Teacher Guide (Pages 1-5) & Rubric Pages (6-10)

Module 3 Lesson B (Carbon in Soils: Build–Maintain–Consume)

Hands-On Activity B1, B2, B3

Lesson Overview and Learning Goals

Lesson B Summary: In this lesson, students engage with the concept of soil as a dynamic part of the carbon cycle through three linked activities. **Activity B1 (Soil Organic Matter)** focuses on how carbon is *built up and stored* in soils (the "carbon sponge" that results from decaying organic material). **Activity B2 (Soil Respiration)** illustrates how carbon is *consumed and released* from soil by microbial activity (soil "breathing" out CO_2). **Activity B3 (Let's Make a Compost Cake)** brings a hands-on, systems thinking component by showing how we can *build soil carbon* (and fertility) through composting – turning linear waste streams into circular nutrient cycles. These activities reinforce key concepts of sustainable agriculture and soil health:

- Healthy soil contains organic matter which acts as a **carbon reservoir** and a "sponge" for water and nutrients.
- There is a balance between carbon inputs (plant litter, compost additions – **building/maintaining** carbon in soil) and outputs (decomposition and **consumption** by microbes releasing CO_2).
- Composting is an example of a **circular economy practice** in food systems: it recycles organic waste back into soil, supporting soil carbon buildup and fertility rather than letting that carbon be lost to landfills or the atmosphere.

Connection to Module 3 Themes: Module 3 emphasizes soil health as foundational to sustainable food systems, touching on climate regulation, nutrient cycling, and more. Lesson B specifically addresses moving from linear to circular thinking in food production by focusing on carbon flows:

- *Build/Maintain (Carbon Sequestration):* Through SOM observation and composting, students see how carbon can be retained in soil (mitigating climate change and improving crop growth).
- *Consume (Carbon Release):* Through respiration, they see that some carbon returns to the air via natural processes, highlighting why continuous inputs (cover crops, compost) are needed to maintain soil carbon.
- The **Build–Maintain–Consume** framework here mirrors the idea of inputs, storage, and outputs in a system, fostering systems thinking. Students should come away understanding that a sustainable system requires replenishing what is consumed – in this case, adding organic matter to offset what microbes break down.

Real-World Connections & SDGs: Emphasize how soil carbon ties into global sustainability:

- **Climate Action (SDG 13)**: Storing more carbon in soils (through practices like composting, cover cropping) helps mitigate CO_2 levels. Conversely, soil mismanagement (tillage, no inputs) causes carbon loss to atmosphere.
- **Life on Land (SDG 15) and Zero Hunger (SDG 2):** Healthy soils rich in organic matter support biodiversity (soil life) and higher crop yields, contributing to food security and ecosystem health.
- **Responsible Consumption & Production (SDG 12):** Composting exemplifies responsible waste management – turning food/agricultural waste into a resource, thus reducing landfill use and pollution.
- **Clean Water (SDG 6):** Though not the main focus here, more SOM means better water retention and less runoff, which improves water quality and resilience to drought/flood.

Encourage students to see these connections. A class discussion after the activities can draw a big picture: "**Soil is a living system where carbon cycles through. If we manage it wisely (like adding compost and keeping soil covered), we can keep that carbon working for us in the soil – feeding plants and microbes – instead of contributing to atmospheric CO_2. That's how farming can be part of the climate solution while also regenerating land.**"

Implementation Notes for Each Activity

Activity B1: Soil Organic Matter (SOM) Estimation

- *Setup & Materials:* Before class, collect or ask students to bring in contrasting soil samples. Ideal pairs: e.g., soil from a vegetable garden or under a lawn (high SOM) vs soil from a construction site, roadside, or sandbox (low SOM). You can also use store-bought topsoil or potting mix (often high organic content) vs. subsoil (dig from deeper layer). Have enough for each group to observe at least two samples. If available, print copies of a **Soil Organic Matter color chart** (NRCS has one in their field test guides) or create your own by showing approximate color-to-OM% comparison. If no chart, simply instruct students that darker = more OM and focus on relative differences.
- *Execution:* Students may need guidance in moistening the soil correctly. Too much water will make mud and mask color – demonstrate a quick spray and mix until soil is just damp. Have them use white backgrounds to observe color.
- *Discussion Points:* As groups work, circulate and ask: "Which soil do you think has more organic matter? Why might this one be darker? What could have made it that way (leaf litter, compost, etc.)?" Prompt them to connect darkness to decayed plant material = carbon. If any group has a surprise (e.g., a black urban soil that's actually polluted or not organic matter), use it as a teachable moment about other soil colors (but typically, black/brown = high OM).
- *Time:* This activity is fairly quick – about 30 minutes is sufficient for sample prep, observation, and short discussion. If needed, it can be done as a demo with prepared soil clods to save time (you show two soil samples to the whole class), but hands-on is preferable.
- *Tip:* If you have the resources, an optional extension is to test soil texture alongside color (e.g., do a ribbon test or jar sedimentation). But given our focus is carbon, ensure the link to OM is front and center: "This dark soil has X% OM – that's carbon that plants originally took from the air (CO_2) and is now stored in the ground."

Activity B2: Soil Respiration Test

- *Setup:* This experiment requires some waiting time for CO_2 to accumulate. It's best to set up the jars at least **one day before** you plan to do the vinegar test in class. One strategy is to conduct B1 and the setup of B2 on Day 1, then do the B2 observations (vinegar fizz) at the start of Day 2, followed by B3 on Day 2. If scheduling is tight, even a single class period can work by assembling jars at the beginning, doing other activities (or a lesson) for ~45 minutes, then testing at the end – results will be weaker than overnight, but still observable if soils are active.
- *Materials & Variations:* Ensure jars seal well – any CO_2 leak will reduce the result. Mason jars with new lids or jars with rubber gasket work great. If you suspect your soil is low in microbial activity (very dry or sandy soil), you can "seed" it with a bit of compost or chopped leaves to kickstart microbes, or simply use a bit from the compost cake activity. Alternatively, as a **faster indicator**, you could use **bromothymol blue (BTB)** solution in a vial inside the jar (it will turn yellow with CO_2) or **limewater** (turns cloudy with CO_2). These visual changes can sometimes be observed within a class period. However, the baking soda/vinegar method provided is simple and uses household materials.
- *During Activity:* Remind students not to jostle or inhale into jars when opening. A slight "whoosh" or smell (earthy or musty CO_2) might be noticed when opening – that's normal. The vinegar amount: just enough to react the baking soda. Too much vinegar can dilute and mask fizz differences (and can cause overflow). A tablespoon or two is usually enough. It might be wise for the teacher or one student per group to perform the vinegar pour while others watch.
- *Expected Results:* Soil with higher organic content and active microbes (e.g., from a garden or compost-rich soil) should produce a **strong fizz** – perhaps even foam up when vinegar is added. A poorer soil (low OM or sterilized soil) will have little reaction. If both soils give little fizz, possible issues: jars leaked, soil was too dry or too wet (waterlogged soil respires less), or not enough time. Use the control jar (no soil) to show that any fizz beyond that baseline is due to CO_2 from the soil. If using BTB, expect color change from blue toward green/yellow in high respiration jars.
- *Teaching Opportunities:* Have students hypothesize before opening: "Which jar will have more CO_2? Why?" Afterward, ask them how this ties to soil organisms' role. This is a good point to introduce the idea that **more CO_2 release = more decomposition** happening. Tie back to B1: "The soil that had more organic matter (carbon) likely fed more microbes, so we saw more CO_2. What happens if we never add more organic matter? (The soil carbon would eventually be depleted.)" This sets up the importance of composting and other regenerative practices addressed in B3.
- *Time:* Vinegar testing and observation takes ~10 minutes. Discussion can be another 5–10 minutes. If the jars were set up previously, this is a quick activity. Clean-up (emptying jars, etc.) may take a few minutes; you can have students dump used soil back in a garden or a designated bin.
- *Next-Day Note:* If you do this over two days, ensure the jars are somewhere safe overnight (room temperature, not disturbed). If more than one day (e.g., over a weekend), that's fine too – just note very long incubations (several days) might saturate the baking soda (if so, adding more baking soda or doing a titration would be needed, but not necessary at this level). Generally 1 day is plenty.

Activity B3: Let's Make a Compost Cake

- *Setup & Materials:* Preparation is key here due to the variety of materials. Gather a mix of browns and greens. You can enlist students to bring items (assign some to bring a bag of dry leaves or shredded paper, others to bring vegetable peels or coffee grounds from home). Have extra on hand in case contributions fall short. Autumn is great for dry leaves; if none, shredded newspaper works as a carbon source. For greens, grass clippings (if available) or even chopped up lettuce/cabbage scraps from a cafeteria work. Avoid any meat, dairy, or oily foods – they smell bad and attract pests. If using manure (like from a farm or store-bought cow manure compost), handle with gloves and use sparingly for demonstration (and warn about pathogens – though aged manure is safer). Provide each group with a container or bucket if working in groups. For a whole-class demo, a single larger bin (like a 5-gallon bucket or a small garbage can) can work; or do it on the ground with a rope circle as outline (if outdoor).
- *Execution:* This activity is interactive and fun – encourage students to layer like they're making a recipe. You may assign roles: one student adds browns, another adds greens, another sprinkles soil, another waters, then rotate. If whole-class, physically involve students: e.g., hand out "ingredient cards" or actual handfuls to different volunteers to add in sequence (this can keep a large group engaged). Emphasize the pattern: **Brown → Green → Soil → water, repeat**... like a song. The "cake" analogy helps – call the soil a "frosting" or "microbe sprinkles." A bit of humor goes a long way in remembering the steps.
- *Class Management:* There will be movement and some mess. Laying a tarp or doing it outside/garden area is recommended. Set ground rules: no tossing materials, everyone needs to participate or at least observe closely. After building, allow them to gently feel the pile's warmth (initially it will just feel like room temp; the heat comes later). If you continue to monitor it for a few days, try checking temp daily with a compost thermometer if available. You could also have students dismantle the pile after a day or two to *see* inside – often inner layers start to get fungus threads or slight warmth. But if not feasible, just discussing it is fine.
- *Time:* Building the compost cake takes about 20 minutes. Budget extra time for setup/distribution of materials and cleanup (maybe 5 min each). If discussion happens concurrently, the total can be ~30 minutes. It's a good culminating activity for the lesson because it's active and synthesizes concepts.
- *Talking Points During Activity:* As layers go in, ask: "Why do we need to add water? What would happen if it's too dry or too wet?" (Too dry – microbes go dormant; too wet – no oxygen, smelly anaerobic conditions). "What do the microbes eat first, the greens or browns?" (Greens decompose faster; browns are more fibrous and slow, need nitrogen to break down; having both creates a balanced diet). "Why might the pile get hot?" (Microbial respiration releases energy; a hot pile indicates rapid decomposition – and also means CO_2 is being released, tie to B2).
- *Post-Activity:* If possible, return to the pile in the next class to measure temperature or check for any changes (even smell – an active compost might start to smell pleasantly earthy or slightly tangy as it heats). If the pile is to be maintained, make sure someone aerates or turns it after a couple of days, or just compost it properly. Otherwise, if it's purely demonstrative, you may transfer it to the school's compost heap or dispose of materials in yard waste after students have observed what they needed. Ensure students wash up – touching raw compostables and soil can expose them to harmless but also some harmful microbes, so hygiene is important.

Integration and Systems Thinking: After all three activities, lead a reflective discussion (or have students answer the synthesis question on the worksheet). Key idea to draw out: **Carbon cycling in soil is a dynamic balance.** Plants (and added compost) put carbon into soil (build), some carbon stays as humus (maintain), and some is released by microbes (consume). In natural systems, this is a loop – e.g., a forest floor builds soil carbon over time but also constantly respires CO_2. In agriculture, if we only take (harvest crops, leave soil bare), we deplete that carbon. So practices like composting, cover cropping, and reduced tillage help **replenish and keep carbon** in the soil, aligning with circular principles.

This is a great place to connect back to **Modules 1 and 2** if applicable:

- Module 1 (systems thinking) introduced linear vs circular – here they physically created a circular solution (compost) to a linear waste problem.
- Module 2 (waste-to-resource) highlighted pathways like biochar, compost, etc. Now in Module 3, they're actually doing one of those pathways (composting) and seeing its effects on soil.
- You can also foreshadow Module 3 Lesson C or others: e.g., mention soil food web (the microbes they "fed" in B2 are part of a larger web), or climate implications (which might come in a later lesson or module on climate).

Encourage students to relate these experiments to real-world scenarios:

- B1: Farmers and ecologists measure SOM because it's crucial for fertility and climate resilience. (Some might mention how prairie soils are deep dark – lots of carbon – vs overfarmed soils that lost carbon and turned pale.)
- B2: Soil respiration is actually measured by scientists to gauge soil health (too low might mean inert soil, but too high could mean losing carbon too fast). Also relates to greenhouse gas emissions from soil – e.g., tilling a field causes a burst of respiration (CO_2 release).
- B3: Many cities (and the state of California) encourage composting. This connects to waste management policies and even personal actions (like composting at home). Also, compost use is a key practice in regenerative agriculture to build soil carbon.

Tips and Differentiation

- For classes with more time or higher level: incorporate data analysis. For B2, you could attempt a rough quantification (e.g., capture CO_2 in a balloon or use more precise measures). For B1, actually weigh and dry soil to calculate SOM loss on ignition (more involved). These go deeper into lab skills.
- For a quicker version of Lesson B: If time is very short, you might choose just one hands-on (B3 is very illustrative for systems thinking) and demonstrate B1 and B2 quickly. But ideally, do all three as they reinforce each other.
- Classroom management: B3 can be messy – consider doing it outside. B2 involves mild chemicals – review lab safety (vinegar is weak acid, but good practice to handle properly).
- English learners or students needing support: Emphasize vocabulary with visuals – show a diagram of the carbon cycle with soil, or pictures of browns vs greens. Possibly have sentence starters on the worksheet for reflections ("The darker soil has more ___, which means it can ___.")
- Advanced extension: Discuss that SOM is not just carbon, but also tied to nitrogen cycles, water retention, etc., linking the multi-functionality of soil organic matter (but keep focus on carbon for this lesson).

Rubric for assessment

Use the **Data Collection Worksheet** and students' participation to assess understanding. The worksheet responses will show both their observational skills and conceptual grasp. The rubric below provides criteria for evaluating their performance. You may assign point values (for example, 4 = Exemplary, 3 = Proficient, 2 = Developing, 1 = Beginning) for each category, for a total of up to 20 points. This can be used as a formative assessment or part of a lab/activity grade.

Grading Rubric (Short Version)

Use this quick-reference table to evaluate short-response, short-essay, and design-based answers. See page 7 for the detailed rubric.

Criteria	Exemplary (4 pts)	Proficient (3 pts)	Developing (2 pts)	Beginning (1 pt)
1. Data Collection (Completeness & Accuracy)	All data tables and observations fully completed, accurate, and detailed. Student clearly performed procedures carefully.	Most data complete and correct; only minor gaps or small inaccuracies.	Partial or vague data; some missing entries or errors show limited attention.	Little or no data recorded; major omissions or incorrect entries.
2. Observations & Explanations (Scientific Accuracy & Detail)	Descriptions are precise, scientific, and insightful; clear, correct explanations of results.	Main observations correct with basic explanations; minor detail missing.	Observations partially correct or unclear; explanations limited or partly wrong.	Minimal or incorrect observations; explanations missing or unrelated.
3. Conceptual Understanding (Soil Carbon Processes)	Demonstrates strong grasp of carbon cycling and soil functions; uses correct terms (SOM, respiration, sequestration).	Shows solid understanding of main ideas; small gaps in detail or terminology.	Partial understanding; mixes up processes or gives superficial reasoning.	Major misconceptions or no understanding of soil carbon concepts.

4. Systems Thinking & Connections (Link to Sustainability & Food Systems)	Makes clear, accurate links between soil carbon, composting, waste reduction, and climate; shows “big-picture” insight.	At least one sound system connection (e.g., compost reduces waste, improves soil).	Mentions general environmental benefit but with vague or limited linkages.	No connection made to broader systems; treats each activity in isolation.
5. Effort & Presentation(Organization & Completeness)	Work is neat, thorough, and shows strong effort and reflection.	Work is complete and readable with consistent effort.	Work somewhat rushed or uneven; some sections incomplete.	Work incomplete or careless; very little effort shown.

Rubric Long Version – Lesson B: Carbon in Soils (Build–Maintain–Consume)

1. Data Collection (Completeness & Accuracy of Data Logging)

- **Exemplary (4 pts):** Student diligently completed all data tables and observation logs. All required fields on the worksheet are filled in with appropriate measurements/descriptions. Data is recorded accurately (e.g., colors and fizz intensity are noted correctly) and even additional relevant details are included. It’s clear the student performed the procedures and paid close attention to results.
- **Proficient (3 pts):** Data recording is mostly complete, with perhaps only minor omissions. The key observations (soil colors, SOM estimates, CO_2 fizz levels, materials used in compost) are all noted and make sense. There may be slight inaccuracies or a lack of detail in some entries, but overall the data is reliable.
- **Developing (2 pts):** Student recorded some data, but parts are missing or unclear. For example, one of the samples in B1 or B2 might not be described, or entries are very vague (“color was normal,” “it fizzed a little”). Some data may be incorrectly noted (estimates way off or observations that contradict what likely happened), suggesting confusion or inattention.
- **Beginning (1 pt):** Little to no data recorded. Many sections of tables are blank or have highly incorrect entries (e.g., calling a very light soil “high % OM” without basis). The student likely did not fully participate in the measurement process or did not understand what to record.

2. Quality of Observations & Explanations (Accuracy and detail in observing phenomena)

- **Exemplary (4 pts):** Observations are detailed and scientifically accurate. The student describes what they saw using appropriate terms (e.g., “Sample 1 soil was dark brown, roughly 8% SOM on the chart, with a loamy texture” or “Jar 1 fizzed vigorously, indicating a high rate of respiration”). Explanations for what was observed are insightful and correct – the student can accurately identify which soil had more organic matter or which jar had more CO_2 and offers a plausible explanation even before the formal questions prompt it. They might note subtle things (like moisture differences or how quickly fizz started) that show keen observation.
- **Proficient (3 pts):** Observations cover the main points with generally correct descriptions. The student correctly identifies, for example, which soil is darker and which sample fizzed more. Explanations for differences are given at a basic level (“soil A is darker so I think it has more

organic stuff; the garden soil fizzed more because it has more living things"). They might not include a lot of nuance, but nothing is blatantly incorrect.
- **Developing (2 pts):** Observations are noted but may contain some inaccuracies or lack clarity. For instance, a student might mix up which sample was darker or misjudge the fizz intensity. They might say both soils were "the same" when in reality there was a difference, indicating they didn't observe carefully or misunderstood. Explanations are minimal or somewhat off – e.g., "Jar 2 fizzed more because it had baking soda" (confusing the cause and effect) or attributing differences to unrelated factors.
- **Beginning (1 pt):** Observational notes are very sparse or wrong. The student might have failed to notice obvious differences (e.g., saying "no difference" when one soil was clearly darker, or not mentioning fizz at all). Any explanations given are incorrect or missing entirely (for example, a student might write something unrelated like "I think soil 1 fizzed because it was magic" or leave it blank). This level shows a serious lack of engagement or comprehension of what was happening in the activities.

3. Conceptual Understanding (Soil Carbon Processes)

- **Exemplary (4 pts):** The student's answers to conceptual questions demonstrate a clear and thorough understanding of the carbon processes in soil. They accurately explain that soil organic matter comes from once-living materials (and thus contains carbon from the atmosphere via plants), and recognize why higher SOM is beneficial (nutrient supply, moisture retention, structure). They grasp that soil respiration is microbes breaking down carbon and releasing CO_2, and articulate the need for balance (e.g., "some CO_2 release is normal and good for nutrient cycling, but we need to keep adding organic matter so we don't lose all the carbon"). They likely use correct terminology such as "decomposition," "microbial respiration," "carbon sequestration," etc., in answers.
- **Proficient (3 pts):** The student demonstrates a solid understanding with minor gaps. They correctly identify the main ideas: that more SOM means more stored carbon and fertility, that compost adds nutrients and carbon, that microbes respire CO_2. They may not use all the scientific terms, but they get the point across (e.g., "the dark soil holds more carbon from dead plants," "the compost keeps the system going by giving back nutrients"). Any minor misconceptions are quickly addressable.
- **Developing (2 pts):** The student's conceptual grasp is partial. They might know, for example, that compost is good and soil life is good, but can't clearly explain the carbon connection. Or they might say "CO_2 came from the baking soda" instead of linking it to the soil microbes (mixing up the indicator with the source of CO_2). They may not connect that SOM is carbon, or might think darker soil is just a different type of dirt rather than higher organic content. Answers might be superficial ("compost is good for plants because it's like fertilizer" – not wrong, but not tying to carbon cycle explicitly).
- **Beginning (1 pt):** Responses show significant misconceptions or lack of understanding. The student might have no idea why SOM matters ("just the color?"), or might think the CO_2 in B2 came from a chemical reaction unrelated to soil life ("vinegar and baking soda always fizz" without linking it to the fact that CO_2 had been absorbed). They may not connect the activities to carbon at all. For instance, they might say "compost is just dirt" or "soil respiration is when soil breathes oxygen" – indicating confusion between basic concepts. Little to no mention of carbon or incorrect references to it would fall here.

4. Systems Thinking & Connections (Ability to connect soil activity to broader systems, cycles, and sustainable practices)

- **Exemplary (4 pts):** The student makes insightful connections between the activities and the broader food system or environmental context. In answers (especially B3 Q4 or the synthesis question), they explicitly describe how composting turns a linear waste stream into a closed

loop, how maintaining soil carbon links to climate change mitigation and farm sustainability. They might mention multiple systems or scales, e.g., "By composting, a farm returns nutrients and carbon to the field (farm system), reduces landfill methane (waste management system), and pulls CO_2 from the atmosphere into soil (global carbon cycle)." They see the "big picture" and may even reference concepts like circular economy or specific sustainability goals discussed in class.
- **Proficient (3 pts):** The student shows a good grasp of systems thinking with at least one clear connection made. For example, they might note that composting reduces waste and improves soil, or that soil carbon helps plants grow which then capture more CO_2 – indicating a feedback loop. They understand there's a cyclical aspect to what they did. The answer might focus on one dimension (e.g., mostly climate or mostly waste) but it's on the right track.
- **Developing (2 pts):** The student's connections to the bigger picture are weak or vague. They might say something like "It's circular because you reuse stuff" without further detail, or "compost helps the environment" without saying how. They could be stuck on one perspective, like only noting "plants need compost to grow" (true, but not expanding to waste reduction or carbon cycle explicitly). They may not use terms like linear/circular even if those were discussed, indicating they haven't fully internalized that framing.
- **Beginning (1 pt):** Little to no evidence of seeing the bigger picture. The student might treat each activity in isolation with no reference to broader implications. For instance, they might answer the circular system question by repeating the steps of composting but not actually comparing to a linear system, or they might leave it blank. If they only state something very narrow like "Compost cake is circular because it's shaped like a circle" (misunderstanding the concept), that would fall here. Essentially, they do not demonstrate understanding of how these ideas connect to sustainable food systems or environmental issues.

5. Effort and Presentation (Neatness, completeness, and effort in communication)

- **Exemplary (4 pts):** The student's work is neatly organized and shows a high level of effort. Tables are filled in clearly (legible handwriting or well-structured sentences), questions are answered in full sentences with care taken to explain reasoning. The student may have added diagrams or extra notes, indicating pride in their work. It's evident they took time to reflect on the questions.
- **Proficient (3 pts):** The work is clean and readable, with all parts completed. Answers are sufficiently detailed though perhaps not exceptionally in-depth. There may be minor spelling or grammar issues, but nothing that impedes understanding. The student's effort meets expectations – they did what was asked reliably.
- **Developing (2 pts):** The presentation is somewhat disorganized or rushed. Some answers might be one-word or very short, suggesting minimal effort to articulate thoughts. Possibly some parts of the worksheet are sloppy or crossed out, but still, the student attempted most sections. The overall effort seems inconsistent – they might have focused on one part they found interesting and neglected others.
- **Beginning (1 pt):** The work appears very incomplete or carelessly done. Hard to read handwriting or numerous blanks in the worksheet suggest a lack of effort. The student may have given up on answering several questions or provided answers so fragmentary that they don't convey meaning. Little attention was paid to instructions (e.g., answers written in random places, tables not used properly). This level would imply the student did not meaningfully engage with the assignment.

Teacher Guidance: Use this rubric flexibly. You can weight certain categories more if they align with your learning objectives (for example, you might double-weight Conceptual Understanding or Systems Thinking if those are critical outcomes for the lesson). When grading, consider providing feedback for each category so students know where to improve – e.g., "Great observations and data!

To improve conceptual understanding, explain *why* you think Soil A had more carbon, not just that it did." Encourage students who did well to share their insights in discussion, especially for the systems thinking piece, to inspire peers. Those who struggled with connections might benefit from a follow-up activity (perhaps a concept map of the soil carbon cycle). Finally, celebrate the inquiry: these activities are meant to be exploratory and fun. If most students understood that carbon in soil is important and that we can influence it through our actions (like composting), then the core goal of Lesson B has been achieved. ✔️