Lesson 1 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
5 min	**Introduction:** Teacher reviews the communicating in scientific ways poster and introduces a scenario.			
3 min	**Focus Question:** Teacher introduces the phenomenon and lesson focus question: **What's in the water that could have caused these changes and how can they investigate the water to figure it out?**	Students have many ideas and questions about the phenomenon matter that they can use to develop a more scientifically accurate way of thinking about matter.		
10 min	**Set Up for Activity 1:** 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. Students record questions in their notebooks.			
20 min	**Activity 1:** We look at two water samples - one from the school-based pond 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 notebooks. Students develop a model of what they imagine each water sample looks like if you were to zoom WAY in and share their models with each other.			
10 min	**Follow Up to Activity 1:** Students discuss the questions they have been developing and apply the concept of testable and non-testable questions to their own questions. Students consider whether the questions are testable or non-testable.			
15 min	**Summarize/Synthesize:** Students write their testable questions on index cards /sticky notes that we have about the pond water. The class creates a Driving Question Board to capture their questions about the unit focus question.			
2 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.	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.		

Lesson 2 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
2 min	**Link to Previous:** The teacher references the Driving Question Board and questions that involve the idea of dangerous substances in the water.			
1 min	**Focus Question:** Introduce today's Focus Question: **What might be in the water that could have killed the animals? What can we observe about each of those dangerous materials?**			
15 min	**Set Up for Activity 1:** Watch a video from the Tennessee Aquarium defining pollutants and explaining the most common pollutants that are found in water in communities. Set up data table together – as we mix each of these pollutants into water, what should we be recording?	Certain properties of matter can be directly observed. Mixing materials with water allows additional properties to be measured.		
5 min	**Activity 1:** Students work in groups to record observations about salt and salt mixed with water.	Directly observable properties include state of matter, grain size, color, among others.		
10 min	**Follow Up to Activity 1:** Groups compare results. Teacher asks questions to highlight differences in data collection procedures (quantity of salt, quantity of water, amount of mixing, etc.). Define "solubility" and "dissolve."	Properties are any traits of a material that can be measured.		
10 min	**Setup to Activity 2:** Design a plan to investigate the five pollutants.			
10 min	**Activity 2:** In expert groups, observe one pollutant and record observations. Do a gallery walk to look at each pollutant in and out of water.			
15 min	**Follow-up to Activity 2:** Create a class consensus chart with observations.			
5 min	**Summarize/Synthesize:** Students create a model for what they imagine it would look like if they were to zoom in on their expert group pollutant mixture.			
3 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.			

Lesson 3 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
3 min	**Link to Previous:** Review definition of "properties" and review the properties students figured out about each pollutant yesterday.			
2 min	**Focus Question:** Revisit the Focus Question we'll continue answering today: **What might be in the water that could have killed the animals? What can we observe about each of those dangerous materials?**			
15 min	**Set Up for Activity 1:** Teacher shares the initial (pre-mixed) weight of salt and water separately. Students make predictions about the mass when mixed. Teacher mixes the salt and water and finds the weight. Class discusses the results of the weight.	Matter remains in water, even if it seems to disappear. We can show this by measuring the mass before and after mixing. When matter is mixed together, mass is conserved even when matter seems to vanish.		
30 min	**Activity 1:** Use agreed-upon procedures to design the next stage of investigation. Introduce procedures for each of the common tests for each group to complete with and chart what each test will tell us. Allow groups to conduct additional tests if they have time. Groups work together to test each mixture.	Some properties that can be tested when materials are mixed with water include electrical conductivity, turbidity, pH, and solubility.		
15 min	**Follow Up to Activity 1:** Groups share out results.			
10 min	**Setup to Activity 2:** Model an evidence chart and model with particles.	The matter in the water-mixture is made of small particles too small to be seen.		
10 min	**Activity 2:** Jigsaw the creation of evidence charts & models with particles			
10 min	**Follow Up to Activity 2:** Define solubility and explore a model on PhET.	Solubility measures a material's ability to dissolve into a solvent (usually water). Matter is made of particles too small to be seen and these particles remain in the water even if we cannot see them. We can reperesent seen and unseen particles using models to show how the particles interact.		
5 min	**Summarize/Synthesize 2:** Summarize the properties we now know about each of the pollutants. Discuss whether there are any we can eliminate from being in the pond water.			
5 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.			

Lesson 4 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
3 min	**Link to Previous**: Review the meaning of "dissolving."			
2 min	**Focus Question:** What factors affect how fast soluble solids dissolve into water?			
15 min	**Set Up for Activity 1:** Refer to brainstormed list of variables from lesson 2 that may change the rate at which salt is dissolved. Expert groups develop a common procedure to test some of these variables (time how long it takes until you can't see the salt anymore).			
15 min	**Activity 1:** Each group tests one variable: water temperature, particle size, stirring speed, size of container, for example.	There are variables that affect how easily new matter will dissolve into the water.		
10 min	**Follow Up to Activity 1:** Combine results on a class results chart and interpret what they see in results across all the groups.	Increasing the temperature of the water will speed up how fast something dissolves. Decreasing the temperature slows it down. Smaller particles dissolve faster than larger particles. Stirring the mixture will speed up how fast something dissolves.		
10 min	**Summarize/Synthesize:** Create a class chart to summarize what factors about a body of water would either make salt dissolve more or less quickly.			
5 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.			

Lesson 5 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
5 min	**Link to Previous:** Review our previous ideas about each of the possible pollutants. **Focus Question:** How can we identify the pollutants in the pond water?			
30 min	**Set Up for Activity 1:** The class reviews each of the tests we have conducted on the pollutant. Students identify evidence that would support claims that the pond is polluted with salt, detergent or fertilizer. Students develop charts with sticky notes describing possible evidence for each claim.	Properties are any traits of a material that can be measured.		
20 min	**Activity 1:** Students develop a plan to test the school-based pond water. Students develop labeled storyboards the describe their plans.			
10 min	**Follow Up to Activity 1:** Students conduct a gallery walk to share and get feedback on their plans.			
10 min	**Set Up for Activity 2:** Groups review their feedback and make revisions to their investigation plan			
20 min	**Activity 2:** Groups conduct the investigations they planned.			
20 min	**Follow Up to Activity 2:** Class shares their results and reach consensus about what is in the water or not in the water.			
20 min	**Summarize/Synthesize:** Students write an argument (C, E, R) about what is in the water and what is not in the water.	Properties of matter are used to identify substances.		
5 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.			

Lesson 6 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
2 min	**Link to Previous:** Link to claims and evidence made in lesson 5 to establish we have salt and detergent in pond water.			
2 min	**Focus Question:** Can we get the water to be safe again?			
5 min	**Set Up for Activity 1:** After the teacher explains the distillation apparatus, **s**tudents predict whether the water will conduct electricity before and after running through the distillation. Students explain their predictions based on their thoughts about what will happen to the particles of water and salt in the distillation apparatus.			
15 min	**Activity 1:** Teacher shows the video distillation apparatus. Students draw/represent their observations and ideas about what is happening at different points in the distillation demonstration.	The phase of water can change from liquid to gas and back to liquid. When water changes from liquid to gas, the salt or detergent stays behind, leaving pure water when it changes to liquid again.		
5 min	**Follow Up to Activity 1:** Discuss how the particle model of matter can help us describe what happened to the pond water and the pollutants in the water. The teacher shows the class the evaporated petri dishes as they make sense of what happened in the distillation.			
5 min	**Set Up for Activity 2:** Discuss the word “gas” and students’ understanding of the term. Show some images that convey key ideas about gas and get students’ initial ideas about these images and what they mean.	Gas is matter.		
10 min	**Activity 2:** Use PhET to show particles and phase change. Ask students what they would see in “pure water” compared to water with the pollutants. The teacher asks questions to help students make sense of observations and results by revising earlier models to explain how the salt was removed.	Models can be used to show that matter, including gas, is made of particles too small to be seen.		
5 min	**Follow Up to Activity 2:** Teacher uses the model of phase change to explain conservation of mass.	When it changes into gas, the same amount is still there and gas is still matter.		
2 min	**Summarize/Synthesize:** Teacher summarizes the link between the science ideas explored today with the phenomenon.			
5 min	**Link to Next Lesson:** Teacher links science ideas to the next lesson.			

Lesson 7 General Outline

Time	Phase of lesson	How the Science Content Storyline Develops	STeLLA Strategies	Notes
5 min	**Link to Previous:** Review the key idea from Lesson 6 that pollutants are not easy to remove once they are in the water. Revisit the DQB to identify a cluster about how the pollutants got into the water in the first place.			
5 min	**Focus Question:** How did the pollutants get into the pond in the first place?			
5 min	**Set-up for Activity 1:** Students look at the model of the school/pond system and think individually about how the pollutants got into the pond then share ideas with a partner.			
10 min	**Activity 1:** Class discusses their ideas about what caused the pollutants to get into the pond and creates a class model.	Models can be used to communicate our ideas. Matter is made of particles too small to be seen.		
5 min	**Follow up to Activity 1:** Class discusses how thinking about particles helped them explain what caused the pollutants to get into the pond.	Natural objects exist from the very small to the immensely large.		
5 min	**Set-up for Activity 2:** Students review their previous learning to identify useful ideas and representations (models) that will be useful in developing a model of the school-pond system that explains how the pollutants got into the pond. Class creates a class model.			

10 min	**Activity 2:** Students learn about another class of students who are investigating their own polluted pond water. Students develop an evidence-based explanation about what pollutant is likely in the water.			
20 min	**Follow Up to Activity 2:** Students will write an explanation of what MYSTERY pollutant is in the pond and support that claim with evidence from their investigations about the properties of the pollutants and reasoning using their understanding that the properties of a substance can be used to identify that substance.	The properties of a substance can be used to identify that substance.		
5 min	**Summarize/Synthesize:** Return to the Driving Question Board			