

Exercise walk-through

The Phosphorus Cycle ■ 1.6

eXercise

You must be able to

- explain that the phosphorus cycle has **no atmospheric (gas) stage**
- describe it as slow (rock → soil → organisms → sediment)
- explain why phosphorus is often the **limiting nutrient** 限制性营养

Method — No gas phase

Unlike carbon and nitrogen, the **phosphorus cycle has no atmospheric stage** — phosphorus does not form a common gas. It moves through **rock, soil, water, and organisms** only.

Method — A slow cycle

Phosphorus is released slowly by **weathering** of rock into soil, taken up by plants, passed through food chains, and returned to soil/sediment by decomposition. It is a **slow** cycle.

Method — The limiting nutrient

Because usable phosphorus is scarce and released slowly, it is often the **limiting nutrient** — the one in shortest supply that limits growth.

Method — Human disturbance

Adding phosphorus (fertilizer, detergents) to water can trigger **algal blooms** and **eutrophication**, because the normally-limiting nutrient is suddenly abundant.

Practice 2.1 ■ 1 mark

What stage does the phosphorus cycle lack (unlike carbon and nitrogen)?

Solution 2.1

Method: No gas phase

Worked steps

An atmospheric (gas) stage **B1**.

Practice 2.2 ■ 1 mark

How is phosphorus released from rock?

Solution 2.2

Method: A slow cycle

Worked steps

By weathering of rock **B1**.

Practice 2.3 ■ 1 mark

Why is phosphorus often the limiting nutrient?

Solution 2.3

Method: The limiting nutrient

Worked steps

It is scarce and released slowly, so it runs out first and limits growth **B1**.

Exam-style 3.1 ■ 1 mark

The phosphorus cycle differs from the carbon cycle because it has no

- A** rock reservoir
- B** atmospheric (gas) stage
- C** role in organisms
- D** water movement

Solution 3.1

Method: No gas phase

- A rock reservoir
- B atmospheric (gas) stage** 
- C role in organisms
- D water movement

Worked steps

B — an atmospheric (gas) stage.

Exam-style 3.2 ■ 2 marks

Phosphate detergents enter a lake.

- (a) Explain why this can cause an algal bloom.
- (b) State why phosphorus normally limits growth.

Solution 3.2

Method: Human disturbance

Worked steps

(a) Phosphorus is normally limiting; adding it lets algae grow rapidly (a bloom), which then decomposes and depletes oxygen **M1 A1**. (b) It is the nutrient in shortest supply, so growth stops when it runs out **B1**.

Exam-style 3.3 ■ 2 marks

Explain why the phosphorus cycle is slower than the carbon cycle.

Solution 3.3

Method: No gas phase

Worked steps

It has no fast atmospheric stage and relies on the slow weathering of rock, so phosphorus moves through the environment much more slowly than carbon **M1** **A1**.