

## 4.1: Grading the Tiny Pool and Flux Game Worksheet

*This worksheet has “grading” in the title because at this point, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below. There are also comments about common Level 2 and Level 3 responses to help you with grading and making decisions about what to emphasize in future lessons.*

*Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 63 points total on this worksheet.*

Ecosystems include carbon **pools**—different forms of organic carbon and CO<sub>2</sub>—and carbon **fluxes**—processes that move carbon atoms from one pool to another. Carbon fluxes cause pools to get bigger or smaller. You can see how this works by playing the Tiny Pool and Flux Game. This game has a tiny ecosystem that has 10 carbon atoms, two carbon pools (Atmospheric and Organic Carbon) and two carbon fluxes (Photosynthesis and Cellular Respiration).

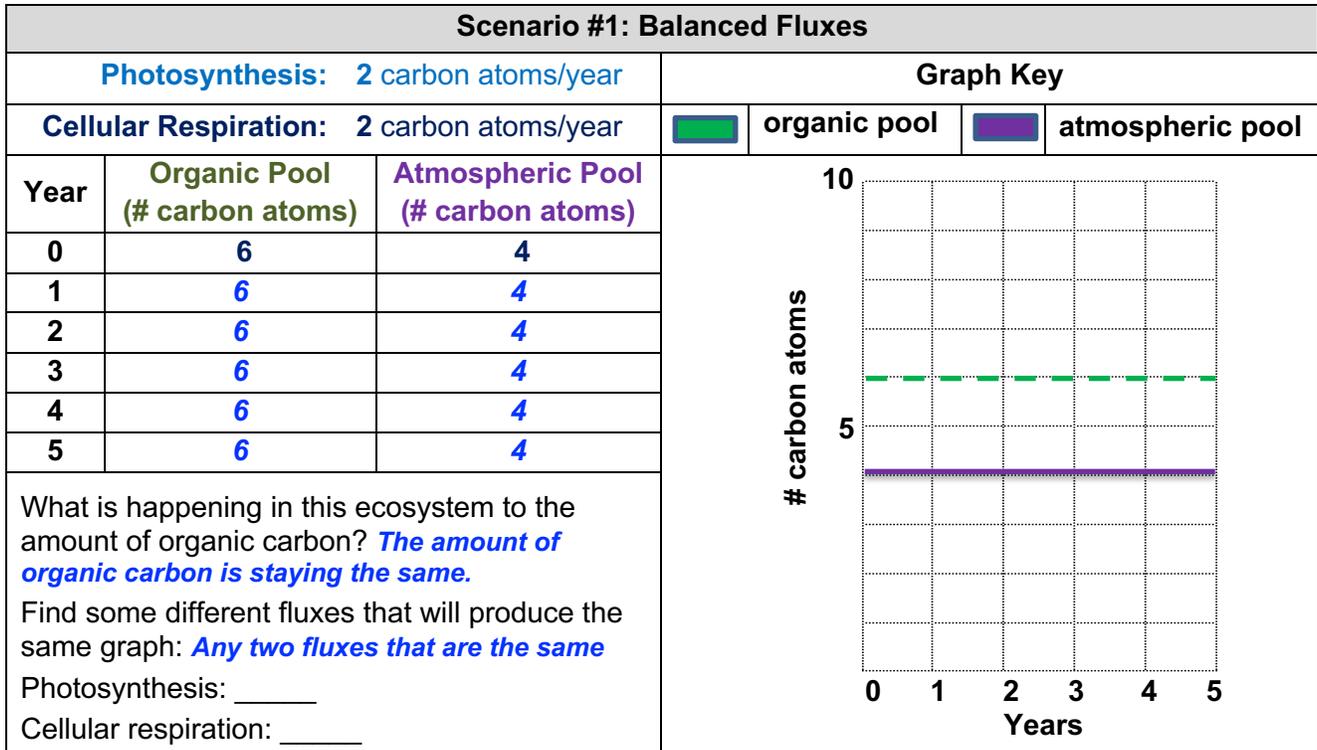
### A. Playing the Game

Here’s what you will need besides this worksheet:

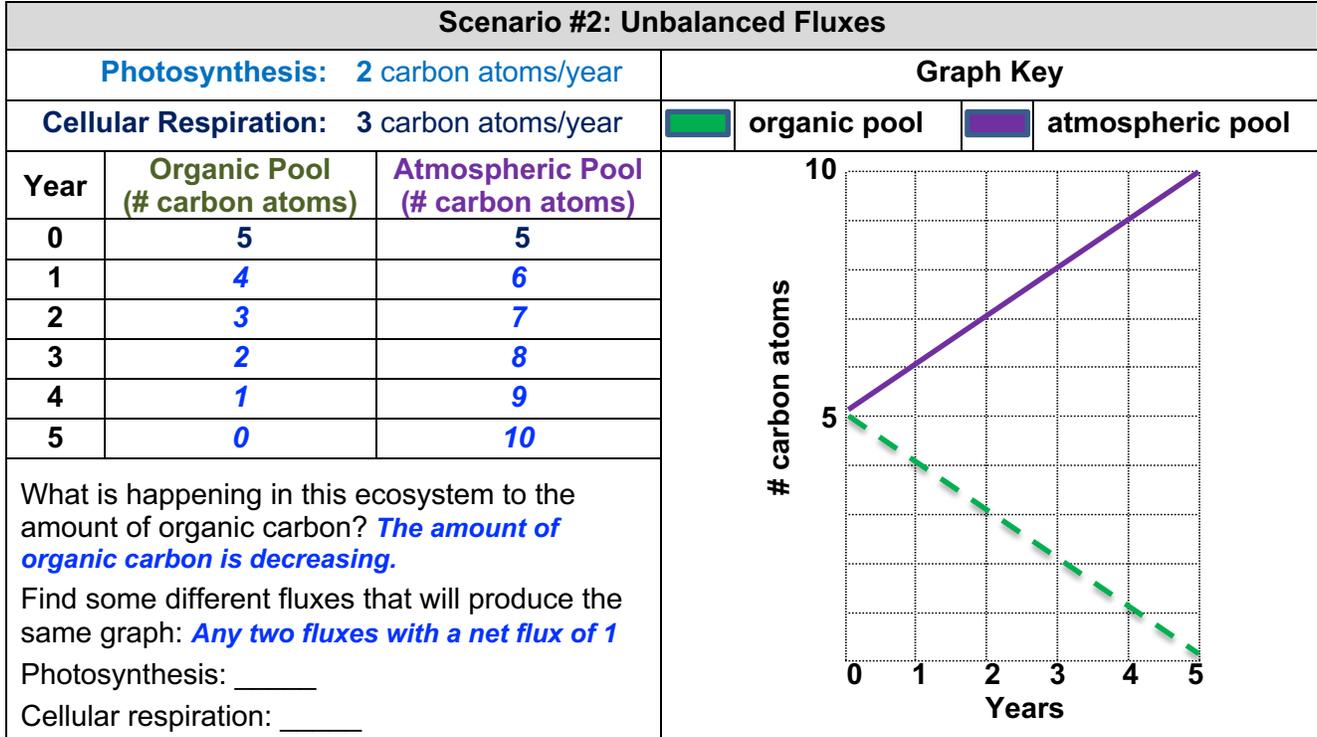
- The Tiny Pool and Flux Placemat
- 10 carbon atoms (from your molecule kits, or other counters such as pennies)

Each scenario in the tables below is a different game. Here’s how to play:

- You start the game by looking at the numbers for Year 0 in the table. If it has numbers, put those numbers of atoms in the Organic and Atmospheric Pools if there are no numbers, decide how many atoms to put in each pool. Put two different-colored dots on the graph showing how many atoms are in each pool.
- Each game has five turns of one year each. For each turn you:
  - Move the numbers of atoms showing in the two fluxes.
  - Record the new numbers of atoms in each pool
  - Put new dots on the graph for each pool and connect the dots with lines.



1 point for each answer. 2 points for graph.  
15 points total.



1 point for each answer. 2 points for graph.  
15 points total.

**Scenario #3: Crossing lines. Can you choose pools and fluxes that will make the graph lines cross each other?**

<b>Photosynthesis:</b> ___ carbon atoms/year		<b>Graph Key</b>	
<b>Cellular Respiration:</b> ___ carbon atoms/year		<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> organic pool	<span style="display: inline-block; width: 15px; height: 15px; background-color: purple; border: 1px solid black;"></span> atmospheric pool
Year	Organic Pool (# carbon atoms)	Atmospheric Pool (# carbon atoms)	
0	_____	_____	
1			
2			
3			
4			
5			
<p>What is happening in this ecosystem to the amount of organic carbon?</p> <p>Find some different fluxes that will produce the same graph:            Photosynthesis: _____            Cellular respiration: _____</p>			

*Answers will vary. There should be a net flux that reduces the size of the pool with the larger initial number of atoms.*

*1 point for each answer. 2 points for graph.*

*15 points total.*

**Scenario #4: Your choice. Try your own pools and fluxes and record what happens.**

<b>Photosynthesis:</b> ___ carbon atoms/year		<b>Graph Key</b>	
<b>Cellular Respiration:</b> ___ carbon atoms/year		<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> organic pool	<span style="display: inline-block; width: 15px; height: 15px; background-color: purple; border: 1px solid black;"></span> atmospheric pool
Year	Organic Pool (# carbon atoms)	Atmospheric Pool (# carbon atoms)	
0	_____	_____	
1			
2			
3			
4			
5			
<p>What is happening in this ecosystem to the amount of organic carbon?</p> <p>Find some different fluxes that will produce the same graph:            Photosynthesis: _____            Cellular respiration: _____</p>			

*Answers will vary.*

*1 point for each answer. 2 points for graph. 15 points total.*

## **B. Questions about Patterns**

What patterns did you notice as you played the game? Use the space below to explain the patterns you saw in how fluxes can change the sizes of pools (or keep them the same).

**Students should describe three patterns:**

**When opposing fluxes are equal, pool sizes stay the same.**

**When opposing fluxes are not equal, pool sizes change.**

**How fast the pool sizes change depends on the difference between the opposing fluxes (or the net flux).**

*1 point for each correct pattern. 3 points total.*