



Module 3: Soil Science and Soil Health

Hands-On Activity Lesson B: Carbon in Soils

Data Collection Worksheet – Module 3 Lesson B, HOA B1, B2, B3 (Student Handout)

Grouping: Pairs or small groups (3–4)

Time: 35-45 minutes

Name: _____ Date: _____ Class: _____

Instructions: Use this worksheet to record your observations, data, and answers for Activities B1, B2, and B3. Be clear and complete – this will help you analyze what you learned about carbon in soils.

Activity B1: Soil Organic Matter

Soil Sample Observations:

Fill in the table for the soils you tested. Describe the color and estimate the % of soil organic matter (% SOM) using the color chart or your best judgment. Add any other notes about the soil (texture, smell, how it holds together, etc.).

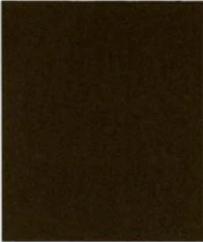
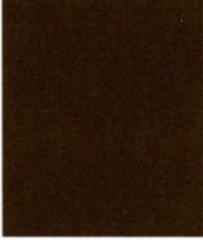
Soil Sample	Location / Description	Soil Color (moist)	Estimated % SOM	Other Notes (moisture, texture, smell)
Sample 1				
Sample 2				

(Optional) Sample 3

Analysis Questions – Soil Organic Matter:

- Comparing Color:** Which soil sample appeared darker in color (indicating more organic matter)? What is the estimated SOM percentage for each, and how confident are you in those estimates?
- Soil Health Implications:** Based on your observations, which sample likely has better soil health and fertility? Explain your reasoning (think about how organic matter affects soil – water holding, nutrients, etc.).
- Carbon Storage:** Soil organic matter is made largely of carbon from dead plants/organisms. What does a higher %SOM tell us about carbon storage in that soil? (Who put the carbon there, and why is it important that it stays in the soil?)

Soil Color Chart (Source: University of Illinois):

ORGANIC MATTER		COLOR
Average	Range	(moist soil)
5%	3½ to 7%	
3½%	2½ to 4%	
2½%	2 to 3%	
2%	1½ to 2½%	
1½%	1 to 2%	

(Strong sunlight may eventually cause these colors to fade slightly.)

Activity B2: Soil Respiration

CO₂ Capture Results:

For the soil respiration test, record what happened in each jar after incubation when you added vinegar. Describe the **intensity of fizzing or any color change** if an indicator was used. Note any differences between samples.

Jar/Test	Contents (Soil type & amount)	Incubation Time	CO ₂ Indicator Result (fizz level or color change)	Observations/Notes
Jar 1	e.g. Soil Sample 1 (_____)			
Jar 2	e.g. Soil Sample 2 (_____)			
Control (if used)	e.g. No soil (empty control)			

(Fill in the type of soil for each jar and how long you left it sealed. Then describe what happened when testing for CO₂.)

Analysis Questions – Soil Respiration:

- Fizz Comparison:** Which jar had the most vigorous reaction (produced the most fizz or strongest indicator change)? What does that tell you about the rate of respiration (CO₂ production) in that soil sample?
- Microbial Activity:** Why do you think one soil produced more CO₂ than another? Consider factors like amount of organic matter, moisture, and microbial life in the soil. (What might the microbes be “eating,” and which conditions encourage them to be more active?)
- Healthy Soil “Breathing”:** Is producing a lot of CO₂ a **good** thing or a **bad** thing for the soil ecosystem? Explain your thoughts. (Hint: CO₂ release means active microbes and nutrient cycling, which is good, but it also means carbon is leaving the soil. How do we balance this?)
- Carbon Cycle Connection:** In the context of the carbon cycle, what part of the cycle did this activity demonstrate? (Where is the carbon coming from and where is it going in your jars?) How does this relate to what happens in soil in nature?

Activity B3: Compost Cake

Compost Cake Composition:

List the materials you used for each component of your compost cake.

- **Brown materials (Carbon-rich “dry” layers):** *examples:*

- **Green materials (Nitrogen-rich “wet” layers):** *examples:*

- **Soil/Compost (microbial “frosting” layers):** *source:*

(If you built multiple layers, you can list multiple materials above. For example: Browns – “dry leaves, shredded paper”; Greens – “grass clippings, food peelings”; Soil – “garden topsoil” etc.)

Observations Immediately After Building:

- Describe the **appearance** of your compost cake layers. Can you see the distinct layers?
- Feel the moisture level: is the pile nicely damp throughout? (If not, what did you do to adjust it?)
- Describe any **smell**: (fresh Earthy? sweet like grass? any bad odors?) – A well-built compost shouldn’t smell rotten.
- If you have a thermometer inserted, record the starting temperature: _____ °C (or °F).

Predictions:

- What do you predict the temperature will be in the center of the compost cake after 24–48 hours? _____ (Higher, lower, same? Why?)
- What do you think the compost cake will look like after 2 weeks? (Describe how the materials might change.)
- What might it look like after 2 months?

Analysis Questions – Compost & Systems Thinking:

1. **Why Layered?** Why did we alternate between brown (carbon) and green (nitrogen) layers instead of just mixing everything or using only one type of material? What balance do the microbes need, and how do these layers provide it?
2. **Role of Soil Layer:** What is the purpose of adding a little soil in each layer? What does the soil contribute to the composting process?
3. **Composting Benefits:** List two benefits of composting organic waste instead of sending it to a landfill or burning it. (Think in terms of soil health, climate, pollution, waste reduction, etc.)
4. **From Linear to Circular:** Explain in your own words how making a compost cake (and using compost on soil) illustrates a circular system in food production, as opposed to a linear one. (Hint: What happens to “waste” in a circular approach? How does this help maintain or build carbon in soil?)

Synthesis Question (Connecting B1, B2, B3):

- **Build–Maintain–Consume Cycle:** Based on all three activities, describe how carbon moves through a soil ecosystem. Use the terms “build,” “maintain,” and “consume” in your explanation. *(For example, think about how compost or plant matter adds carbon (build), how soil organic matter holds it (maintain), and how microbes release some as CO₂ (consume).)* What practices can help keep this cycle in balance in agriculture?

(Use the back of the sheet or additional paper for longer answers or diagrams if needed. You can sketch the compost cake or the soil carbon cycle to illustrate your ideas.)