Garden Element Routes

Trace three elements through a garden and creek.

ENV.1.5 "Develop and use models to diagram the flow of nitrogen, carbon, and phosphorus through the environment."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline words that name processes moving an element. Write N, C, or P beside the starting and ending reservoirs for each process to trace the three routes.

Where the Garden's Elements Go

1. After a heavy rain, water runs from a school garden toward a creek. The garden is more than soil and plants: it is a meeting place for three moving elements. A cycle model uses labeled reservoirs, such as air, soil, plants, and water, with arrows for transfers or changes. An arrow should name the process moving an element, not just point at its next location. Some paths are fast, while others take thousands of years. Follow nitrogen, carbon, and phosphorus through this garden to see where their routes meet and where they differ.

2. In the garden, bacteria fix nitrogen gas (N_2) from the air into ammonium in the soil. Other bacteria convert ammonium to nitrate, which plant roots absorb. Animals eat plants. Waste and dead organisms feed decomposers, which return ammonium to the soil. Other bacteria convert soil nitrate back to nitrogen gas through denitrification. Carbon takes a different entrance: plants absorb carbon dioxide (CO_2) from the air during photosynthesis. Carbon moves to animals when they eat plants. Respiration by plants and animals releases carbon dioxide into the air. Decomposers also release carbon dioxide as they break down dead matter.

3. Phosphorus has no major gas route through the air. Weathering releases phosphate from rocks into soil, where roots take it up. Animals get phosphorus by eating plants. Decomposers return phosphate from waste and dead organisms to the soil. Rain can wash soil phosphate into the creek, where it can settle in sediment. Over very long periods, sediment can become rock. A useful model can share a plant node and a decomposer node across all three paths, yet keep each element's arrows distinct. Marking where an arrow starts and ends helps show which reservoir gains or loses an element.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace nitrogen from the air to soil nitrate. Name the process on each arrow.

2. From plants, trace two different paths by which carbon returns to the air. Label the processes.

3. Trace phosphorus from rock to creek sediment without passing through an organism. Label the transfers.

4. Which two nodes could be shared by all three element paths in one model? Explain how each element reaches the first shared node.

3 YOUR TURN

Your own words

A garden compost pile receives dead leaves and animal waste after a storm. Draw one combined model that traces nitrogen, carbon, and phosphorus from air or rock through plants and the compost pile, then onward. Label at least two process arrows on each path, show shared nodes, and include a path into the creek.

ANSWER KEY

Garden Element Routes

PART 1 · READ AND MARK

Underline words that name processes moving an element. Write N, C, or P beside the starting and ending reservoirs for each process to trace the three routes. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace nitrogen from the air to soil nitrate. Name the process on each arrow.	**Air nitrogen gas → fixation by bacteria → soil ammonium → conversion by bacteria → soil nitrate.**
2	From plants, trace two different paths by which carbon returns to the air. Label the processes.	**Plants → respiration → carbon dioxide in air. Plants → feeding → animals → respiration → carbon dioxide in air. A path through dead matter and decomposers is also valid.**
3	Trace phosphorus from rock to creek sediment without passing through an organism. Label the transfers.	**Rock → weathering → soil phosphate → washing by rain → creek → settling → sediment.**
4	Which two nodes could be shared by all three element paths in one model? Explain how each element reaches the first shared node.	**Plants and decomposers can be shared nodes. Plants take up nitrogen and phosphorus from soil and carbon dioxide from air.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Shared nodes: PLANTS and COMPOST PILE (decomposers).
Nitrogen: Air N_2 → fixation → soil ammonium → conversion by bacteria → soil nitrate → root uptake → PLANTS → dead leaves → COMPOST PILE → decomposition → soil ammonium.
Carbon: Air CO_2 → photosynthesis → PLANTS → dead leaves → COMPOST PILE → decomposition → air CO_2.
Phosphorus: Rock phosphate → weathering → soil phosphate → root uptake → PLANTS → dead leaves → COMPOST PILE → decomposition → soil phosphate → washed by rain → creek → settling → sediment.

Accept other accurate routes through animals and their waste. In the combined model, check that arrows identify transfers, plants and decomposers are shared, and phosphorus reaches the creek without an atmospheric gas step.