

Fixing Marco's Cycle Poster: Seven Claims That Break the Rules

Learning target: I can find the mistaken idea behind a wrong claim about matter cycling, explain what rule it breaks, and rewrite the claim so that it is accurate.

Error analysis

About 40 min

Individual

MS-LS2-3 · practice

MS-LS1-6 · supports

writing

independent practice

Name _____

Date _____

Period _____

Directions

Marco made a poster about the cycles of matter for the science fair. His teacher found seven claims that are wrong or partly wrong. Your job is to be the reviewer. In Part A, name the rule each claim breaks. In Part B, for each claim write (a) **What went wrong:** the mistaken idea behind it, and (b) **The fix:** the claim rewritten so it is accurate. Keep the fix in Marco's plain style; do not just add vocabulary.

You will need: This worksheet, Pencil

Marco's seven claims — **1.** A big oak tree can weigh several tons. Almost all of that mass came up out of the soil through its roots. **2.** When firewood burns, the wood is destroyed. Its matter turns into heat and light. **3.** Plants pull nitrogen gas straight out of the air through their leaves and use it to make protein. **4.** The water molecules in your glass are the exact same water molecules a dinosaur drank. Water molecules never change. **5.** Decomposers get rid of dead matter. Once they finish, that matter is gone from the ecosystem. **6.** The carbon cycle is one loop: air → plant → animal → decomposer → air. Every carbon atom takes those steps, in that order. **7.** Earth is a closed system, so nothing comes in from space. Not even energy.

Part A: Which rule does each claim break?

Here are the five rules a good cycle model follows. **Rule A:** Atoms are never created or destroyed; they change form and reservoir (conservation of matter). **Rule B:** Producers build most of their mass from carbon dioxide and water, not from soil. **Rule C:** Only nitrogen fixation (mostly by bacteria) makes nitrogen gas usable; plants and animals cannot use it directly. **Rule D:** Atoms persist, but molecules are taken apart and rebuilt; a cycle diagram shows possible routes, not one required track. **Rule E:** Earth is closed for matter but open for energy.

1. For each claim, write the letter of the rule it breaks and copy the few words from the claim that show the error. One rule is broken by more than one claim.

Rule broken (A to E)	The three or four words in the claim that give it away
Claim 1	
Claim 2	
Claim 3	
Claim 4	
Claim 5	
Claim 6	
Claim 7	

Part B: What went wrong, and the fix

2. **Claim 1** (the oak tree's mass came from the soil). (a) What went wrong? (b) Write the fix. Include where most of the tree's mass actually came from and what process brought it in.

3. **Claim 2** (burning destroys the wood and turns it into heat and light). (a) What went wrong? (b) Write the fix. Your fix must say where the wood's atoms are after the fire and must keep energy and matter separate.

4. **Claim 3** (plants pull nitrogen gas from the air through their leaves). (a) What went wrong? (b) Write the fix, naming who actually makes nitrogen usable and the form plants take in.

5. **Claim 4** (the same water molecules a dinosaur drank; water molecules never change). (a) What went wrong? Hint: think about what photosynthesis does to water and what cellular respiration produces. (b) Write the fix so that it is still a surprising fact but a true one.

6. **Claim 5** (decomposers make dead matter disappear from the ecosystem). (a) What went wrong? (b) Write the fix, naming at least two reservoirs the matter actually goes to.

7. **Claim 6** (the carbon cycle is one loop every atom follows in order). (a) What went wrong? (b) Write the fix, and give one example of a carbon atom skipping a step and one example of a carbon atom staying in a reservoir for a very long time.

8. **Claim 7** (closed system means no energy comes in). (a) What went wrong? (b) Write the fix, naming what enters Earth and what leaves.

Part C: Step back

9. Two of Marco's claims make the **same** underlying mistake even though they are about different things (wood and dead matter). Which two, and what is the shared mistake?

10. Marco says: 'But the log in the cage really did get lighter. Doesn't that prove matter can disappear?' Describe one measurement or experiment that would convince Marco that the matter went somewhere instead of vanishing.

Ask the atom

For every claim, ask one question: 'Where is the atom now?' If the claim's answer is 'nowhere' or 'it became energy,' Rule A is broken. If the answer is 'in the plant, from the soil,' check Rule B. If the answer is 'in the plant, straight from nitrogen gas,' check Rule C. If the claim says an atom must take one exact path or that a molecule lasts forever, check Rule D. If the claim is about energy rather than atoms, check Rule E. Then write the fix by answering the question correctly.

Write the eighth claim

Marco's poster also says: 'Decomposers break down proteins and leave nitrates in the soil for plants.' This is close but not accurate. Find out which form of nitrogen decomposers actually release and which organisms make nitrates from it, then write a (a) and (b) for this claim as you did in Part B. Finally, explain why a claim that is 'almost right' can be harder to catch than one that is clearly wrong.