Matter
Lesson 1: Anchor Lesson: Introducing the Pond

Grade: 5	Length of lesson: 65 minutes	Placement of lesson: 1 of 7
Anchoring Phenomenon: A healthy pond near a school has changed, and students see that there are a few dead fish in the pond.		
Unit Learning Goal: We can use our understanding of the particulate nature of matter and properties of matter to explain the world around us.		
Lesson Main Learning Goal: Scientists make observations and ask testable questions to study water. **Science and Engineering Practices:** Developing and Using Models: Develop a model to describe phenomena. (Secondary) Asking Questions and Defining Problems: Identify scientific (testable) and non-scientific (non-testable) questions. **Crosscutting Concept:** Scale, Proportion, and Quantity: Natural objects exist from the very small to the immensely large.		
Unit Central Question: How can we figure out what was mixed with pond water that could have changed the water?		**Lesson Focus Questions:** What is changing in the water that is causing the death of living things, and how can we, as scientists, investigate the water?
Science content storyline: The phenomenon of a local pond that has dead things in the water suggests that something has changed in the water. Students begin to investigate the water by making observations and asking testable questions.		
Ideal student response to the Lesson Focus Questions: Students share their current thinking about what could have happened to the water and how we might investigate the phenomenon.		

Preparation

MATERIALS NEEDED	AHEAD OF TIME
Teacher Resources • *Communicating in Scientific Ways* poster • Lesson 1 video from Tennessee Aquarium **Student Handouts** • HO1.1 *Communicating in Scientific Ways* (optional; 1 per student; this may have been handed out in a previous unit) • Lesson 1_HO1 *Initial Models* (optional; 1 per student) **Other Materials** • 3 1.5-liter bottles to prepare pond water samples • 10 ml scoop • 40 ml (4 scoops) iodized salt • 1 small syringe • 10 ml hand soap (needs to be milky and white for later investigations) • Food coloring (not gel -- red, blue, green, yellow) • 16 4 oz water bottles with lids (For 8 healthy water samples and 8 unhealthy water samples or one of each sample per small group. Use a permanent marker to label each container with a "U" or "W") • hand lenses (1 per group of students) • 3"x3" sticky notes, 1-3 per student • fine-point, dark-color markers (1 per student) • chart paper and markers • painter's tape for hanging posters	• Review the information in the *Content Background* document about "Reflections on Models" (both "What are models, and how can they be used?" and "Purpose"). • Review the focus questions for the unit. You will be listening to student thinking carefully to surface and capture as many of these ideas as you can through student contributions in class. • Determine where you will post the Communicating in Scientific Ways (CSW) poster. It will remain posted throughout the unit. • Create a Driving Question Board. This board should be posted throughout the unit somewhere that is visible and accessible to students and referred to at the end of each lesson to check off any questions that were answered and with an opportunity to add more student questions. • Prepare all handouts as needed. • Check the video link to make sure it's working. • Prepare the water samples. First you'll add food coloring to a large batch so that both the healthy and unhealthy samples are the same color. To make the water with food coloring mixture, use the ratio of 1 liter of water with: 1 drop blue, 1 drop green, 1 drop red, 2 drops yellow. It should still be light enough to see through easily, so the food coloring doesn't affect turbidity. If it's too dark, you can always add more water to dilute the mix. For the "healthy" pond water, you'll use plain water with the food coloring. For the "unhealthy" pond water samples, use the water with the food coloring to make a large sample then pour it into the smaller containers and label each container with either a "U" for unhealthy or "H" for healthy. The ratios for making the unhealthy samples are for every 1 liter of water, you'll add 40 ml of salt then shake until it's fully dissolved. After that you can add 10 ml of soap and gently swirl to mix it in without creating a lot of bubbles. The soap and salt should stay fully incorporated in the water throughout the unit.

Lesson 1 General Outline

Time	Phase of lesson	How the science content storyline develops
5 min	**Introduction:** Review the Communicating in Scientific Ways poster and introduces a scenario.	
3 min	**Focus Question:** Introduce the phenomenon and Lesson Focus Questions: **What is changing in the water that is causing the death of living things, and how can we, as scientists, investigate the water?**	Students have many ideas and questions about the phenomenon that they can use to develop a more scientifically accurate way of thinking about matter.
10 min	**Setup for Activity:** Watch a video about how scientists study bodies of water and water quality. Make observations and write additional questions about the pond in the notebook.	
20 min	**Activity:** Look at two water samples—one from the pond near the school and the other from a "healthy" pond. Make observations and generate questions. What are ways we can investigate the quality of the water? Record questions in their notebook. Develop models of what students imagine each water sample looks like if you were to zoom way in and share models with small groups.	
10 min	**Follow-up to Activity:** Discuss the and apply the concept of testable and nontestable questions to their own questions.	
15 min	**Summarize and Synthesize:** Write on sticky notes their testable questions about the pond water. Create a Driving Question Board to capture questions about the Lesson Focus Questions.	
2 min	**Link to Next Lesson:** Links science ideas to the next lesson.	Several ideas emerge from the classroom discussion that have to do with what could be in the pond water and how we might investigate the water.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
5 min	**Introduction** Synopsis: Teacher reviews the Communicating in Scientific Ways poster and introduces a scenario.	Engage students in communicating in scientific ways. (Slides 1-2)	Today we are going to start investigating a new phenomenon. Before we begin, we are going to take a minute to review our Communicating in Scientific Ways chart. ***NOTE TO TEACHER:*** *Show students the Communicating in Scientific Ways (CSW) poster that you have on the wall and distribute copies of the chart to students (HO1.1, Communicating in Scientific Ways). Have students attach it to their notebook as you have done in the past or reference the handout if they already have one from an earlier unit.* Take a look at your CSW handout, and remember, that handout also matches our poster in the room. Review the CSW prompts with a partner and discuss when and how you have used the CSW prompts in past units. **Are there any CSW prompts that you feel unsure of or need further discussion?** As we have done in past units, we will use our CSW chart to help us communicate with each other. As we learn in this unit, I will refer to this chart and suggest rows that may give you ideas as you talk in your small groups or with the class. Also remember that you as a scientist are not	

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			limited to using these sentence stems. These are meant to give you ideas about a lot of ways that scientists communicate, but you will also develop your own way of sharing your ideas. You can make suggestions too! I will be listening to hear how you are communicating like a scientist. **Let's take a look at row #2 observe. How have you made observations in class before?** While you hear about a new phenomenon today and you want to share your ideas, feel free to use these sentence starters if you need help. As others are sharing, use the sentence starters to help you build on what they are saying or to agree or disagree with what they are saying. Doing this will help us all to communicate like scientists. ***NOTE TO TEACHER:*** *You may want to put die cut stars or sticky notes on your CSW chart to call out #2 and rows indicated by students.*	We use the prompts to talk about things we observe—"I see …" or "I notice". To share my ideas with my group I use the prompts "My idea is …" from #4 or "I agree with you because …" from #7. **How did the prompts help you to share your ideas?**
3 min	**Focus Question** <u>Synopsis:</u> Teacher introduces the phenomenon and Lesson Focus Questions: **What is changing in the water**	Set the purpose with a focus question. (Slide 3)	We are now going to hear about a situation going on in another nearby community. There's a pond downhill from a school where students often visit. One day, the kids noticed some dead fish on the side of the pond. That's really unusual for this pond--the kids had never seen that before. They wondered if the water was safe for them to play	

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	that is causing the death of living things, and how can we, as scientists, investigate the water? <u>Science Content Storyline</u>: Students have many ideas and questions about the phenomenon that they can use to develop a more scientifically accurate way of thinking about matter.	(Slide 4)	in. **What is changing in the water that is causing the death of living things, and how can we, as scientists, investigate the water?** Today, those will be our focus questions. ***NOTE TO TEACHER:*** *Display those focus questions on the board or somewhere visible to students. Students may have questions about the imaginary location of the pond. While the location is not central to the unit, it does need to be in a location that has winter temperatures cold enough for roads to be salted. You may want to assign a more specific location for the class or simply remain vague about the specific school by saying it's in a nearby town. Or you may want to pick a town that's too far away for them to know anything about so location is not a distraction.*	
10 min	**Setup for Activity** Students watch a video about how scientists study bodies of water and water quality. Students make observations and write additional questions about the pond in their notebook.	Engage students in communicating in scientific ways. Make explicit links between science ideas and activities	We'll watch a video to learn more about how scientists study a body of water and investigate water quality. Record in your notebook what you observe in the video and any questions that arise. ***NOTE TO TEACHER:*** *Show the video.* Share with a partner what you observed in the video and any questions you have. When you	

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		(before the activity).	share, use our CSW prompts #1 ask why and how questions, #2 observe, and #6 listen to others' ideas and ask clarifying questions.	
20 min	**Activity** Synopsis: We look at two water samples—one from the pond near the school and the other from a "healthy" pond. Groups make observations and generate questions. What are ways we can investigate the quality of the water? Students record questions in their notebook. Students develop models of what they imagine each water sample looks like if you were to zoom way in and share their models with their group.	Ask questions to elicit student ideas and predictions. Engage students in communicating in scientific ways. Engage students in using content representations and models. Make explicit links between science ideas and activities (during the activity). (Slide 5)	We have some samples of water from the unhealthy pond near this school and from another pond where the plants and animals seem to be healthy. I'm going to give each table group a sample from each pond. You'll have a chance to discuss them altogether, but first I'd like you to take some time to individually jot down in your notebook what you notice and what you wonder about these water samples. You can make a two-column chart in your notebook. You can write a "N" and "W" at the top of each column to mean "notice" and "wonder" (the teacher may model drawing this if it supports students). Everything that goes in the "Notice" column should be a description, in words or drawings with labels, of something we can see with our eyes. Write your "why" and "how" questions in the" Wonder" column. If you have ideas that are not observations, see if you can turn those into a question. ***NOTE TO TEACHER:*** *Move students into a small group of 3-4 students. Distribute water samples and hand lenses to each group of students.*	

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		(Slide 6)	Take a few minutes to share your observations and questions with your group. If they are helpful, remember you can use our Communicating in Scientific Ways sentence starters to share what you notice and wonder. You can use whatever stems are useful, but stems from #1 ask why and how questions, #2 observe, and #6 listen to others' ideas and ask clarifying questions are related to our discussion. At this point, we want to avoid disagreeing with one another, but we can always ask clarifying questions to make sure we understand what others are thinking. Now that we've started to think about what's happening in the unhealthy pond, we're going to see if we can capture our ideas that show what's happening in each water sample. I'd like you to make models on our handout (*distribute handout 1 Initial Models*) describing or showing your ideas about what could be in the water samples. Imagine you zoom *way*, *way* into each water sample. Use words and drawings to show your thinking. As you capture your starting ideas about what might be in each water sample, show enough detail for me to understand your thinking without talking to you. You can use a combination of	Both samples are clear. The unhealthy one is a little cloudy. When I shake them, this one makes more bubbles.

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			pictures, symbols, and words to fully communicate your ideas. ***NOTE TO TEACHER:*** *The handout HO1.2* Initial Models *provides an alternate to the student notebook entry and an example for what student notebooks might look like. Student models may contain drawings of the containers of the water. Models may indicate differences in the clarity of the water or show bubbles in the polluted sample. In the zoomed-in portion of the models, there may be squiggles or dots to indicate "stuff" in the water.* During this unit, we'll talk more about all these ideas, so if there's anything that feels puzzling to you, that's OK. At the bottom of the page beneath where you make your models, write down your questions. These will be really important later! Remember from our Communicating in Scientific Ways chart that when scientists are trying to figure something out, a lot of time their questions are what lead the way to learning brand new things. Let's take about 8 minutes to show your thinking on your models. Now that you've developed your initial models and questions, take about 10 minutes with your group to share your ideas and to practice using our Communicating in Scientific Ways sentence stems.	

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			NOTE TO TEACHER: *Split groups into no more than 3-4 students. As the groups discuss, walk among the groups and listen for student ideas. Are there any common ideas you hear? Are there any questions that will lead into the unit storyline? If so, prompt students to capture those questions on their paper to make sure they're incorporated into the Driving Question Board later in the lesson.*	
10 min	**Follow-up to Activity** Synopsis: Students discuss the questions they have been developing and apply the concept of testable and nontestable questions to their own questions.	Engage students in communicating in scientific ways. Make explicit links between science ideas and activities (after the activity). (Slide 8)	Our next task is to consider the questions that we have generated so far. Read back through your questions from your Notice and Wonder chart and your initial model and consider some ways we might answer some of these questions. After you've considered some ways to answer the questions, ask yourself, **Which questions could be answered by using data from an investigation?** ***NOTE TO TEACHER:*** *Testable questions could include the following: Is there something in the water that is killing the fish, and what is it? Can we get the bad stuff out of the water? What types of animals could be killed by the water (testable but unethical)? Does the pond water have other living things in it? Is there garbage in the pond water? Nontestable questions could include questions like these: Why would someone*	My idea is that the pond water is poisoned. **What do you mean by poisoned?** That idea makes sense to me because there are dead things in the pond. **Does this match with your ideas?** Kind of. I want to add to my idea.

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			poison the pond? Should we try to clean the pond? In your group, take a few minutes to discuss which questions are testable and which ones are not testable. You may be uncertain about some questions. That's OK! See if you can come up with a few examples of questions that are clearly testable and those which are not. Now as a whole class, let's have a discussion. **What are some questions that you feel are testable questions? What are some questions you feel are not testable? What are questions you aren't sure about?** As you share your ideas, I'll capture your questions in this two-column table in categories of testable and nontestable. We'll talk about those questions that we feel uncertain about and see if we can decide where those should go together. ***NOTE TO TEACHER:*** *Either on the board or using a document camera, make a table with these column headings: "Testable questions" and "Nontestable questions". There may be questions that don't easily sort into one of the categories. You may need to ask some probing questions to understand the group's ideas about the question, and the context of the question may change*	**Why did you decide that one was testable?**

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			whether it is testable or not. Some questions may be testable, but not by your 5th grade class. They would still be placed under the "Testable questions" category. *The SEP "asking questions and defining problems" requires that students distinguish a scientific question (e.g., Why do helium balloons rise?) from a nonscientific question (e.g., Which of these colored balloons is the prettiest?). Scientific questions are those that are answered by the data or evidence collected during a scientific investigation. Testable questions are answered by collecting and analyzing evidence and developing explanations based on that evidence. Questions that cannot be answered through scientific investigation are those that relate to personal preference, moral values, the supernatural, or unmeasurable phenomena.*	**Tell me more about that question.** **How would others classify that question? Why?**

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15 min	**Summarize and Synthesize** Synopsis: Students write on index cards or sticky notes their testable questions that we have about the pond water. The class creates a Driving Question Board to capture their questions about the Lesson Focus Questions.	Summarize key science ideas. Engage students in making connections by synthesizing and summarizing key science ideas.	We have a lot of ideas about our pond water samples and ways we might investigate the water. You may have heard some ideas in your small group that made you curious about something. Take a couple minutes to write down any new questions that came up for you today about what we need to figure out. While you have both testable and nontestable questions written down, we're going to focus on only the testable questions you came up with. As we get ready to build our Driving Question Board for this unit, each person will have the chance to write down 1-3 questions. Please be sure to write only one question on each sticky note and use a dark marker so we can easily see your questions. We'll share these questions in a few minutes. ***NOTE TO TEACHER:*** *Collect of have a student collect the water samples and hand lenses at this point. Someone may want to refer to them as they share their questions for the Driving Question Board, so you may want one on hand. Have students write their questions in marker so they're easier to read. Students will ask a range of questions. They will not all be answered in this unit. At this point, a question like "What is in the water?" should be on the Driving Question Board.*	

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			To wrap up our conversation today, we need to organize our questions. It is now time to create our Driving Question Board. Please join me by the board and bring a marker in case you think of more questions to add. I have extra sticky notes we can use when we think of more questions. **Can anyone share a question that is sticking with you from our conversation today?** ***NOTE TO TEACHER:*** *Have one student share a question from a sticky note. Ask others who have a related question to raise their hand and share that question. They can then organize those questions nearby each other on the board. Once there are no more related questions, ask if anyone has a question on a different topic. Continue this until all science questions are on the board. If anyone thinks up a related question as you're putting together the board, they can capture that question on a sticky note and add it.* It looks like we have learned a lot about asking questions today. These are all testable questions. During our unit, we'll see how many of these questions we can answer together. **Can someone describe what a testable question is and why those are important?**	It is a question that we can test! **What do you mean by test?** It is a question that we can do an experiment or investigation to answer. **How are testable questions different from others?** Others may include your opinion or what you like or don't like. **Can you give me examples of these?**

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2 min	**Link to Next Lesson** Synopsis: Teacher links science ideas to the next lesson. Main science ideas: Several ideas emerge from the classroom discussion that had to do with what could be in the pond water and how we might investigate the water.	Link science ideas to other science ideas (next lesson).	***NOTE TO TEACHER:*** *You may have to adjust this closing to reflect the questions and ideas that emerged from students during the lesson. You can make more specific links if this question or something similar is posted in the Driving Question Board.* Today as we shared our ideas, we developed testable questions related to what is in the water. We have also made models to explain our thinking. Next time, we'll continue to investigate what might be in the water.	