Photosynthesis Evidence

Explain matter cycling and energy flow using observations.

MS-LS1-6 "Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline matter evidence and circle energy evidence; use both marks when evidence supports both. Use at least two observations in your explanation.

Evidence from a model meadow

1. These are simulated classroom results, not measurements to copy as your own. Two similar plants were tested in matching chambers for two hours at the same temperature. Both chambers began with 600 parts per million carbon dioxide. In bright light, the reading fell to 480; in darkness, it rose to 640. A starch test indicated more starch in a lit leaf than in a comparable dark leaf. These comparisons are consistent with plants using light to make food from carbon dioxide and water, while also respiring.

2. In a second simulated investigation, scientists supplied plants with carbon dioxide containing a traceable carbon label. Later they detected the label in plant sugars and, after plant-eating animals fed, in animal tissue. They also detected labeled carbon dioxide released during respiration. The label tracks carbon atoms; it does not mean light turns into matter. These observations support movement of carbon from air into plants, through food and back to air. Dead plants and animal waste also carry carbon to decomposers.

3. Photosynthesis uses light energy to make sugars from carbon dioxide and water and releases oxygen. Some sugar is stored as starch; some supplies respiration or builds plant material. Animals and decomposers obtain stored chemical energy from food. Plants, animals and decomposers all release carbon dioxide and transfer energy to their surroundings as heat during respiration. Carbon can cycle through these pathways. Energy enters as light, transfers through food and eventually spreads as heat; it does not return to plants as usable sunlight. Our models omit detailed biochemical reactions.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the chamber results. What do the light and dark results suggest, and why would the chamber readings alone not identify every product?

2. Use the traceable-carbon result to explain why plant food is made from matter rather than from sunlight.

3. Use at least two stated observations to construct a scientific explanation of photosynthesis in matter cycling and energy flow. Connect evidence to your claim.

3 YOUR TURN

Your own words

Build the two models to communicate your explanation. Label the parts and arrows, then connect each model to the simulated evidence or scientific notes.

1. Model matter: carbon cycling

Draw air, plants, animals, dead material and decomposers inside a labeled system boundary. Add carbon arrows for photosynthesis, feeding, death/waste from plants and animals, movement from dead material into decomposers, and respiration from all three living groups. Show at least one complete cycle. Assume no carbon crosses this simplified boundary.

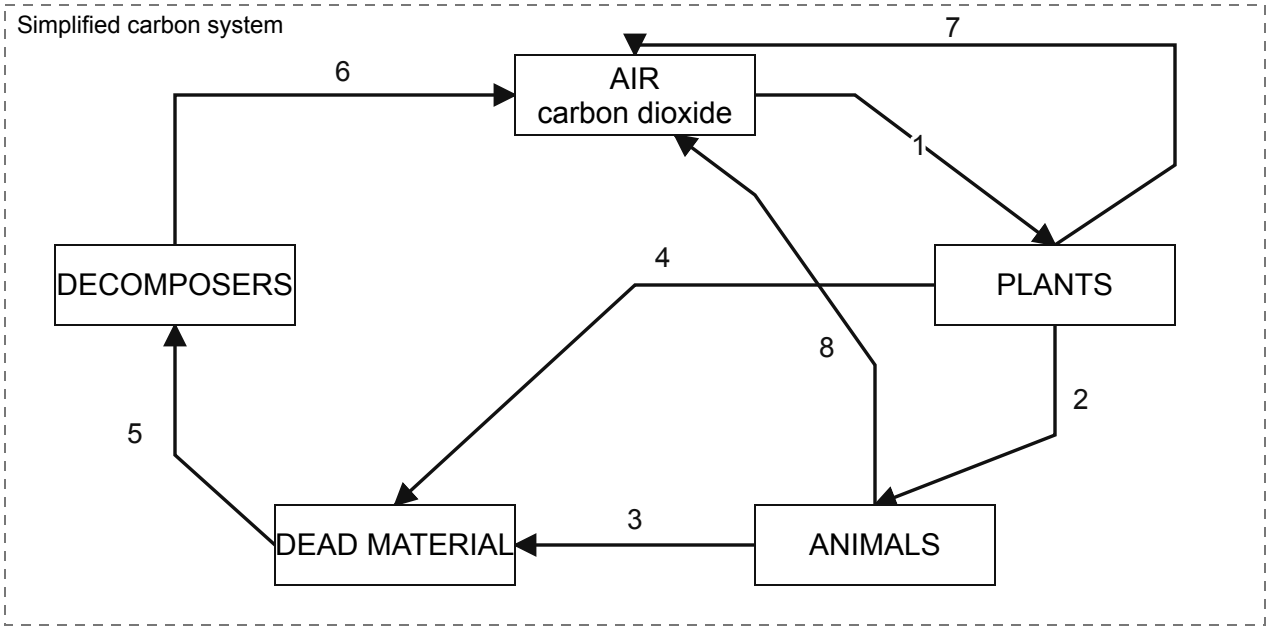
Use one traceable-carbon observation to support a pathway in your model. Explain why a carbon atom is not destroyed.

2. Model energy: input, transfers and output

Draw plants, animals, dead material and decomposers inside a labeled meadow boundary. Put the Sun and heat in the surroundings outside. Show sunlight entering plants, stored energy moving through feeding and dead material, and heat leaving plants, animals and decomposers. Do not draw heat returning as usable sunlight.

Connect light and starch evidence to your energy model. Explain why energy flows through organisms rather than cycling back as sunlight.

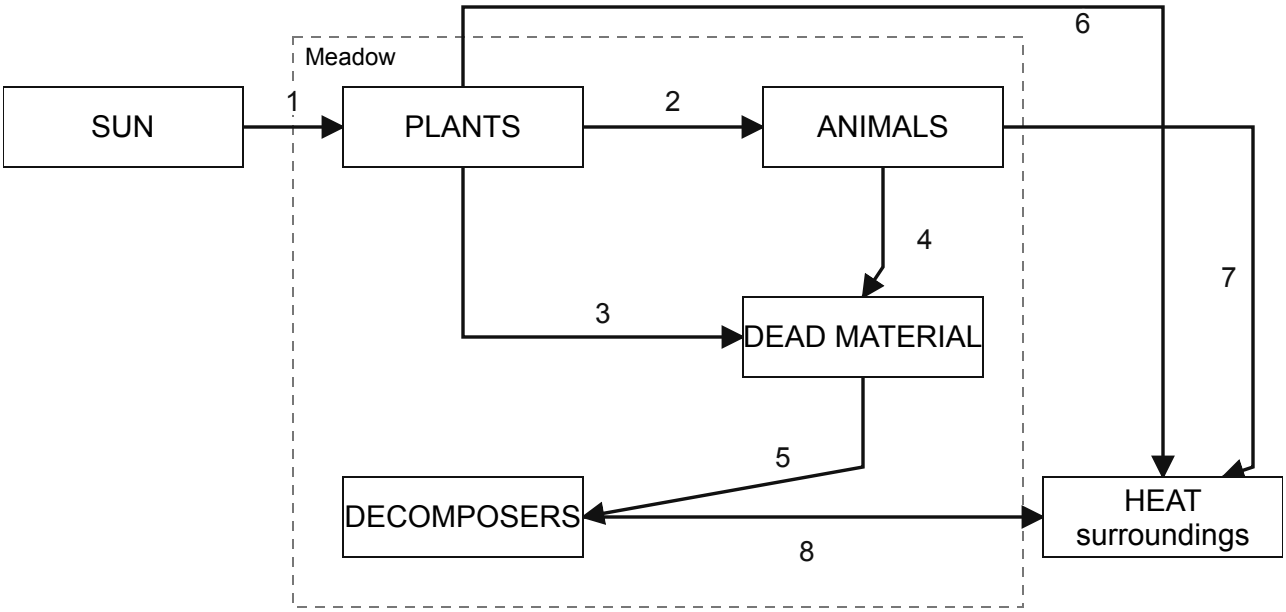
1. Model matter: carbon cycling · example model



Arrows: 1 photosynthesis; 2 feeding; 3 animal death/waste; 4 plant death; 5 carbon entering decomposers from dead material; 6 decomposer respiration; 7 plant respiration; 8 animal respiration. Example cycle: air, plant, animal, air. The boundary includes all five modeled parts; real ecosystems also exchange matter beyond them.

1. Carbon dioxide fell by 120 ppm in light and rose by 40 ppm in dark. They are consistent with photosynthetic uptake in light and respiration in dark. Carbon dioxide readings alone do not identify sugars, oxygen or every process; the starch test provides additional evidence.

2. Model energy: input, transfers and output · example model



Arrows: 1 sunlight; 2 stored energy in food; 3-4 stored energy in plant/animal remains and waste; 5 stored energy reaching decomposers; 6-8 energy spreading as heat from plants, animals and decomposers. The Sun and heat in the surroundings lie outside the meadow boundary. Energy is transferred, not destroyed; it does not cycle back as usable sunlight.

2. The carbon label from carbon dioxide was found in plant sugar, so carbon matter entered the food. Light supplies energy, not carbon atoms.

3. Light-related carbon dioxide uptake and starch storage support photosynthesis making food. The tracer enters sugar, animal tissue and respired carbon dioxide, showing carbon cycling. Light supplies energy; food transfers it and respiration releases heat. Matter cycles while energy flows.

PART 3 · YOUR TURN (SAMPLE ANSWER)

Carbon can travel air to plant to animal to air. Energy enters as sunlight, transfers in food and exits as heat. Require a labeled pathway plus a link to a stated observation; accept other correct routes.

Require explanations supported by two stated observations, not labels alone. All supplied results are simulated. A carbon dioxide reading alone does not identify all products. Accept correct alternative layouts. No biochemical mechanisms required. Reference: NGSS MS-LS1-6, nextgenscience.org/pe/ms-ls1-6-molecules-organisms-structures-and-processes.