4.2 Cycles and human influences

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

Objective

Build the skills to answer exam questions on **cycles within ecosystems and human influences** : the carbon and nitrogen cycles, air pollution, the greenhouse effect, water pollution and eutrophication, and deforestation.

You must be able to:

- describe the processes that move carbon in the carbon cycle
- explain the greenhouse effect and its sources
- explain how fertiliser and sewage cause eutrophication
- analyse river pollution data

1 Key knowledge and worked examples

Cycles and pollution

idea	rule
carbon cycle	photosynthesis takes carbon dioxide from the air; respiration and combustion return it
nitrogen cycle	nitrogen-fixing bacteria; decomposers make ammonium; nitrifying bacteria make nitrate; denitrifying bacteria return nitrogen gas
greenhouse effect	some gases absorb heat given off by the Earth, so the atmosphere warms
percentage change	(new − old) ÷ old ×100
mean rate of change	change ÷ time

Worked example 1: percentage change. Carbon dioxide in the air was 315 ppm in 1960 and 420 ppm in 2024. Find the percentage increase.

1. Known: old 315; new 420.
2. Rule: change ÷ old ×100.
3. Numbers: $105 \div 315 \times 100$.

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4. Result: 33%.

Worked example 2: rate of change. Find the mean yearly increase over the same period.

1. Known: 105 ppm in 64 years.
2. Rule: change ÷ time.
3. Numbers: $105 \div 64$.
4. Result: **about** 1.6 **ppm per year**.

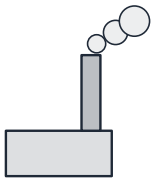
Answer shapes: for eutrophication, write the steps in order: each step causes the next.

2 Practice

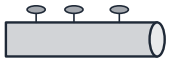
2.1 Name **two** greenhouse gases that come from farming, and give a source of each. [2]



2.2 Give **two** effects of sulfur dioxide pollution on living organisms. [2]



2.3 Explain the role of decomposers in the carbon cycle. [2]



3 Exam-style questions

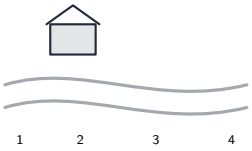
3.1 Explain how cutting down and burning large areas of forest increases the carbon dioxide in the air. [3]



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3.2 Fertiliser runs off a farm into a river. Students measure the oxygen concentration in the water and count fish at four sites. The results are shown.

(a) Calculate the percentage decrease in oxygen concentration from site 1 to site 2. [2]



site	1	2	3	4
oxygen / mg dm^{-3}	9.0	2.0	3.5	7.0
fish counted	24	0	3	15

(b) Suggest **three** reasons why the oxygen concentration rises again at sites 3 and 4. [3]

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(c) Trout need at least 7 mg/dm^3 of oxygen. State at which sites trout could live, and explain why they need this much oxygen. [3]

(d) Explain how the fertiliser causes the oxygen concentration at site 2 to fall so far. [6]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

2.1

- methane, from cattle or rice fields
- nitrous oxide, from fertilisers

2.2

Any two (1 mark each):

- it forms acid rain, which damages leaves and kills trees
- acid rain makes lakes acidic, killing fish
- it damages human lungs, causing breathing problems

2.3

- decomposers (bacteria and fungi) break down dead organisms and waste
- they respire, releasing carbon dioxide back into the air

3.1

- fewer trees, so less photosynthesis removes carbon dioxide
- burning the wood releases carbon dioxide (combustion)
- decomposers respire as they break down the remaining wood, releasing more carbon dioxide

3.2

(a) $(9.0 - 2.0) \div 9.0 \times 100 = \mathbf{78}\%$

(b) any three (1 mark each): the fertiliser is diluted further down the river; fewer nutrients, so fewer algae and decomposers; water plants photosynthesise and add oxygen; fast-flowing or mixed water takes in oxygen from the air

(c) sites 1 and 4; trout are active fish that respire aerobically and need a lot of oxygen to release energy

(d) points to include:

- fertiliser adds nitrate and phosphate to the water (K)
- algae and water plants grow very fast (an algal bloom) (K)
- algae cover the surface and block light, so plants below die (An)
- when algae and plants die, decomposers (bacteria) feed on them and increase in number (K)
- the bacteria respire aerobically and use up the oxygen in the water (An)
- so fish and other animals die, which adds more dead matter (eutrophication) (An)

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.

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