Carbon Cycle Diagrams

A Level

Part A Digestive and respiratory enzymes

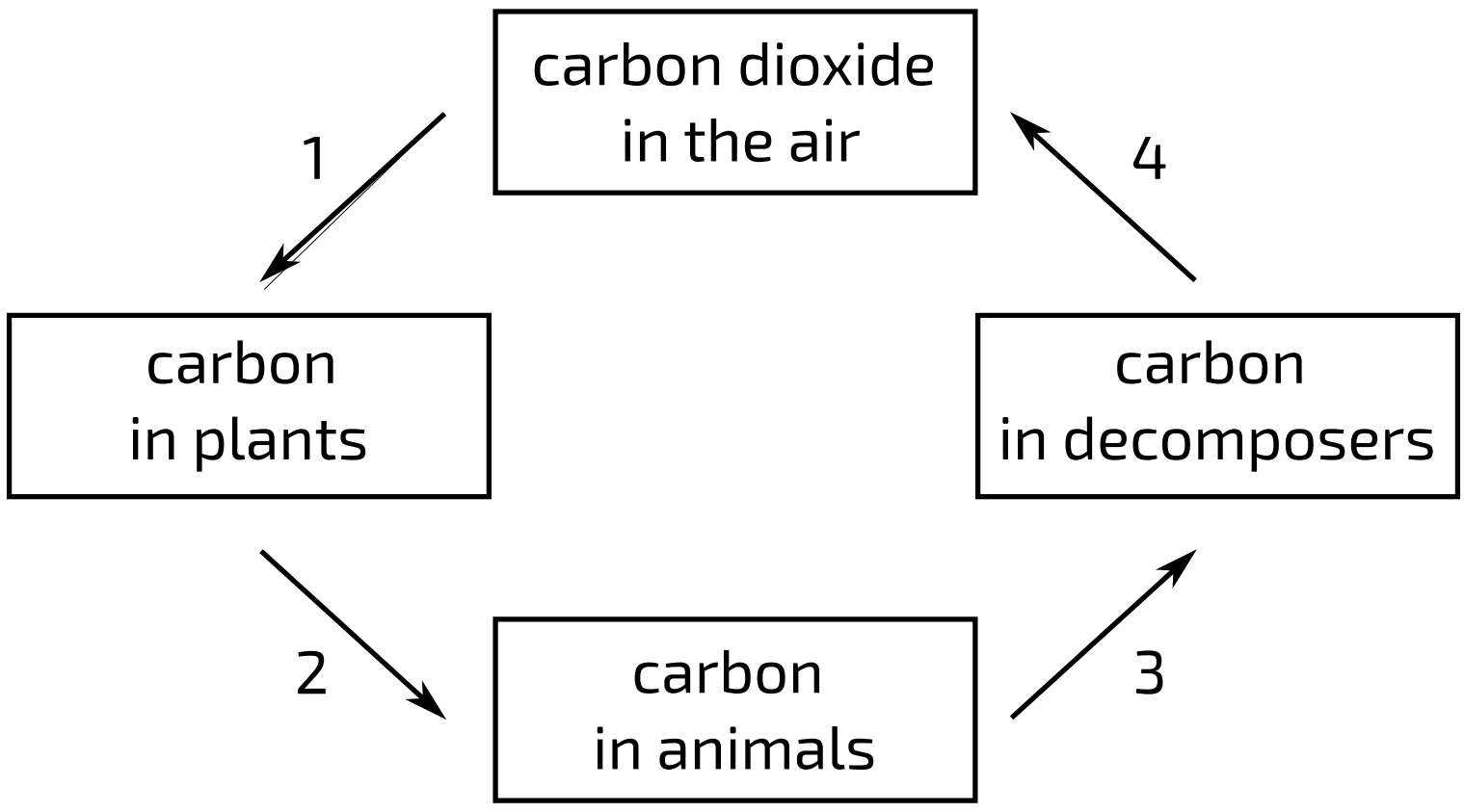

Figure 1: Part of the carbon cycle. Four processes are labelled 1-4.

Which processes involve digestive enzymes? Select all that apply.

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] none of the above

Which processes involve respiratory enzymes? Select all that apply.

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] none of the above

Part B Chemical processes

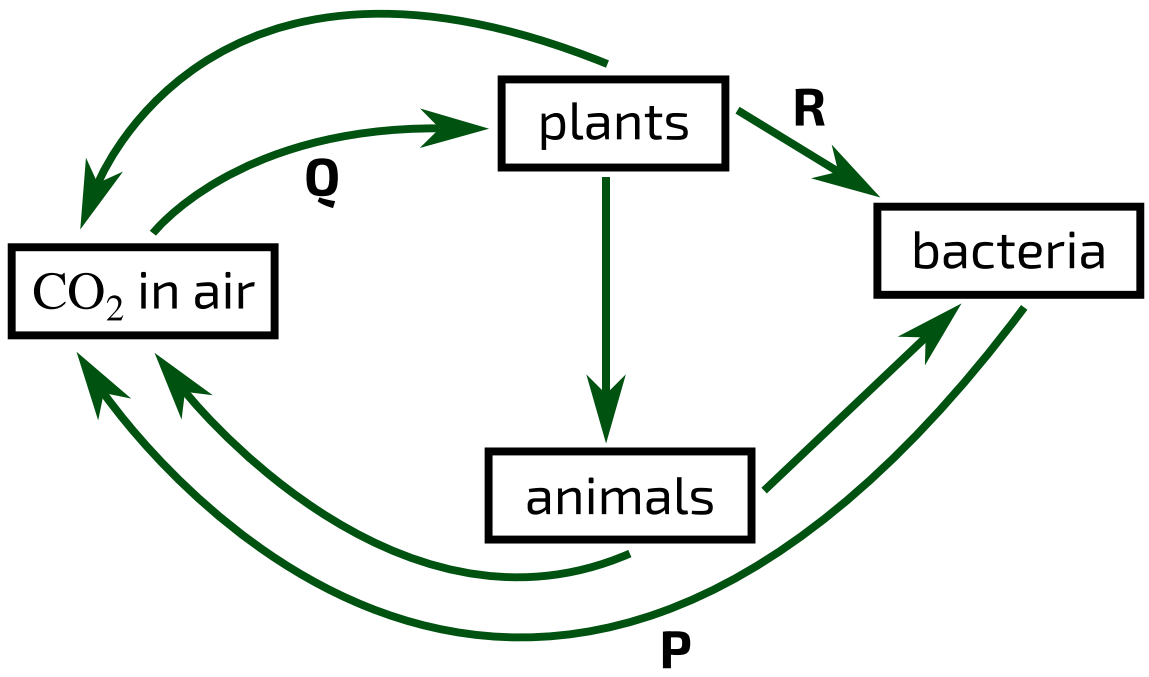

Figure 2: Part of the carbon cycle. Three processes are labelled **P**, **Q** and **R**.

Which of the following statements is/are correct?

- [ ] **P** requires the presence of mitochondria.
- [ ] Overall, **Q** releases heat.
- [ ] **R** is sensitive to changes in pH and temperature.

Part C Sources of carbon

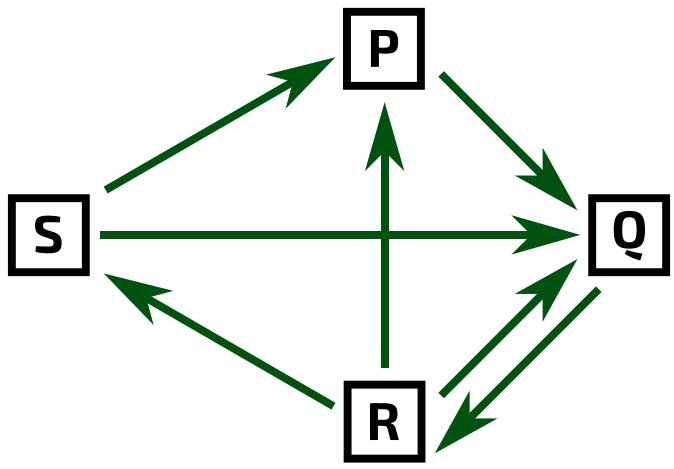

Figure 3: Part of the carbon cycle. Four parts are labelled **P**, **Q**, **R** and **S**. Arrows represent processes.

Drag and drop the correct descriptions for the boxes in **Figure 3**.

Description	Box
CO_2 in atmosphere	
carbon-rich compounds in animals	
carbon-rich compounds in decomposers	
carbon-rich compounds in plants	

Items:

P **Q** **R** **S**

Question elements adapted with permission from NSAA 2022 Specimen Paper Section 1 Q74, NSAA 2021 Section 1 Q72, NSAA 2020 Section 1 Q64

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.

Nitrogen Cycle Processes

A Level

Nitrogen is an important component of many biological molecules. However, plants and animals cannot directly utilise atmospheric nitrogen. Most plants obtain nitrogen from nitrates, which they absorb from the soil. Animals obtain nitrogen from plants either directly (by consuming plants) or indirectly (by consuming other animals that obtained nitrogen from plants).

The conversion of atmospheric nitrogen to nitrates (and back) involves many processes. The main processes involved are nitrogen fixation, nitrification, denitrification, and ammonification. Together, these processes make up the nitrogen cycle.

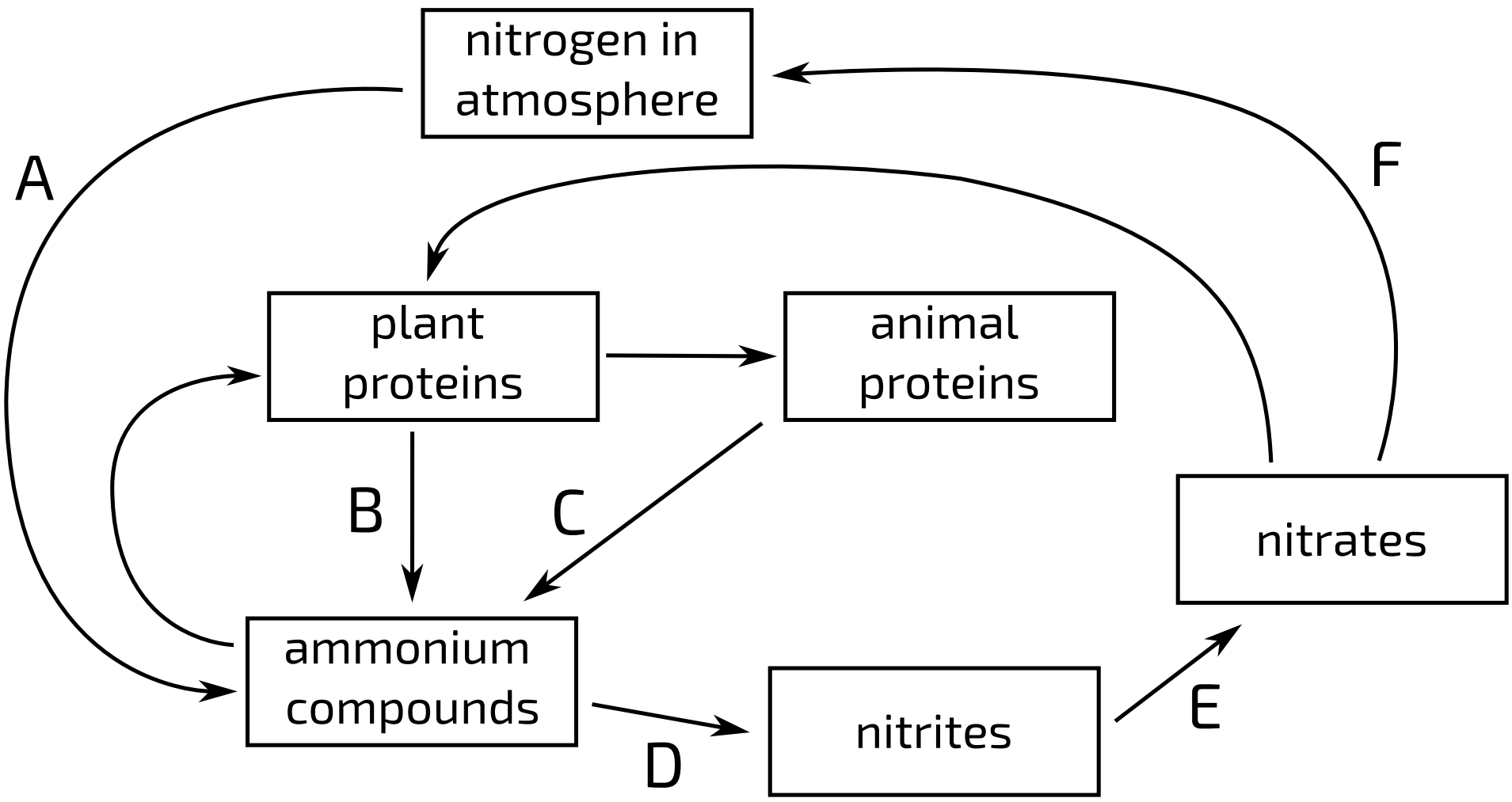

Figure 1: Part of the nitrogen cycle. Arrows represent processes within the nitrogen cycle, some of which are labelled (A-F).

Part A Nitrogen Fixation

Which letter(s) in **Figure 1** represent(s) nitrogen fixation? Select all that apply.

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

Part B Nitrification

Which letter(s) in **Figure 1** represent(s) nitrification? Select all that apply.

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

Part C Denitrification

Which letter(s) in **Figure 1** represent(s) denitrification? Select all that apply.

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

Part D Ammonification

Which letter(s) in **Figure 1** represent(s) ammonification? Select all that apply.

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

Adapted with permission from CIE AS Level November 2001, Biology Paper 1, Question 40

Gameboard:

STEM SMART Biology Week 30 - Nutrient Cycles

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.

Nitrogen Cycle Compounds

A Level

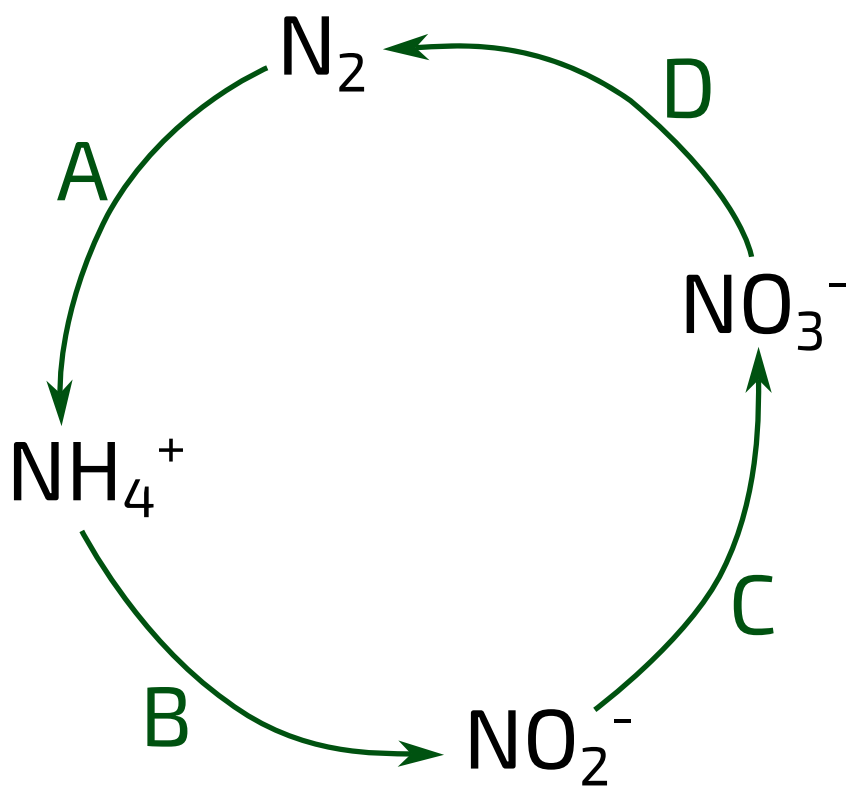

Figure 1: A part of a the nitrogen cycle. Arrows (A-D) represent processes within the nitrogen cycle.

Part A Name the molecule/ion

Match the name to the molecule/ion in the table below.

Formula	Name
N_2	
NH_4^+	
NO_2^-	
NO_3^-	

Items:

ammonium ions **nitrite ions** **(atmospheric) nitrogen** **nitrate ions**

Part B Identify the process

Match the figure label to the process in the table below.

Label	Process
A	
B	
C	
D	

Items:

nitrification **ammonification** **denitrification** **nitrogen fixation**

Part C Nitrogen necessity

Which of the following biological compounds contain nitrogen?

- [ ] starch
- [ ] glucose
- [ ] amino acids
- [ ] RNA
- [ ] DNA
- [ ] ATP
- [ ] cholesterol
- [ ] triglycerides

Created for isaacphysics.org by Lewis Thomson

Gameboard:

STEM SMART Biology Week 30 - Nutrient Cycles

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.

Nitrogen Cycle Organisms

A Level

The nitrogen cycle involves several processes, each of which is carried out by different groups of organisms.

Part A Bacteria

Match the type of bacteria to the process in the table below.

Process	Bacteria
conversion of atmospheric nitrogen to ammonium ions	
conversion of ammonium ions to nitrate ions	
conversion of nitrate ions to atmospheric nitrogen	
conversion of organic nitrogen compounds to ammonium ions	

Items:

nitrifying bacteria (e.g. *Nitrosomonas* and *Nitrobacter*) **denitrifying bacteria (e.g. *Pseudomonas*)**

nitrogen-fixing bacteria (e.g. *Azotobacter* and *Rhizobium*) **decomposers**

Part B Plants

Most plants obtain nitrogen by absorbing nitrate (NO_3^-) ions and/or ammonium (NH_4^+) ions from the soil. However, there is one type of plant that obtains nitrogen from symbiotic bacteria that live in the root nodules of these plants.

What is the name of this type of plant?

Part C Abiotic nitrogen fixation

Nitrogen fixation is carried out by nitrogen-fixing bacteria. However, there is an abiotic process that also fixes nitrogen.

Which of the following **abiotic** processes cause nitrogen fixation?

- the Calvin cycle
- rain
- evaporation
- lightning strikes

Created for isaacphysics.org by Lewis Thomson

Gameboard:

STEM SMART Biology Week 30 - Nutrient Cycles

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.

Nutrient Cycles Summary

A Level

Part A Plants

Which of the following processes are carried out by most plants?

- [ ] carbon fixation (conversion of $\mathrm{CO_2}$ into carbohydrates)
- [ ] nitrogen fixation (conversion of $\mathrm{N_2}$ into ammonium)
- [ ] $\mathrm{CO_2}$ production
- [ ] $\mathrm{N_2}$ production
- [ ] assimilation (conversion of nitrates into amino acids)
- [ ] digestion of carbohydrates obtained from other organisms
- [ ] internal digestion of proteins obtained from other organisms
- [ ] external digestion of nitrogenous compounds and release of ammonium into the soil

Part B Animals

Which of the following processes are carried out by most animals?

- [ ] carbon fixation (conversion of $\mathrm{CO_2}$ into carbohydrates)
- [ ] nitrogen fixation (conversion of $\mathrm{N_2}$ into ammonium)
- [ ] $\mathrm{CO_2}$ production
- [ ] $\mathrm{N_2}$ production
- [ ] assimilation (conversion of nitrates into amino acids)
- [ ] digestion of carbohydrates obtained from other organisms
- [ ] internal digestion of proteins obtained from other organisms
- [ ] external digestion of nitrogenous compounds and release of ammonium into the soil

---

Part C Decomposers

Which of the following processes are carried out by most decomposers?

- [ ] carbon fixation (conversion of $\mathrm{CO_2}$ into carbohydrates)
- [ ] nitrogen fixation (conversion of $\mathrm{N_2}$ into ammonium)
- [ ] $\mathrm{CO_2}$ production
- [ ] $\mathrm{N_2}$ production
- [ ] assimilation (conversion of nitrates into amino acids)
- [ ] digestion of carbohydrates obtained from other organisms
- [ ] internal digestion of proteins obtained from other organisms
- [ ] external digestion of nitrogenous compounds and release of ammonium into the soil

---

Created for isaacphysics.org by Lewis Thomson

Gameboard:

STEM SMART Biology Week 30 - Nutrient Cycles

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.

Soil Fertilisers

A Level

Fertilisers are mixtures of nutrients that increase plant growth i.e. they increase the "fertility" of the soil that they are added to. Fertilisers can be natural (e.g. manure, compost) or artificial.

Part A Why use fertilisers?

Which of the following are reasons for why farmers add fertiliser to the soil in which they grow their crops?

- [ ] The addition of fertilisers may help the crops grow faster and larger than they would without the addition of fertilisers.
- [ ] Fertilisers contain carbohydrates that the crops use in respiration.
- [ ] Fertilisers kill pests that would damage the crops.
- [ ] Crops are harvested before they die, which means that (unlike in natural ecosystems), the plants are not releasing nutrients back into the soil by decomposition. Without fertilisers, the levels of these nutrients will decrease over time.
- [ ] Fertilisers contain nitrates that the crops use to make amino acids.
- [ ] The addition of fertilisers increases the rate of denitrification, which increases nitrate levels in the soil.

Part B Water pollution

Because fertilisers contain soluble nutrients (e.g. nitrates), these nutrients may be washed into streams and rivers by rain. These bodies of water then become enriched with those nutrients. What is the name for this process?

Part C Consequences

Which of the following are possible consequences of fertilisers being washed into rivers and streams?

- [ ] decreased nitrate levels in the water
- [ ] a large increase in the populations of surface algae i.e. algal bloom
- [ ] decreased oxygen levels in the water
- [ ] death of animals (e.g. fish) and a loss of biodiversity

---

Created for isaacphysics.org by Lewis Thomson

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.