sulfur dioxide from burning fuels, dissolve in rainwater to make **acid rain**. This damages trees and can make lakes and rivers too acidic for many organisms.
- **Smoke** contains tiny solid particles that can harm the lungs of animals and coat leaves, reducing photosynthesis.
- **Landfill** takes up land that could be a habitat, and toxic chemicals can leak from it into the soil and water.
- **Toxic chemicals**, such as pesticides, can kill organisms other than the pests they are meant to kill.

Fertiliser and sewage in water Grade 7+ only

- Fertiliser washed into a lake or river adds mineral ions such as nitrates, so algae and surface plants grow rapidly.
- They block the light, so plants lower down cannot photosynthesise enough and die.
- Decomposers (bacteria) feed on the dead plants and algae. Their numbers increase, and their respiration uses up the oxygen in the water.
- Fish and other animals die from lack of oxygen, so biodiversity falls.



How fertiliser in a lake kills fish (eutrophication).

- Untreated sewage also feeds decomposers, so it can use up the oxygen in the same way.

How to answer each type of question

Recall: name a source of pollution 1 to 3 marks Grade 3

1. Match the source to where it pollutes: water, air or land.
2. Be specific: 'fertiliser' or 'sewage', not just 'waste'.

Example. Give one source of pollution for each of:
(a) water
(b) air
(c) land.

Model answer.

(a) Sewage / fertiliser / toxic chemicals (1)
(b) Smoke / acidic gases, e.g. sulfur dioxide (1)
(c) Landfill / toxic chemicals (1)

Explain why pollution is increasing

2 marks | Grade 4

1. Say that the human population is growing rapidly.
2. Say that the standard of living is rising.
3. Link both to more resources used and more waste made.

Example. Explain why the amount of waste produced by humans has increased over the last 100 years.

Model answer. The human population has increased rapidly (1). The standard of living has increased, so each person uses more resources and produces more waste (1).

Describe and explain pollution data

2 to 3 marks | Grade 5

1. Describe the pattern with numbers.
2. Link the pollutant to the number of organisms or species.
3. Explain using the chain of effects.

Example. Scientists counted the invertebrate species in samples taken from a river at three sites near a sewage outlet.

Sampling site	Number of invertebrate species
Upstream of the outlet	14
100 m downstream	3
1 km downstream	9

Describe and explain the pattern. (3 marks)

Model answer. The number of species is lowest 100 m below the outlet (3 species), compared with 14 upstream and 9 at 1 km downstream (1). Bacteria break down the sewage and their respiration uses up oxygen, so fewer species can survive just below the outlet (1). Further downstream the sewage has been diluted or broken down, so there is more oxygen and more species survive (1).

Explain how a pollutant reduces biodiversity

3 to 5 marks | Grade 5

1. Name the pollutant and where it goes.
2. Explain the chain of effects step by step, one point per sentence.
3. Finish with organisms dying, so there are fewer species.

Example. After heavy rain, fertiliser from a field washed into a lake. Several weeks later, many fish in the lake died.
Explain why. (5 marks)

Model answer. The fertiliser adds mineral ions (nitrates) to the lake, so algae grow rapidly (1). The algae block the light, so plants below the surface cannot photosynthesise and die (1). Decomposers / bacteria feed on the dead plants and increase in number (1). The decomposers respire, using up the oxygen in the water (1). The fish cannot get enough oxygen for respiration, so they die (1).

Don't lose marks

- Saying fertiliser 'poisons' the fish. The fish die from lack of oxygen, used up by respiring decomposers.
- Saying the plants die from lack of oxygen. Plants below the surface die from lack of light; it is the animals that die from lack of oxygen.
- Writing 'pollution' or 'waste' without naming a specific source.
- Forgetting to link back to biodiversity: pollution kills organisms, so there are fewer species.

More tips

Memory tricks

- Water: Sewage, Fertiliser, Toxic chemicals. Air: Smoke, Acidic gases. Land: Landfill, Toxic chemicals.
- Fertiliser chain: algae grow → light blocked → plants die → decomposers respire → oxygen falls → fish die. Each link is usually a mark.
- Two reasons for more waste: more people, and more resources used per person.

Exam technique

- Pollution chains are long: set them out in order, one point per sentence.
- If a question names water, air or land, only give sources for that one.
- Use the words decomposers, respiration, photosynthesis and biodiversity where they fit.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Name sources of water, air and land pollution**
Water: sewage, fertiliser, toxic chemicals. Air: smoke, acidic gases. Land: landfill, toxic chemicals.

Grade 4 — **Explain why more waste is produced**
The human population is growing rapidly and the standard of living is rising, so more resources are used.

Grade 5 — **Explain how pollution reduces biodiversity**

Pollution kills plants and animals, so fewer species survive in the area.

Grade 6

Explain the effects of acidic gases

Gases such as sulfur dioxide dissolve in rain to make acid rain, which damages trees and makes lakes acidic.

Grade 7

Explain how fertiliser run-off kills aquatic life

Algae grow, block light, plants die, decomposers respire and use up oxygen, so fish die.

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