Solutions

Each answer shows the steps, then the **result**.

2.1

- **nitrate ions** (and other mineral ions)
- **organic waste**, which decomposers feed on – also acceptable: **pathogens**

2.2

- fertiliser that the crop does not take up stays in the soil
- **rain washes it through the soil** and into the river; this is **leaching**

2.3

- the algae at the surface multiply and **cover the water**, shading the plants below
- those plants cannot **photosynthesise** enough, so they die

2.4

- **decomposers** feed on the dead algae and water plants, and multiply
- they carry out **aerobic respiration**, which uses up the **dissolved oxygen** in the water
- the fish need dissolved oxygen for their own respiration, so they die or leave

2.5

- **decomposers cannot break it down**
- so it stays in the environment for hundreds of years

2.6

- methane: **cattle**, **rice fields**, **landfill sites** or decaying waste
- carbon dioxide: burning **fossil fuels**, burning wood or **deforestation**

3.1 C

- the extra nitrate makes the algae grow, and when they die the **decomposers** multiply and use up the dissolved oxygen in their respiration
- **A** and **D** invent a poison; **B** names the wrong organisms – the algae's respiration is far smaller than the decomposers'

3.2

(a)

- the fertiliser adds **nitrate ions** to the water
- so the algae have more of the mineral ions they need and **grow and reproduce faster**, increasing in number

(b)

- fertiliser only adds **ions**, so the decomposers cannot multiply until the algae have grown and died first
- sewage adds **organic waste** as well, which decomposers can feed on **immediately**, so they multiply and use up the oxygen straight away

(c)

- it carries **pathogens**, which cause water-borne diseases such as **cholera**

3.3

(a)

- it **falls** from 9 mg per dm^3 at the outflow to **1 mg per dm^3** at 2 km
- it then **rises** again, to 8 mg per dm^3 at 10 km
- so it is lowest at **2 km**, a little way downstream of the outflow, not at the outflow itself

(b)

- the nitrate concentration is **highest** at 2 km (24 mg per dm^3), so the algae grew most there
- the algae and shaded plants then **died**
- **decomposers** fed on the dead material and multiplied
- their **aerobic respiration** used up the dissolved oxygen faster than it could be replaced

(c)

- by 10 km most of the nitrate has been used up or diluted, so far fewer algae die
- the decomposers therefore use less oxygen, and oxygen dissolves back into the water from the air as the river flows

(d)

- at 2 km there is almost **no dissolved oxygen**, so only a species that can survive at 1 mg per dm^3 can live there
- by 10 km the oxygen has recovered to 8 mg per dm^3, so many more species can respire and survive, giving greater **biodiversity**

(e)

- any **two** of: animals become **tangled** in it and drown or cannot feed; animals **swallow** it and it blocks the gut, so they starve; it breaks into small pieces that are eaten and pass along the **food chain**