SCED 480

Name: Robyn, Jeannia, Wendelin **Curriculum (Kit) Title:** Water
Lesson Title: Surface Tension
Grade level: Third

Curriculum Context/Long Term Goals: How does this lesson contribute to the big idea(s) of the curriculum (kit) and specific unit?

Big Idea & Connection of Lesson:

1) What are the big ideas of the curriculum?

Water is one of the most important substance on earth. The focus for this lesson will be the discovery of how water responds to temperature variations such as condensation, the properties of surface tension, and interaction with different materials. Water expands when it is heated and retracts when heat taken away. Surface tension causes water to stick together causing it to form into a ball. Dissolving materials into water effects properties of surface tension. Water flows more easily through some earth materials than others such as soils verses gravel. Condensation occurs when water vapor touches a cool surface and changes into liquid. Evaporation can be used to detect materials dissolved in water. Flowing water can be used to do work.

2) How does this lesson fit with one of the big ideas of the curriculum? How does this lesson help students make those connections?

- This lesson explores a property of water; surface tension.
- This lesson helps students to create a deeper understanding of water by exploring one of its many properties.

3) Are there any specific lessons that need to have preceded this lesson? Are there specific areas of knowledge, skills, or background experience that are necessary for the students to be able to successfully engage in this lesson (**content or practice**)?

This lesson is being used as a base line lesson. Assessments will be conducted before this lesson is administered to develop an understanding of students' current knowledge about water. Since it is assumed that students have not previously studied water in their science curriculum, vocabulary and expectations will be explicit throughout this lesson. Also, it is assumed that students will have experience with water through everyday activities (drinking, cooking and playing with it) but the students will most likely not be completely aware of water's properties and why they work.

Learning Targets for this lesson:

1. **Content**
   a. **Content Learning Target**

      Surface tension causes water droplets to pull together into the smallest possible volume. Surface tension can be disrupted by the addition of some other substance.

   b. **Content Learning Target Assessment**

Using evidence from this lesson, students will explain that the addition of different materials will break the attraction properties of water.

c. **NGSS Standard from DISCIPLINARY CORE IDEAS**
PS1.A: Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means.

2. **Science Practice Learning Targets**
   a. **Write a target for one science practice that is the focus in your lesson. This is just a statement of the practice such as "Scientists build claims based on evidence."**
   Scientists use data to evaluate claims about cause and effect.

   b. **Science Practice Learning Target Assessment:**

   Students will distinguish between claims and evidence based on collected data.

   c. **NGSS Language from Appendix F**
      - Practice 7 Engaging in Argument from Evidence: Grades 3-5
      - Bullet one: Compare and refine arguments based on an evaluation of the evidence presented.

3. **Academic Language-**
   a. What are the key vocabulary items (content-specific terms) or language necessary to understand this lesson?
   Surface tension
   dome
   materials
   attraction
   cohesion
   b. How will you teach students that vocabulary/language? (LAST LESSON ONLY)

YOU DO NOT NEED TO LIST MATERIALS IN SCED 480

ASSESSMENT PLAN:

What are the known misconception(s)?

Pre-Assessment: (**content and practice**):
How will you find out what/how **ALL** students think about the targeted content and science practice addressed in this lesson?

For the pre-assessment, we will create a concept cartoon of a water strider flying and three possibilities for it landing on water (sinking, floating and swimming free-style) then ask students to choose what they think will happen. The cartoon will accentuate the water strider's large feet and have the dome-shaped surface tension indents that it creates to stand on water. Students will be asked to provide evidence for their choice that can come from prior knowledge, educated guess, common misconceptions or any combination thereof. Then we will discuss initial claims of what would happen to the bug when it landed on the water. Why sink, why float, why swim?

Formative Assessment: (**content and practice**):
How will you monitor students' emerging understandings?

We will review the student pre-assessment results and monitor student's science notebooks to see if they make any connections between the dome-like indents the floating water strider makes and the dome shape of water on the penny.

What questions could you ask about content? About science practice?

- What shape was the water on the penny before it spilled?
- Have you ever seen water dome up like this before?
- What do you think causes the water to dome?
- What is your evidence to support your claim?
- What changed when you added salt to the water?
- What changed when you added soap to the water?
- Why do you think the water with soap added acted differently than the normal water?

What should student answers look like if learning is on target?

Since we have the pre-assessment data to base the students' learning from, we can look for a shift in conceptual understanding. We can ask students questions that test their current and new conceptual understanding. Students' answers should use evidence from the investigation we have done in class along with their previous background knowledge. The students' science notebooks should be filled with evidence from the investigations that can be used to support their claims.

- The shape is a dome.
- I have seen water in domes like this on our family car in the rain.
- It forms a dome when water is put on a waterproof surface.
- I can see it forming a dome on the penny.
- Nothing changed when I added salt.
- The water dome broke and the water ran off the penny.
- The soap did something to the water to break the dome.

Summative Assessment: (**content and practice):**
How will students demonstrate that they have met both of your learning targets?
Is your assessment measurable or observable?

They should be able to make connections between the dome on the penny, dome-like intents that the water strider makes to rest on the water and how water domes on other waterproof surfaces. They should also be able to explain that some materials cause the water to break its dome like the addition of soap.

REQUIRED LESSON COMPONENTS

COMMUNICATING LEARNING TARGETS:
DO NOT state the Learning Target you developed for the lesson. One option is to state the general expectations. Another option is to state the challenge question for this lesson; e.g., "How does electricity flow?" or "Why are plankton important to the ocean ecosystem?"

Teacher	Student

If you were to draw an insect that could float on the water, what would it need to have?	It would need to have large waterproof feet with tiny hairs so it could use the surface tension of the water to float.

ELICITING INITIAL IDEAS

How will you structure the lesson so that students:

- become aware of their initial ideas
- explain their thinking
- record initial ideas
- share their ideas in a small group and/or whole class

(Note: this is not just a review of previous lessons or past experiences –it is what they know about the learning targets *IN THIS LESSON*)

Teacher	Student
"What happened to the bug in each picture when it landed?" Teacher tells students to each choose one picture as the one they think will be the correct result.	The students will choose one picture that they agree with based upon prior background knowledge. Students will explain their reasoning for picking a particular image.
Teacher creates a chart to record initial claims after students share their initial ideas in small groups. Column 1 Column 2 1. Pict - bug sinks why? 2. Pict - bug floats why? 3. Pict - bug swims why?	Students will create claims based upon the image they chose and their prior background knowledge. Students share their claims in small groups.
Teacher asks which picture appears to be correct.	
Teacher tells students to record which image they agree and reasoning behind picking that image in their science notebook.	Students record their choice of picture and reasoning for choosing that image in their science notebook.
The teacher will ask another initial ideas question. "Have you ever spilled your water on the table?" The teacher will elicit responses from students raising their hands.	Students will raise their hands in response to the question posed.
"What would happen if you spilled water on a penny?" The teacher will have students partner share their answers. The teacher will call on a few students to get common conceptions and misconceptions.	Students will share their ideas with a partner then be ready to present their ideas to the whole class.
"Today we are going to put water drops on a penny. How many full drops of water do you think stay on the penny?" Teacher will have students record their initial ideas in their science notebook. Teacher record responses on the board.	Students will record their initial ideas in their science notebook.
By the end of the lesson students should be able to help tell why the bug can walk on water.	

Also, today, during our investigation, we are going to be making claims. Many times, people have trouble telling the difference between claims and evidence. Can anyone tell me what evidence is? [wait] Can anyone tell me what a claim is? [wait] [Put example of evidence and claims on the board]. Why do you think this statement is evidence? Turn and talk with a partner to discuss this question. [Wait] Why do you think this statement is a claim? Turn and talk with a partner to discuss this question. [Wait] So what do we know about the difference between a claim and evidence? Turn and talk with a partner to discuss this question. [Wait] Please write what you talked about in your science notebook. [Wait] I heard some great conversations happening! Can _____ and _____ share what they talked about? Does anyone have a different idea? Great job! During your investigation you will need to write down some evidence and some claims. Remember the difference between the two and if you forget, refer to your science notebook.	Students will raise their hands and volunteer guesses for the definition of evidence and a claim. Students will turn and talk with their partners about their reasoning why a statement is a evidence. Students will turn and talk with their partners about their reasoning why a statement is a claim. Students will turn and talk about the difference between claim and evidence. Students write about the difference between claim and evidence in their science notebook. Two students will share their ideas.
ENGAGING with DATA/EVIDENCE This is the section in which the students engage in an investigation to gather evidence and make observations. Students should connect the data collected to the investigative question (why are these data important?) Students should record their data Generally the teaching of the science practice begins here (but that can vary)	
<u>Teacher</u> "Today we are going to investigate what happens when we put drops of water on a penny. Find the name of your partner on the board. Move next to your partner." Once students have moved next to their partner, get the students' attention. "I will now show you the steps to do this investigation. [Show steps underneath overhead and write directions on the board for future reference.] First, put your penny on the dry paper towel. Then you will use this tool, called a dropper. What is the name of this tool? [Students respond here.] Does anyone know how to use the dropper? Would like to show the class? [Student demonstrates.] You will use the dropper to place drops of water on the penny one at a time. [Teacher demonstrates.] Next, hold the dropper straight up and down and release drops from about this high above the penny.	<u>Student</u> Students will move next to their assigned partner. Students will be looking at teacher. Students will respond in unison to the teacher, saying "dropper".

[Teacher, does not actually drop water on to the penny.] Be sure to count the number of drops as you go until the water spills off the penny. Record the number of drops in your science notebook. If you want to try counting the number of drops again, make sure that you dry your penny first and place it on a dry paper towel. Also, write down any other observations in your science notebook."	Students will volunteer to demonstrate using a dropper. One student will be called on and come front of the room to model.
"Now you are ready to start the investigation. Can the GETTERS pick up the materials needed for the team? The materials are in the back of the room." [Teacher will circulate the classroom as students are conducting their investigation. As needed, teacher will prompt students with questions to promote deeper thinking. Check for understanding of surface tension by conducting interviews]	GETTERS will pick up team supplies and go back to their seats. Students will begin their investigation. Students will record their individual data in their science notebook.
"Time is up. Please put all your materials down on the desk. What is the highest number of water drops you were able to fit on the penny? I am going to ask each group to share their data and record these responses on the board."	
If there are large differences in the results then this will be discussed. "I notice there are large differences between some of the data that was collected. What do you think happened to cause these large differences between the results?" [This could lead to a discussion about different size of drops, jiggling the table, etc.]	Students will respond to teacher as questions are posed. Students share their data with the class.
"What shape was the surface of the water on the penny before it spilled? [Call on students to share with the rest of the class.] Can you come up to white board and draw a side view of the penny and water?"	Students will raise their hands to share what they noticed about the surface of the water on the penny. One student will draw a side view of the penny and water on the white board.
"The curved surface of the water shows us an interesting property of water. Scientists call this property surface tension. Everyone, please, write the words surface tension in your science notebook. Write your own definition of surface tension."	Students will write surface tension and their own definition of the concept in their science notebook.
"We aren't done investigating yet. Now, I wonder what would happen if we added a drop of liquid soap to a water dome on a penny? Turn and talk with your partner about what you think will happen."	Students will turn and talk about what will happen once a drop of soapy water is added to the dome on a penny.
"Record your initial ideas in your science notebook."	

[Wait.] "Can I have a volunteer share what they think will happen when a drop of liquid soap is added to a water dome on a penny?" "Does anyone have a different initial idea what will happen?" "Great! Well let's find out what will happen. I am now going to explain how to do this part of the investigation. [Show steps underneath overhead and write directions on the board for future reference.] First, put your penny on the dry paper towel, the same as before. Next, put enough drops of plain water on a penny to make a dome. [Teacher will not actually do this in front of students but make the motions of doing the experiment.]" Before we can start on the next part of the experiment, you are going to need liquid soap. There are more cups in the back of the room by the sink. Can the GETTER go to the back of the room, get one cup of liquid soap, a new dropper, and a clean, dry penny? [We will set up the soap cups while the students are working on the first part of the investigation.] "Use this new dropper for the liquid soap only. You may use the old dropper for regular water only. Students, you may now start on the experiment. "Once you have enough drops of water to form a dome on your penny, make as many observations about the water dome as you can in your science notebook. Do not touch the liquid soap yet." It looks like you are all ready to move on. Let me give you the next part of the instructions. You can start on these steps once I have finished explaining all of the steps to you. Next, you're going to want to view the dome from the side while you add one drop of liquid soap to the dome. [Demonstrate this from the front of the room. Do not actually add a drop of liquid soap, let the students do this.] Then, put in as many drops of liquid soap to spill the dome. Record your individual observations of how many drops of soap you used and what happened to the dome of water as you are experimenting."	Each student will record their individual initial claims in their science notebook. Students will raise their hands. One pair of students will share their initial claim. One pair of students will share their initial claim. GETTERS will pick up team supplies and go back to their seats. Students will begin their investigation. Students will record their individual data in their science notebook. Students start the experiment by first adding the water drops. Students then watch the water dome from the side while they add drops of soap. Then they record how many drops of soap they used and what happened to the dome of water.

"Time is up. Please put all your materials down on the desk. Now that you have investigated what happens to water when liquid soap is added, do you still agree with your initial ideas? Please turn and talk with your partner to discuss your initial ideas. Does soap affect surface tension? How do you know? Please turn and talk with your partner to discuss this question. [Wait] Please write a claim in your science notebook. Next I am going to ask each group to share their claim and record these responses on the board. "We still aren't done investigating yet. Now, I wonder what would happen if salt is added to a water dome on a penny? Turn and talk with your partner about what you think will happen." "Record your initial ideas in your science notebook." [Wait]	Students discuss what happened with their partner and then write their answers in their individual notebooks and on the white board.
"Can I have a volunteer share what they think will happen when a drop of salt is added to a water dome on a penny?"	Students record their individual initial claims in their notebook.
"Does anyone have a different idea what will happen?"	Students will raise their hands. One pair of students will share their claim.
"Great! Well let's find out what will happen. I am now going to explain how to do this part of the investigation. [Refer to steps written on the board. You do not need to actually show the steps to do this portion of the investigation.] You are going to follow the exact same steps as we did with the soapy water. You are going to put your penny on a dry paper towel. Then place enough drops of plain water on the penny to make a dome. Before we can start on the next part of the experiment, you are going to need new materials. There are more cups in the back of the room by the sink. Can the GETTER go to the back of the room, grab one cup of salt and one more clean, dry penny? [We will set up the salt cups while the students are working on the first part of the investigation.] Make sure your fingers are dry and sprinkle some salt from the cup onto the penny with the water dome.	One pair of students will share their claim. GETTERS will pick up team supplies and go back to their seats. Students will begin their investigation. Students will record their individual data in their science notebook.

"Time is up. Please put all your materials down on the desk. Now that you have investigated what happens to water when salt is added, do you still agree with your initial ideas? Please turn and talk with your partner to discuss your initial claims. Does salt affect surface tension? How do you know? Please turn and talk with your partner to discuss this question. [Wait] Please write a claim in your science notebook. Next I am going to ask each group to share their claim and record these responses on the board. "Time is up. Please put all your materials down on the desk. Now that you have investigated what happens to water when salt is added, do you still agree with your initial ideas? Why? Please turn and talk with your partner to discuss your initial claims. [Wait] Does salt affect surface tension? How do you know? Please turn and talk with your partner to discuss your initial claims. Use evidence to support your reasoning. [Wait] Record your claim in your science notebook. [Wait] I am going to ask each group to share their claim and record these responses on the board.	Students dry their fingers and then begin sprinkling salt on the water dome on their penny. Students individually record their observations. Students discuss their observations with their partners. Students share their claims with the class and write their claims in their science notebook. Students discuss their observations and evidence with their partners. Students use evidence to make claims. Students share their claims with the class.
USING EVIDENCE to DRAW CONCLUSIONS and MAKE CLAIMS In the lesson, students should: ● Reflect on meaning of the data/experience. ● Facilitate interpretations of the data/experience. ● Use evidence to support their own claims - use evidence from investigation to create claims about bug. ● Critique claims of other students - done in the investigation. ● Draw conclusions - from pre-assessment and investigation - find similarities. ● Make sure that you have taught the learning target for practice as well.	

Teacher	Students
At each section of the lesson, students made claims and observations which were discussed and documented in each of their science notebooks.	Students have already made claims and observations, which were discussed and documented in each of their science notebooks.

During the investigation, students critiqued claims of other students by stating if they agreed or disagreed with another student's claim and why. The places where we have taught the learning target for the practice is colored in red.	During the investigation, students critiqued claims of other students by stating if they agreed or disagreed with another student's claim and why. The places where we have taught the learning target for the practice is colored in red.

MAKING SENSE OF THE LESSON:

Students are led to reflect on what they learned and connect it back to the big idea. Teacher organizes this through questions! Students must be expected to make sense – the teacher cannot do it for them. You must list specific questions you plan to ask students in this section.

1) SYNTHESIS

Use evidence to support and critique claims about the learning target

2) CONNECTIONS

Students connect what they did to learning targets

Connect to other ideas they already know (such as what I know about shadows helps me understand the phases of the moon)

3) REFLECTION

Compare their emerging ideas to initial claims

What made ideas change?

How do the ideas in this lesson help us understand the bigger ideas of the unit?

Teacher	Student
Teacher will review student findings and data, which are ready to be discussed as a class and documented on the board for all to see. Now we can evaluate the different sets of data obtained throughout the investigation. To do this we will make a chart on the board so we can see the connections between the three investigations. [Wait]	Students will answer questions by raising their hands to volunteer their scientific ideas, evidence, data and patterns they notice on the charts.
Create summary chart by listing each of the three experiments and what was learned. Take student's responses to fill out this chart. Students will create this chart in their science notebook.	
Create another summary chart listing initial claims and revised claims for the penny.	Students will make connections and record their data and evidence on poster paper to share with the class.
Did anyone change their claim during your group discussion? [Wait] Can you explain why/why not? [Wait]	
[This comparison between evidence and claim will serve as the post assessment for the practices. Students have shown that they know the difference between evidence and claims.]	

Teacher will ask the following questions: 1. Why do you think the water formed a dome on the penny? 2. Why do you think it changed when you added a different substance to the water? 3. Was there a substance that did not change the results?	Students will answer questions by raising their hands to volunteer their responses to each prompted question.
Look at these pictures again, (referring to initial assessment) did you see any connections between the penny experiment and the pictures. [Collect students' responses on poster paper.] Did anyone's initial claims of what would happen to the bug change after our experiment with the penny? Record your own answer in your science notebook. Discuss your answer with your partner.	Students will record their post assessment in their science notebooks.
What did you find? [Record answers on board.] What do you think will happen when the bug lands? Why? [Collect responses from students.] Yes! You're right, the bug does use the properties of surface tension to float on the water.	Students will discuss and conclude together what their new findings are so they can be included on the board of recorded responses.

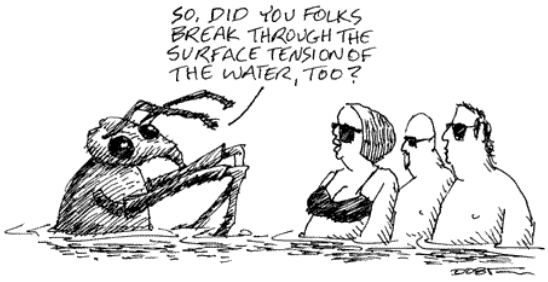
APPLY OR EXTEND NEW UNDERSTANDING IN A NEW CONTEXT

Students apply or extend their learning to a slightly different context. This can lead into next lesson.

Teacher	Student
Have you ever seen water domes anywhere else? [Collect students' responses.] Do you notice anything when it rains? Students should notice water droplets on their rain jacket, car or clothes. Those are all examples of surface tension.	Students will think about other times they may have seen a drop of water on different surfaces and respond.

I think when the bug hits the water he will swim near the top of the surface like I do in the pool each summer.

(A)



Giant water strider attempts to engage other swimmers in small talk.

I think the bug will float on the top of the water and not fall in.

When a bug lands on the water he will break through the surface and swim below and come up for air like we do.

(B)

(C)

Which scenario do you agree with? Please explain your reasoning.

_____

_____

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_____

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_____