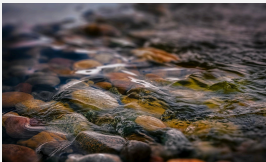


STORYLINE

UNIT 5.2: HOW CAN WE MAKE WATER HEALTHY FOR ALL LIVING THINGS?

Lesson Set One • Lessons 1-7

Lesson	Phenomenon	What we do	What we figure out
Lesson 1 Anchoring Phenomenon <i>How can we tell if water is healthy or unhealthy?</i>	 There are five different water samples that look very different from each other.	Work in small groups to sort pictures of water into “healthy,” “unhealthy,” and “unsure” categories. Closely observe water samples and make models showing what we think is in the water that is making them unhealthy and explain what we could do to make them healthy again.	We have a lot of questions about what is in the water that makes it healthy or unhealthy. We wonder if water can be healthy for some people, plants, or animals but not for others. We want to know how to make water healthier.

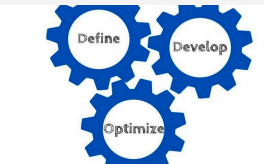
↓ Navigation to next lesson: *We are wondering what exactly is in the water samples.*

Lesson 2 Investigation <i>What else can we figure out about our water samples?</i>	 Several water samples look and smell very different.	Investigate the water samples and record their properties on our data table. Discuss our results and create a class table with the properties of the water samples that we observed. Identify what materials are in the water samples based on the properties we observed.	Our water samples have different properties (odors, colors, cloudiness, solids, magnetism). These properties can help us identify the materials in our water samples. Each of our water samples is a combination of different materials.
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↓ Navigation to next lesson: *We wonder what else is in the water and which materials make water healthy or unhealthy, and for whom.*

Lesson 3 Investigation <i>How can we design filters to separate these materials out of the water?</i>	 We can design and test a filter to separate out materials that can be seen in the water samples.	Decide to start improving the health of our water samples by removing the visible materials. Brainstorm and read about ideas to build filters. Identify success criteria and limiting constraints for designing filters. Design a filter and investigation plan for one of the water samples. Test the water filters.	We need to account for criteria and constraints when designing solutions for engineering problems. During design testing, we collect data to decide if a design meets the criteria. Since the materials in the water are matter, we can weigh our samples to see how much matter is removed by filtering.
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↓ Navigation to next lesson: *Now that we have designed a filter and an investigation plan to test it, we are ready to build our filter and carry out the investigation.*

Lesson 4 Investigation <i>How can we develop and optimize our filters to separate unhealthy materials out of the water?</i>	 Filters can remove some stuff we can see from the water.	Optimize and test the filter we designed in Lesson 3. Use our investigation data to decide how to redesign our filter. Compare our redesigned and original filters to decide which one worked best to remove materials from our water sample. Identify how our filter design and investigation activities fit with the Engineering Design Process.	Our water samples weigh less after filtering, so we know that we got at least some of the materials out of the water. We identify how our filter design and investigation activities fit with the Engineering Design Process. Our redesigned filters were able to remove a lot of the materials that we could see in our water samples, but we are still not sure how healthy the filtered samples are.
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↓ Navigation to next lesson: *We wonder if there are things in the water that we could not filter out.*

Lesson 5 Investigation <i>How can we figure out more about unseen matter that can be in water?</i>	 Water contains seen and unseen matter	Read articles about the health of water. Decide which types of water are healthy or unhealthy and for whom. Develop a model that explains how water that looks clear can contain unhealthy matter.	Water can have a color and still be healthy, and it can look clear but be unhealthy. Water can have matter in it that is too small to see with the human eye. Matter that is too small to be seen is called <i>particles</i>.
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↓ Navigation to next lesson: *Now that we figured out that there can be particles of matter in water that are healthy and unhealthy, we wonder if there are unhealthy particles in any of our water samples.*

Lesson 6 Putting Pieces Together <i>How can we figure out if any of this matter that could be unhealthy is in the water samples?</i>	 Test strips can identify matter in water that we cannot see.	Recall that some water contains matter that could be unhealthy. Wonder if our water samples contain any of that type of matter. Test our water samples with test strips and magnets and record the data. Use the data as evidence to explain how we know that there is matter in some of the water samples that is unhealthy for some living things and for some purposes. Consider an example of water testing in the school community. Have a class discussion about what we have figured out so far.	Water can contain other matter that is too small to be seen. Matter can be detected with test strips and magnets even if it cannot be seen. The water samples contain matter that is unhealthy for some living things and for some purposes.
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↓ Navigation to next lesson: *Now that we figured out that there is matter that could be unhealthy in some of our water samples and that some of that matter is too small to be seen, we wonder how we can use what we have figured out to help when there is matter that can be unhealthy in water causing harm.*

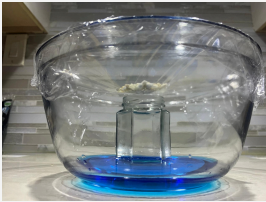
Lesson 7 Putting Pieces Together <i>How can we use what we figured out about our water samples to identify the cause of a rash?</i>	 A child swims and gets a skin rash.	Celebrate what we have figured out so far. Revise our initial class consensus model. Read about a child who got a skin rash after swimming. Make observations of the water that he swam in. Analyze data to identify the type of matter in the water based on the matter's properties. Construct a poster that could warn others of about potentially unhealthy matter in water. Revisit the DQB . Discuss investigation ideas.	We can make observations and use it as evidence for an explanation. We can use properties to identify types of matter. We can use standard units of measurement to help identify types of matter.
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↓ Navigation to next lesson: *We figured out that making observations of a material's properties can help us identify what it is. Now that we know how to identify those types of matter, we think the materials/matter in the water are making it unhealthy so we are wondering what we can do to get matter out of the water to make it healthier.*

Lesson Set Two • Lessons 8-15

Lesson	Phenomenon	What we do	What we figure out
Lesson 8 Investigation <i>How can boiling help to remove unhealthy materials from the water samples?</i>	 Boiling water changes its form.	Watch videos of water boiling to observe the physical changes. Analyze and interpret data from boiling our water samples. Share our results and create a class model to explain our findings at a particle level. Read an article to understand why people sometimes have to boil drinking water.	Boiling water causes it to change form but the water does not vanish. Boiling our water samples removes some, but not all, of the unhealthy matter. The matter that stays in the sample has properties that keep it from being removed. Boiling kills microorganisms that live in water.

↓ Navigation to next lesson: *We figured out that boiling only sometimes works to remove material that makes the water unhealthy. We wonder about the properties of the water that collects on the lid of the pot as it boils.*

Lesson 9 Investigation <i>How can we remove unhealthy matter from water without boiling it?</i>	 Solar stills change water properties.	Observe and analyze data from a solar still. Use our data as evidence to explain how the solar still works to make water healthier. Build a model for how the solar still works. Discuss how to make the solar still meet our design constraints better.	A solar still is an inexpensive and easy way to make water healthier but takes a long time. A solar still starts and ends with approximately the same amount of matter. It works by using heat to separate particles that have different properties.
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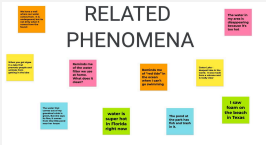
↓ Navigation to next lesson: *We wonder about how to remove unseen things from larger amounts of water.*

Lesson 10 Investigation <i>How do scientists remove matter that is making water unhealthy?</i>	 Water treatments used to solve water problems can help us identify solutions for our samples.	Decide we need to figure out more about what scientists and engineers do to solve water problems. Establish a connection between our water samples and the water problems that scientists and engineers try to solve. Read and share about the different ways scientists and engineers design solutions to water problems.	Scientists and engineers design solutions for water problems in a similar process to how we design solutions for our water samples. There are many different design solutions for water problems all over the world. One way to make water healthier is to add substances to change the unhealthy properties of the matter in the water.
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↓ Navigation to next lesson: *We figured out that adding substances can make water healthier and want to try this with our water samples.*

Lesson 11 Investigation <i>How can adding a substance make the water healthier?</i>	 Adding substances to water changed some of its properties.	Discuss substances we want to add to make changes to water. Plan an investigation to add a substance to our water samples. Investigate how our water samples change when we add a substance. Use our findings to compare all the methods we use to make our water healthy.	When combining substances, a new substance may form with new properties, or may not, with unchanged properties.
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↓ Navigation to next lesson: *We figured out that adding a substance to water samples changed their properties, and we wonder if this change in properties also means a change in the property of weight.*

Lesson 12 Putting Pieces Together <i>What have we figured out about making water healthier for a variety of living things?</i>	 Our related phenomena from Lesson 1.	We revisit our Growing Ideas charts. We develop a model for how our water samples became healthier throughout the unit. We identify evidence from our investigations of water samples so that we can explain a new phenomenon.	We can use what we have figured out in the unit to explain why filtering, boiling, or adding a treatment to an unhealthy water sample results in a healthier water sample that has materials with different properties. We can use the evidence from our investigations to explain what is happening in other related phenomena.
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↓ Navigation to next lesson: *We figured out how to make our water samples healthier and want to use that to explain new phenomena.*

Lesson 13 Investigation <i>What community water problems need solutions?</i>	 Different communities face different water problems.	Read about water problems in different communities. Identify criteria and constraints for solving our water problems. Consider the difference in scale between our water samples and these community problems. Brainstorm solutions to our water problems. Begin to design solutions to our water problem.	We identify a water problem in a community. We establish criteria and constraints for that water problem. Different solutions may be required when the problem is at a larger scale.
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↓ Navigation to next lesson: *We identified criteria and constraints for community water problems and have designed initial solutions, but we need to get feedback and optimize the solutions.*

Lesson 14 Putting Pieces Together <i>How can we use our design evaluations to refine our water solutions to better address the needs of our community?</i>	 Evaluating our designs to test how well they will address the needs of a community.	Develop criteria and constraints for our community water problem. Give and receive feedback about our solutions. Revisit the DQB and My Growing Ideas charts to reflect on our accomplishments, and celebrate discovery from throughout the unit.	Our water solutions need to make the water safe for all living things. Our solutions have constraints that we need to overcome. Feedback from our peers can help optimize solutions.
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↓ Navigation to next lesson: *Now that we have figured out information about the health of water and the engineering process, we are figuring out how to develop solutions for a community water problem.*

Lesson 15 Putting Pieces Together <i>How can we use what we figured out about our water samples to create a healthy habitat for a turtle?</i>	 How to make a turtle habitat healthy.	Construct an evidence-based explanation for how adding a substance to water can help make the water healthier for a turtle. Explore how to maintain a healthy habitat for an animal or plant of our choice. Celebrate what we figured out in this unit!	We can support an explanation with evidence from our investigations. We can use our science ideas to explain that mixing 2 substances makes a new substance if the properties change.
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