

Global Cycles of Matter: Mastery Check

Learning target: I can show that I understand how water, carbon and nitrogen move between reservoirs, why the total amount of matter stays the same, and how people change and repair the carbon cycle.

Retrieval and mastery check

About 35 min

Individual

MS-LS2-3 · assesses

MS-ETS1-1 · practice

independent practice

writing

Name _____

Date _____

Period _____

Directions

Work alone. Part A has twelve items of mixed types; answer every one, and show your work on the numeric items. Part B is a short written synthesis. If a question asks you to name a reservoir or a process, use the chapter's terms. Use the scaffold if you get stuck on the drawing.

You will need: This worksheet, Pencil, Calculator (optional)

Part A: Retrieval

1. Scientists model Earth as a closed system. What does that mean?

- ☐ A. No energy enters or leaves Earth.
- ☐ B. Almost no matter enters or leaves Earth, although energy flows in and out.
- ☐ C. Matter and energy are both trapped inside Earth's atmosphere.
- ☐ D. Earth's matter is slowly used up and must be replaced from space.

2. True or false: A tree builds most of its mass from matter it takes in from the soil through its roots.

- ☐ True ☐ False Explain your thinking:

3. Which process moves carbon from a **nonliving** reservoir into a **living** one?

- ☐ A. Cellular respiration
- ☐ B. Combustion
- ☐ C. Photosynthesis
- ☐ D. Decomposition

4. Name two **nonliving** reservoirs that store carbon, and for one of them name the process that moves carbon out of it.

5. A sealed glass jar containing water, a water plant, a snail and mud has a total mass of 1,240.0 g on day 1. By day 60 the plant has grown and some leaves have rotted. Predict the total mass on day 60 and explain your prediction in one sentence.

6. Fill each blank with the right kind of bacteria. _____ bacteria change nitrogen gas into ammonia. _____ bacteria change ammonium into nitrate. _____ bacteria change nitrate back into nitrogen gas.

7. Lightning makes nitrogen gas react with oxygen in the air. In what form does that nitrogen reach the soil?

- ☐ A. As nitrogen gas dissolved in rain
☐ B. As nitrate carried down in rain
☐ C. As protein
☐ D. As fertilizer pellets

8. A classmate says, 'When I eat a bean, I use its nitrates to build my muscle protein.' Correct the statement: what form of nitrogen does your body actually use from food, and how does it get it?

9. Which statement best describes what burning fossil fuels does to the carbon cycle?

- ☐ A. It creates new carbon atoms that were not on Earth before.
☐ B. It moves carbon that was stored underground for millions of years into the air within moments.
☐ C. It destroys carbon atoms, so the air has less carbon dioxide.
☐ D. It moves carbon from the air into the ground.

10. A farmer spreads 100 kg of nitrogen on a field. The crop takes up 55 kg, and denitrifying bacteria return 15 kg to the air as nitrogen gas. If nothing else happens to it, how much nitrogen is left to wash into nearby water? Show your work and name the law that lets you be sure.

11. A county is choosing a reforestation site. Label each statement as a **criterion** (a goal to judge plans by) or a **constraint** (a limit plans must stay within).

Criterion or constraint?
The forest must capture at least 200 tons of carbon per year.
The project cannot cost more than \$80,000.
No one may be moved off their land.
The carbon should stay stored for at least 30 years.

12. Draw a model of carbon moving inside the sealed jar from q5. Include at least three reservoirs (boxes) and three labeled process arrows, and draw a dashed boundary around the system. Label one thing that crosses the boundary and say whether it is matter or energy.



Part B: Synthesis

13. A classmate says: 'If we keep burning coal and oil, Earth will eventually run out of carbon.' Write a response in five to eight sentences. Use the law of conservation of matter and the carbon cycle to explain what actually happens to the carbon in burned fuel, where it goes, and why that is still a serious problem even though no carbon is lost. End with one way people can move carbon back out of the air and one limit of that method.

A starter for the drawing

For q12, begin with three boxes: 'carbon dioxide dissolved in the water', 'water plant', and 'snail' (or 'dead leaves and mud'). Draw an arrow from the carbon dioxide box to the plant labeled 'photosynthesis', an arrow from the plant to the snail labeled 'feeding', and an arrow from the snail (or from the decomposers in the mud) back to the carbon dioxide box labeled 'cellular respiration'. Then draw the dashed line around everything and write 'light' with an arrow crossing it from outside, labeled 'energy'.

Three cycles, one sandwich

Choose a simple meal, such as a cheese sandwich, and write a short account of how the carbon, the nitrogen and the water in it got there from the air, the soil and the sky, and where each will be one year after you eat it. Name every reservoir and process, and point out at least one place where two cycles share a single process.