The Water Cycle
Lesson 1a: Ideas about Water Disappearing

Grade 5	**Length of lesson:** 46 minutes	**Placement of lesson in unit:** 1a of 6 two-part lessons on the water cycle
Unit central questions: How does water change in the world around us? Does Earth ever run out of water?		**Lesson focus question:** Does liquid water ever disappear? Explain your thinking. **ELL support:** To avoid confusion, explain the word *disappear* explicitly as "no longer visible" rather than "cease to exist."
Main learning goal: Scientific explanations can be constructed by (1) stating a claim that answers the question being studied, (2) identifying evidence that supports the claim, and (3) including logical reasoning that uses science ideas and principles to show how the evidence supports the claim.		
Science content storyline: Water undergoes changes we can observe, and it sometimes seems to disappear, such as when water boils away from inside a beaker. We observed that the water level in the beaker went down as the water boiled. Did some of the water disappear? Why did the water level go down? To explain this scientifically, we need a claim that proposes an answer to the question, observable evidence to support the claim, and reasoning that uses science ideas and principles to show how the evidence supports the claim. We came up with claims and evidence about the boiling water, but we need some science ideas that we can use in our reasoning to build a stronger scientific explanation.		
Ideal student response to the focus question: We came up with a claim that the boiling water didn't disappear; some of it went into the air. Our evidence is that we saw the water level in the beaker go down, and bubbles popping into the air at the top of the beaker. But we need some science ideas that we can use in our reasoning to build a stronger scientific explanation.		

Preparation

Materials Needed • Science notebooks • 1 hot plate • 1 beaker with water (Mark starting level of water on the side.) **Note: Save the beaker of water for use in lesson 1b.** • Chart paper, markers (Save charts for use in lesson 1b.)	**Ahead of Time** • Review the Water Cycle Content Background Document: introduction and sections 1.1–1.2. • Review Common Student Ideas about Matter, Molecules, and the Water Cycle. Refer to it as necessary throughout this unit. • Review the PowerPoint slides and modify them as you wish. • This lesson focuses on **eliciting** student ideas and predictions about water changes; the scientific explanation will be given in lesson 1b. • Boil water in a beaker to see how long it will take for the water level to move noticeably lower. Use a small enough amount of water so it will "disappear" in about 5 minutes. • Decide whether to have students write or just talk to a partner about their ideas and predictions. (Talking instead of writing will save time.)

Safety: *When boiling the water in the beaker, monitor the amount that evaporates. To avoid breakage, TURN OFF the hot plate before all of the water evaporates. Allow the glassware to cool before moving it to a tabletop or cool surface.*

Lesson 1a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
3 min	**Introduction/unit central questions:** The teacher introduces the unit central questions, *How does water change in the world around us? Does Earth ever run out of water?* and elicits student ideas about how water changes.	• Water is all around us. • Water undergoes changes we can observe.
2 min	**Lesson focus question:** The teacher introduces the focus question, *Does liquid water ever disappear?*	
10 min	**Setup for activity:** The teacher elicits students' ideas about the focus question and their predictions about what will happen to boiling water in a beaker.	
15 min	**Activity:** Students observe the beaker of boiling water and then draw and write about their observations.	• Water sometimes seems to disappear, such as when it boils away from inside a beaker.
10 min	**Follow-up to activity:** Students learn about the explanation-building framework (claim, evidence, reasoning) and practice making claims and providing evidence about why the water level in the beaker of boiling water went down.	• Scientific explanations include a claim (which is an answer to the question being asked), evidence to support the claim, and logical reasoning to tell how the evidence supports the claim. • Scientific explanations are stronger when they include reasoning that links science ideas or principles to the evidence.
5 min	**Synthesize/summarize today's lesson:** Students synthesize and summarize the day's learning by deciding whether they've developed a complete science explanation for why the water level in the beaker of boiling water went down.	
1 min	**Link to next lesson:** The teacher links to the next lesson by setting up the need for more science ideas to explain why the water level went down in the beaker of boiling water.	

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3 min	**Introduction/unit Central Questions** **Synopsis:** The teacher introduces the unit central questions, *How does water change in the world around us? Does Earth ever run out of water?* and elicits student ideas about how water changes. **Main science idea(s):** • Water changes in the world around us. • Water undergoes changes we can observe.	Ask questions to elicit student ideas and predictions.	**Show slide 1.** Today we're going to start a unit about water in the world around us. Let's begin by thinking about where we find water on Earth. Where are some of the places you would find water? **Show slide 2.** The unit central questions we're going to explore next are *How does water change in the world around us?* and *Does Earth ever run out of water?* Copy these questions into your science notebooks and draw a double-lined box around them. **NOTE TO TEACHER**: *Post the unit central questions where students can see them throughout this series of lessons.* What ideas do you have about the first question? Can you think of ways you've seen water change?	Lakes. The ocean. Rivers. Puddles. Dew.	

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		Ask questions to probe student ideas and predictions.	**Turn and Talk:** Turn to a neighbor and talk about your ideas. Be ready to share with the class! **Whole-class discussion:** What are your ideas about how water changes in the world around us?	Water freezes. It gets harder and doesn't splash around anymore. Ice cubes melt. It gets liquidy and makes a puddle. Clouds change. When clouds get gray, they drop rain.	*For each response:* Tell me more about that. How does water change when it freezes? Any other examples of water changing? How does water change when ice cubes melt? Any other examples? What do you mean by "change"?

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2 min	**Lesson Focus Question** **Synopsis:** The teacher introduces the focus question, *Does liquid water ever disappear?*	Set the purpose with a focus question or goal statement.	**Show slide 3.** Now we're going to talk about one type of change, and it starts with water in the liquid state. Today's focus question is *Does liquid water ever disappear? Explain your thinking.* Write this question in your science notebooks and draw a box around it. **NOTE TO TEACHER:** *The focus question should also be posted where everyone can see and refer to it throughout the lesson.* **ELL support:** Encourage ELL students to use the terms *liquid water*, *solid water*, and *water vapor*.		
10 min	**Setup for Activity** **Synopsis:** The teacher elicits students' ideas about the focus question and their predictions about what will happen to boiling water in a beaker.	Make explicit links between science ideas and activities **before** the activity.	What if we wanted to make water *seem* as if it disappeared? What might we do? **NOTE TO TEACHER:** *Listen carefully to students' ideas. What's visible about student thinking?* *In general, ask probe questions to find out how students are defining the word* **disappear**. *Is it just that something can't be seen? Or is it really gone?* **ELL support:** Make sure the use of the word *disappear* in this lesson doesn't confuse ELL students. **NOTE TO TEACHER:** *At this point, you*	Dump it down the sink. Pour it on the grass. Leave it out in the sunlight. Drink it. Put it in the microwave. Boil it.	

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			*should ask **only** elicit and probe questions to find out more about what students think. Let them talk! Don't push for or hint at right answers.*		
		Ask questions to elicit and probe student ideas and predictions.	Now we're going to think about a particular change in water. I'm going to put this beaker of water on a hot plate. What do you think will happen when I turn on the hot plate and heat the water?	The beaker will get hot. The water will boil. It will bubble. The water will make steam.	*For each response:* • Where does the water go? • Does it disappear? • What do you mean by "disappear"? What do you mean by "boil"? What does water do when it boils? Tell me more about the bubbles. What do you think steam is? Where did it come from?
			Show slide 4. **NOTE TO TEACHER:** *In their science notebooks, have students draw a picture of the beaker (including the water level)* **before** *you*		

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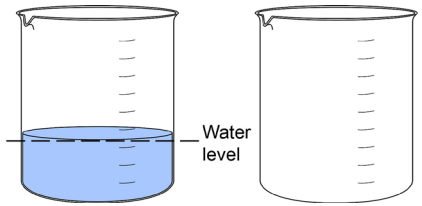
			turn on the hot plate. (Students will draw an "after" picture later to describe their observations.)  **NOTE OF CAUTION:** *Make sure you mark the water level on the beaker* ***before*** *turning on the hot plate. And be sure to turn the hot plate off again* ***before*** *all of the water boils away.* I marked the water level on the side of the beaker. Do you think the water level will change when the water boils? Why or why not? Write your predictions in your notebooks [*or talk about them with a partner*]. Be sure to start your sentences, "I predict the water level will ____. My reason is ____." **Students write [*or talk about*] their predictions.** **ELL support:** Allow ELL students to think, pair, and share. **Whole-class discussion:** Now let's hear what you wrote [*or talked*] about. What do you predict will happen to the water level?		

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		Ask questions to elicit and probe student ideas and predictions.	**NOTE TO TEACHER**: *Again, ask elicit and probe questions only! Don't push for right answers. The goal is to hear a range of student ideas and reasoning.*	I predict the water level will go down. My reason is that the water will boil away. I predict the water level will go down. My reason is that the water will evaporate. Evaporate is when water dries up and disappears. The water will disappear—like we can't see it anymore. It will still be there. We just won't see it. It will go into the air.	What do you mean by "boil away"? What do you mean by "evaporate?" How are you defining "disappear"? Do you mean the water will no longer exist, or that it will still exist in the air, but we won't be able to see it? The water will still be where? How do you know the water will go into the air? Will

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					you see it? Have you seen this happen before? When? Why does this happen?
15 min	**Activity** **Synopsis:** Students observe the beaker of boiling water and then draw and write about their observations. **Main science idea(s):** • Water sometimes seems to disappear, such as when it boils away from inside a beaker.	Make explicit links between science ideas and activities **during** the activity.	**NOTE TO TEACHER:** *After the water has been boiling long enough to lower the water level, have students draw and write about their observations. Emphasize that they should draw and write about their* ***observations only****—what they see or hear happening in the beaker.* **Show slide 5.** Now I want you to draw and write about your observations. Underneath your drawing, write as many details as you can about what you **observed**—or saw—happening with the water in the beaker. Start your sentences with words like "I saw …" or "I noticed that …." Observe carefully! Use words that describe where you see things, the size of things you observe, and so forth. **Student work time.** **Whole-class discussion:** What did you see or observe? **NOTE TO TEACHER:** *Make sure students notice that the water level went down. You can have a student help you use a ruler to measure how far it went down.*	I saw that bubbles formed. They started at the bottom of the beaker and then floated up to	Where did you see bubbles forming?

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				the top. I noticed that as the water heated up, there were more bubbles. It noticed that it went down. The height of the water.	Did you notice anything else about the bubbles? What went down?
10 min	**Follow-Up to Activity** **Synopsis:** Students learn about the explanation-building framework (claim, evidence, reasoning) and practice making claims and providing evidence about why the water level in the beaker of boiling water went down. **Main science idea(s):** • Scientific explanations include a claim (which is an answer to the question being asked), evidence to support the claim, and logical reasoning to tell how	Make explicit links between science ideas and activities **after** the activity. Engage students in constructing explanations and arguments.	There's a lot to observe in this experiment, but let's focus on the water level and try to think about things we can't necessarily observe, like reasons why the water level went down. What happened to make it go down? Scientists ask questions like this. They want to be able to explain how and why things happen. Why do you think the water level went down? What happened? **Show slide 6.** We're going to be scientists and try to explain why the water level went down. To build good scientific explanations, scientists do three things: 1. They make a claim. 2. They give evidence to support their claim. 3. And they give the reasons why their evidence supports the claim. **Show slide 7.**		

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	the evidence supports the claim. • Scientific explanations are stronger when they include reasoning that links science ideas or principles to the evidence.		Let's try the first step in building a good scientific explanation by making a claim that we think will answer the questions, *Why did the water level go down? What happened?* So everyone write down one sentence in your notebooks stating a claim you think will answer these questions. Write the words "My Claim:" at the top of the page as a heading and begin your claim with the words "I think …." **Students write claims.** **Whole-class discussion:** What are your claims? You don't have to give your evidence or reasons yet; just your claim. Let's hear some claims. I'll write them on this chart paper. **NOTE TO TEACHER**: *Focus on helping students recognize what is and isn't a claim. Help them strengthen their claims. A claim should not give evidence and reasons. Also, don't indicate whether their claims are right or wrong.* *Write down students' claims on chart paper. Using shorthand is fine.*	I think the water boiled away. The water boiled away into the air. I think the water evaporated.	That's a good example of a claim, an answer to our question. But what do you mean by "away"? Good! So you improved your claim by saying the water boiled away and went into the air.

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					Another good claim. What do you mean by "evaporate"?
				I think the water disappeared. *[Misconception]*	
					Interesting claim! Can you clarify what you mean? Do you mean the water no longer exists, or that we can't see it, but it's still there somewhere?
				I think some of the water turned into a gas.	
					Another good claim. What is a gas? Where have you heard this term before?
				I think some of the water turned into air. *[Misconception]*	
					So you think somehow the water at the top of the beaker turned into air?
				I think some of the water went up to the clouds. *[Misconception]*	
			CONTENT NOTE ABOUT STEAM: *Steam and clouds are **not** examples of water vapor. The*		Are you thinking it went outside our room and up into the clouds somehow? Or

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			*part of clouds and steam we can see is actually small droplets of **liquid water** that form when water vapor cools. Steam forms as a result of **condensation**, which is addressed in the next lesson. If students make observations that don't relate to the apparent disappearance of water (i.e., observations that relate to the condensation or formation of liquid water from water vapor), acknowledge those observations and tell them you'll come back to those ideas in a later lesson. **Don't focus on steam in this lesson.** Let the class know you'll come back to it in the future.* **Providing evidence:** Look at this great list of claims we came up with! Now let's think about whether we have evidence to support any of these claims. Evidence would be things we actually observed. Look at what you wrote for your claim. As of right now, can you think of any evidence to support your claim? **Show slide 8.** To get us started, let's take one of your claims and think about this together. For example, let's take the claim that some of the water went into the air.* What evidence do we have to support this claim? What did we observe that can support this claim? ***NOTE TO TEACHER:** *If your students didn't come up with this claim, pick a different one to chart. But pick one that can be supported with evidence. For example:*	I think the water escaped from the beaker as steam. *[Misconception]* I saw bubbles popping at the top of the water, so I think the water was popping into the air. The water level went down.	into clouds inside our classroom? How do you define "steam"? Is it different from water? *For each example*: Do we all agree that this is evidence—something we observed that might support the claim that water went into

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			Claim: *Some of the water disappeared.* ***Evidence:*** *The water level went down. We can't see the water that used to be in the beaker.* *Write the claim on chart paper and list any evidence students come up with that supports the claim. Emphasize that their evidence should be something they observed, not something they heard or read about.* ***Save this chart for lesson 1b.*** So now we have a claim with some evidence. Next, we need to add our reasoning. This is where we use scientific ideas or principles to tell how the evidence supports the claim. Tomorrow we'll learn about a science idea that will help us finish our explanation using scientific reasoning.	I read in a book that water can go into the air.	the air? Is reading this in a book evidence that we observed? No, it isn't evidence from an observation, but you might use this idea in your reasoning.
5 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** Students synthesize and summarize the day's learning by deciding whether they've developed a complete science explanation for why the water level in the beaker of boiling water went down. **Main science idea(s):** • Scientific explanations include a	Highlight key science ideas and focus question throughout.	**Show slide 9.** Today we explored the focus question, *Does liquid water ever disappear? Explain your thinking.* We worked on developing a scientific explanation for this boiling beaker of water. We observed that the water level went down and asked the questions *Why did the water level go down? Did the water disappear?* **NOTE TO TEACHER**: *If the beaker is cool enough, mark the new water level.* ***Then cover the beaker and save it for lesson 1b.***		

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	claim (which is an answer to the question being asked), evidence to support the claim, and logical reasoning to tell how the evidence supports the claim. • Scientific explanations are stronger when they include reasoning that links science ideas or principles to the evidence.	Engage students in making connections by synthesizing and summarizing key science ideas.	We also learned that a good scientific explanation has three parts: (1) making a claim, (2) giving evidence to support the claim, and (3) giving reasons that tell how the evidence supports the claim. **Show slide 10.** To summarize where we are, turn to a partner and discuss the question on the slide: *Do we have a complete scientific explanation for why the water level in the beaker of boiling water went down? Explain your thinking.* **Turn and Talk:** Partners discuss the question. **Whole-class discussion:** Let's hear what you came up with! Do we have a complete scientific explanation for why the water level in the beaker went down? Remember to explain your thinking.	*Ideal Response:* No, we don't have a complete explanation. We have a claim and evidence, but we don't have any reasoning. Science ideas or principles.	What do we need to know in order to add reasoning to our explanation?
1 min	**Link to Next Lesson** **Synopsis:** The teacher links to the next lesson	Summarize key science ideas.	**Show slide 11.** Today we began building a scientific explanation to answer the questions, *What happens when*		

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	by setting up the need for more science ideas to explain why the water level went down in the beaker of boiling water.	Link science ideas to other science ideas.	*water boils? Why does the water level go down? Does the water disappear?* We observed boiling water and used our observations to develop a claim to answer these questions. We also wrote down our evidence to support this claim. Tomorrow we'll learn some science ideas that will help us finish our explanation with good scientific reasoning.		