Decomposition Lesson 5: How can we plan an investigation to help us answer our questions about decomposition?

Description: In this lesson, students will work in pairs to plan an investigation that will help them answer one of the questions they have generated about decomposition. They will make decisions about what materials to use, how they will set up their jars, and what they will look at each day as evidence of decomposition. They will then set up their jars.

Objective: Students will make a plan for how to use two jars and provided materials to design an investigation that helps them answer a question about decomposition.

Concepts/Subconcepts Addressed:

- Consumers eat dead things which provide the consumers with the matter they need to grow and the energy to carry out life functions.
- When plants "decompose," they are being turned into something else. This process also relies on other organisms (like fungi and worms).

What Students Figure Out: Students will figure out that they can develop an investigation plan that will help them make progress on understanding an aspect of the phenomenon that they are curious about. Developing a plan involves thinking about how many things to change at once and how to keep track of evidence of decomposition over time.

Estimated Time: Four 45-minute class periods.

Materials:		**Set-Up and Preparation Notes:**
• Student investigation notebooks • Chart papers from Lesson 4 with student questions • Checklist for student feedback • Enough jars for each student group to have 2 jars • Aluminum foil to use as jar lids, with something to poke holes in it (such as a pencil or chopstick) • Materials that students can put into their jars- see **Teacher Note** below • Lesson Slides		• Before Day 1 of this lesson, print out an investigation notebook for each student. Be sure to have a plan for how you will help students keep track of these- you may want to collect them at the end of each class, or you might have students place them in a central location. • See **Teacher Notes** below and in Day 4 for additional information about how to set up the jars. You may want to have some materials ready to show students as they are planning their investigation in Days 2-3.

ELL/Special Education Supports: Consider which of your students may need additional support with writing their plan in their notebooks. You may want to allow some students to complete their notebook digitally– but be aware that they may need support with drawing their ideas.

Teacher Note: Investigation Materials

Consider ahead of time how many choices you want to provide for students. Providing some limitations will make it easier for you to get materials and for students to compare what they find across jars. We recommend including a limited number of fruits and vegetables with different properties (such as grapes, strawberries, carrots, and lettuce). Students should also have access to real soil that comes from outside, which contains microbes that are important for decomposition. If students have questions about the role of soil you may want to also provide an alternative substrate like gravel or sand.

You will also need to be able to put water into the jars (in order to represent rain outside and maintain conditions that allow mold to grow) and allow air to pass through. One way to do this is to cover the jar with tin foil and use a thumb tack or skewer/chopstick to poke holes in the top. Water can then be put into the jars by putting an eyedropper through these small holes or briefly removing the foil.

Additional information about materials to use in this investigation can be found in the investigation overview document.

Procedure and Facilitation Points:

Day 1: Introduce the investigation as a tool for making progress on students' questions about decomposition.

Teacher Note: Preparation for Day 1

Before this lesson, review the posters from Lesson D. Make a list of all the possible investigation questions students have posed that you want to allow students to choose from. Write these on a slide, chart paper, or paper you print out so they can be shared with students.

The Plant Investigation Decomposition Overview provides examples of questions that we would recommend for investigations and those that we provide some caution about or think are less useful. It is very likely that your students will have posed questions like these on their chart papers and in discussion over time. Choose questions that are doable given the materials and time that you have. You might choose to allow students to pick 1 or 2 that you know are

harder to answer, as those provide interesting discussion too. Provide enough questions for students to have some agency in choosing and so that no more than 2-3 groups per class are investigating the same question.

Another option is to develop 1-3 shared class investigations. You can post a list of questions and have students discuss which ones would be the most interesting or important to make progress on as a class. Then, the activities in this lesson could be carried out as a whole group.

1. **Make a connection to the anchoring phenomenon and students' progress:** Say to students, *In the previous lesson, we developed questions about decomposition that we think we can answer by doing an investigation. Today, you are going to start to think about which questions you're most interested in investigating and thinking through how you would investigate these questions. Then, we will develop final plans and start the investigations in the next few days.*

   As needed, briefly review what makes a question testable, and how to go from a question to an investigation plan, using the slides from Lesson D. Here are some options for how to do this:
   - You can ask students to do a brief warm-up in which they turn and talk about 4 questions, discussing which would be easier and harder to test.
   - You might point out some ways to move from questions to investigations that can be helpful. For example,
     a. Does X decompose faster than Y? ---> *Put X material in one jar; Y in another jar*
     b. Does X help decomposition or make it slower? —> *Do X or more of X in one jar; Don't do or do less of X in another jar*
     c. Where are the X coming from? —-> *find a way to prevent them from coming from a source*

2. **Show students the list of questions you generated by looking at their chart papers from the previous lesson.** Review some of the questions, discuss why you chose these but not some of the other questions, and briefly talk about any that you added.

3. **Distribute the investigation notebooks:** Pass out the student investigation notebooks. Allow students to look through them and write their name on the front. Explain that they will use the notebook to develop a question and plan, keep track of evidence, do research, and, later, make a claim based on the evidence they gather from the investigation.

4. **Investigation brainstorming:** Ask students to work individually or in pairs to complete the first page- to write down three questions they would be interested in studying and sketch initial ideas for how they would answer the question.
   Note: You can either have students do this individually and then pair them based on what questions they select or pair up students who you think work well together and have them work together to discuss what they want to study.

5. **Closing**: Explain that you will look at the questions and ideas they came up with and use this to pair up students and/or assign pairs to a question. Tomorrow they will get to develop their plan!

Teacher Note: After this lesson, you will need to assign partners for the investigation. To do this, consider students' common interests. When possible, pair up students who are demonstrating interest in similar questions, as well as students that you think will work well together. Assign each pair or trio to one investigation question. Make a slide that lists questions and students who will investigate that question. Try not to have more than two groups investigating the same question– it is fine to have some repetition since different groups may get different results due to slight differences in their plans, which can support further discussion.

Day 2: Investigation planning

1. **Review the previous day's activity and go over the partners and questions they will study.** Review partners and questions to be studied. Use a slide or a piece of chart paper to keep track of who is working together and what question they will focus on.

2. **Go over what students will do to develop a plan.** Project the planning page of the investigation notebook and review what you are asking students to do to develop a plan. Students are going to need to make decisions about what materials to use, how to use them, and what they are going to use as evidence or look for each day. Show students the materials that will be available and briefly review what they might be used for.

   Tell students that as they develop their plan, they should think carefully about how the plan will help them figure out the answer to their question. Show them the example investigation of temperature and ask them to turn and talk about whether this is a good investigation for answering the question, "Do warmer temperatures help decomposition?" or if they think that there are ways to improve the investigation to help you answer the question.

Teacher Note: In the temperature investigation, many factors are different across the two jars (not just temperature, but also the amount of light, water, and which fruits are used) so that even if there is a difference in the two jars, you wouldn't know what is causing this difference. It might also be difficult to tell a difference if you use strawberries in one jar and carrots in the other because they will look different as they decompose. If you've talked with students about "controlling variables" or "changing just one thing" you can connect this example to that concept when they have identified some of the problems. What's most important is to highlight their reasoning– if so much is different, then you don't know if the difference in mold is really because of the thing you're trying to test (temperature) or something else.

3. **Investigation planning:** Allow students time to work in partners on the first page of their plans (what materials they will use, how they will set up the jars, what they will keep the same and change). Encourage them to use scrap paper or whiteboards to sketch their ideas, then write their plan when they agree as a group.

4. **Teacher work to prepare for the next day's lesson:** After this lesson, review students' plans. Provide feedback you would like them to address with sticky notes and identify any groups that will need more support from you to finish their plans.

Day 3: Finish plans

1. **Review the work students have begun on their plans:** Begin by telling students you were excited to see their ideas. Point out some examples where students were working through their plans in useful ways. If there is a question or feedback you want to provide to the whole class, do that now as well. Explain that by the end of today's class, students should be ready to set up their jars tomorrow. This means that they will have a plan for what they will put in their jars and will have begun thinking about what they will look for as evidence of decomposition over the next few days and weeks.

2. **Go over the next page of the investigation notebook:** Review the directions for the second page of the planning sheet. Remind students of their chart describing evidence they want to attend to. Tell students you want them to spend a bit of time talking with their partners about:
    - What evidence will they pay attention to (refer to the chart paper started in Lesson B)
    - How to describe and compare how the jars are changing over time: For example, if they say "how shriveled it is" or "how much mold there is," what can they do or record to be able to compare that from one week to the next?

3. **Investigation planning and preparation:** Provide students with a set of tasks they can do that allows you to have the space to move around and check with students who need further help and other students to finish their plans and use their time in a way that feels productive. You might consider asking students to do the following tasks:

    - Review your feedback on the post-it note and address it
    - Work on the second page of the evidence sheet in their investigation notebooks
    - Find another group to share their plans with and get feedback from.
    - Consider having students use a checklist to use for evaluating their own plan or another group's plan.
    - If they finish, bring their notebook to you and complete a reading or piece of research that you assign.

    During this time, you should move around the room to check with any groups that you know need support and help them finish their plans. **What is most important is that by the end of today, each group has completed the first sheet of their planning document and that you can see that they are ready to collect materials and set up their jars the next day.**

Day 4: Setting up the jars

1. **Introduce today's activity and how students will assemble their jars:** Explain to students that today they are going to set up their jars. This is going to be very exciting, but we need to make sure that we go about doing this in an organized way. Here are some suggestions for how to do this:
    - One option is to have all materials in a central area where you will help students assemble their jars. Alternatively, you can make different stations around the room (such as one for the jars, one for the soil or other substrates, one for fruits and vegetables, one for lids, and one for labels) and have student groups go to each station.
    - Make sure students have filled out the materials list in the investigation notebook (and that you have okayed their plan) so that they know what they are putting in the jars ahead of time (as opposed to making decisions when they get to the materials)
    - If possible, enlist another adult to be in your classroom to support students during the assembly process.

2. **Go over what students will do before and/or after they set up their jars**: Explain the process you want students to follow. Consider the following options for what students can do while they are waiting or after they are finished:
    - Some students might still be finishing their writing about what kind of evidence they will attend to- they should be completed by the end of class today.
    - Consider having another piece of work that students can do when they are done or while they are waiting. This could include reading an article about decomposition, reviewing another science topic, or reading an article about a science-related current event.
    - After students have finished setting up their jars, they should complete the "Our Jars on Day 1" page in their investigation notebooks (page 7). They should draw a picture of their jars and write down anything interesting they notice.

3. **Jar Assembly:** Provide time for students to set up their jars.

4. **Closing**: Explain to students that they will make observations of their jars over the next 1-2 weeks, and express excitement about this process. Make sure that all students have clearly labeled their jars and have put them in places that they will be able to access in subsequent classes. Have students help clean up the classroom.