AP ENVIRONMENTAL SCIENCE • EXERCISE SHEET

1.6 The Phosphorus Cycle

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

Build the skills to answer exam questions on the **phosphorus cycle**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ 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.

■ 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.

■ 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.

■ Human disturbance

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

2 Practice

Now apply the methods above.

2.1 What stage does the phosphorus cycle lack (unlike carbon and nitrogen)? [1]

2.2 How is phosphorus released from rock? [1]

2.3 Why is phosphorus often the limiting nutrient? [1]

3 Exam-style questions

3.1 The phosphorus cycle differs from the carbon cycle because it has no [1]

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

3.2 Phosphate detergents enter a lake.

(a) Explain why this can cause an algal bloom. [2]

(b) State why phosphorus normally limits growth. [1]

3.3 Explain why the phosphorus cycle is slower than the carbon cycle. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **1.6 The Phosphorus Cycle** lesson on the **Learn** page;

- read the **The Phosphorus Cycle** section of the AP Environmental Science handout on the **Know** page.

Solutions

2.1 An atmospheric (gas) stage.

2.2 By weathering of rock.

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

3.1 B —an atmospheric (gas) stage.

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

3.3 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.