RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

Grade Level	5	**Day**	2	**STeLLA Strategy**	STL Strategies 1, 2, 3: Elicit, Probe, and Challenge Questions	**Subject Matter Focus**	Water Cycle

Focus Questions	• How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking? • How does the movement of a water molecule change based on its physical state? • Can we make water vapor reappear as liquid water? • Can the movement of water molecules (in various physical states) be modeled as a dance (or shown in a simulation)?
Main Learning Goals	Participants will understand the following: • Student thinking can be made more visible in science classrooms when the teacher asks questions that elicit and probe student ideas and predictions and challenge student thinking. • Lesson analysis allows us to slow down teaching so we can clarify our understandings of the distinct purposes of elicit, probe, and challenge questions and how they can be used effectively in science lessons. • Energy gained or lost effects the movement of water, which dictates the number of attractive hydrogen bonds (H-bonds) and the packing pattern of molecules. This movement of water molecules is demonstrated in several lessons in the water cycle. • The phenomena of the water cycle can be explained by examining the nature of water molecules.

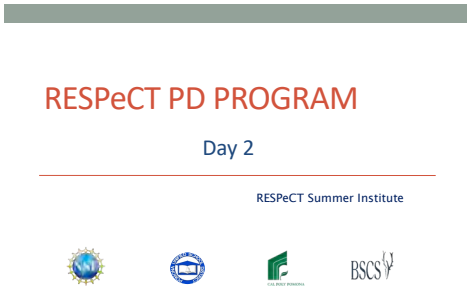
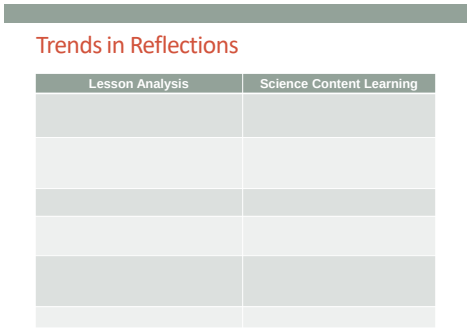
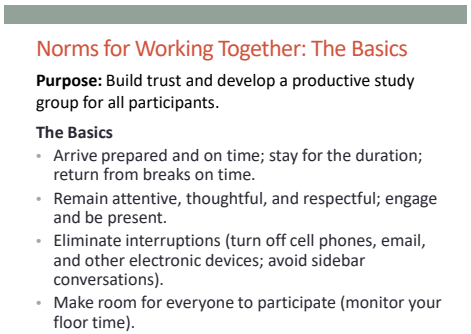
Preparation	**Materials**	**Videos**
Daily Setup Tasks • Check that video clips are correctly linked to PowerPoint (PPT) slides. • Set up PowerPoint. • Make sure video clips play correctly with good sound. • Arrange furniture and food. • Arrange participant materials. • Put up posters and charts. **Planning and Preparation Tasks** • Study the PDLG, PowerPoint slides (PPTs), video clips, and handouts. Make changes to the PPTs if needed. • Review the content deepening slides and determine the amount of time to allot for each slide based on the needs of your group. Add timing cues to PPTs, if desired, to help you stay on track. • Review the reflections from day 1 and	**Posters and Charts** • STeLLA Framework and Strategies poster • Day-2 Agenda (chart) • Day-2 Focus Questions (chart) • Norms for Working Together (chart) • Effective Science Teaching chart (from day 1) • Strategy charts from day 1 (STL strategies 1–3) • Common Student Ideas chart • Parking Lot poster **Handouts in RESPeCT PD Binder Front Pocket** • Z-fold summary chart: Student Thinking Lens Strategies **Handouts in RESPeCT PD Binder, Day 2** • 2.1 Transcript for Video Clip 2.1 • 2.2 Transcript for Video Clip 2.2 • 2.3 Transcript for Video Clip 2.3 • 2.4 Daily Reflections—Day 2	• Video Clip 2.1: Amber interview, Dieken classroom (elicit and probe questions); 2.1_stella_WC_dieken_amber_c1 • Video Clip 2.2: Duin classroom (probe and challenge questions); 2.2_stella_WC_duin_web_c2 • Video Clip 2.3: Dieken classroom (probe and challenge questions); 2.3_stella_WC_dieken_c4

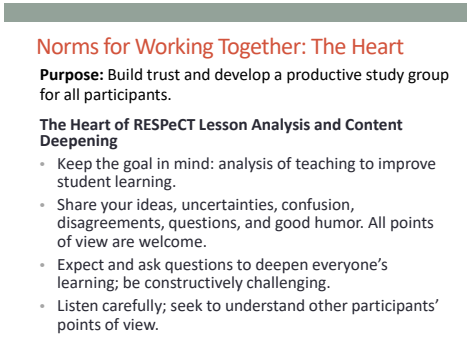
create a summary slide. • Cut apart the elicit-question cards from the PD leader master to pass out for practice interviews. • Watch video clips and anticipate participant responses. • Prepare charts for the day's agenda and focus questions. • Review the activities for Water Cycle lessons 2a/b and 3a/b in lesson plans binder. • On chart paper, create a Common Student Ideas chart (see resources section in lesson plans binder) and post it at the front of the class. Make sure to leave space in the left-hand margin to apply sticker dots. This chart will be used during lesson analysis (slide 19).	**PD Leader Masters, Days 1–4** • PD Leader Master: Elicit Question Cards—Matter, Molecules, and the Water Cycle (for practice interviews) • PD Leader Master: 5th-Grade Guide to Video Clips for Day 2 **Supplies** • Science notebooks • Chart paper and markers • Red and blue sticker dots (or pencils) • Sticky notes (for Parking Lot poster) • Plastic cups • Ice • Food-coloring dye • Hula-Hoop for dancing simulation • 2–3 laptops with *States of Matter* PhET simulation (download from University of Colorado, Boulder) **PD Resources** • STeLLA strategies booklet • RESPeCT PD program binder • RESPeCT lesson plans binder **Resources in Lesson Plans Binder** *Resources section:* • Water Cycle Content Background Document • Common Student Ideas about Matter, Molecules, and the Water Cycle	

DAY 2 SESSION OUTLINE

Time	Activities	Purpose
8:00–8:35 35 min	**Getting Started: Housekeeping, Day-1 Reflections, Norms, Agenda, Focus Questions, Review STL Strategies**	• Build community by sharing participants' reflections from day 1 and reviewing/revising the norms. • Set the stage for a day of learning by introducing the focus questions for day 2 and reviewing the purposes and key features of elicit, probe, and challenge questions. (These strategies will be the focus of today's lesson analysis work.)
8:35–9:20 45 min	**STL Lesson Analysis: Elicit and Probe Questions**	• Begin to develop an understanding of the RESPeCT lesson analysis process. • Deepen understandings of elicit and probe questions (STL strategies 1 and 2) and how they reveal student thinking. • Deepen science-content knowledge of the water cycle through lesson analysis.
9:20–11:20 120 min (Includes 10-min break)	**STL Lesson Analysis: Probe and Challenge Questions**	• Develop a deeper understanding of the RESPeCT lesson analysis process. • Deepen understandings of probe and challenge questions (STL strategies 2 and 3), how they reveal student thinking, and how they move student thinking forward. • Deepen science-content knowledge of the water cycle through lesson analysis. • Understand that science-content knowledge is essential for using probe and challenge questions effectively in the classroom.
11:20–12:00 40 min	**Practice Using Elicit and Probe Questions: Interviews**	• Deepen understandings of elicit and probe questions. • Begin to develop the ability to ask elicit and probe questions effectively. • Appreciate that science-content knowledge is essential for using elicit and probe questions effectively in the classroom.
12:00–12:45 45 min	**LUNCH**	
12:45–3:15 150 min (Includes 10-min break)	**Content Deepening: Water Cycle**	• Develop an understanding of the movement of water in various phases of the water cycle. (This is essential for understanding the interactions of water molecules in Water Cycle lessons 2a/b and 3a/b.)
3:15–3:30 15 min	**Wrap-Up: Summary, Homework, and Reflections**	• Summarize and reflect on the day's learning, including progress made in understanding the water cycle and the relationship between lesson analysis and asking effective elicit, probe, and challenge questions.

DAY 2

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
8:00–8:35 35 min **Getting Started** Slides 1–8	**Purpose** • Build community by sharing participants' reflections from day 1 and reviewing/revising the norms. • Set the stage for a day of learning by introducing the focus questions for day 2 and reviewing the purposes and key features of elicit, probe, and challenge questions. (These strategies will be the focus of today's lesson analysis work.) **Content** • Norms enable the group to build trust and productivity. • Probe questions seek to understand what students are saying/writing and encourage them to explain their ideas more clearly or fully (**not** to change their thinking). • Challenge questions seek to engage students in ways that will challenge them to think, reconsider their ideas, change their initial ideas, and move toward more-scientific understandings. **What Participants Do** • Discuss the reflections from day 1 and how the group is doing with the norms. • Study a short transcript example from the STeLLA strategies		**Display Slide 1.** RESPeCT PD Program (3 min) a. Take care of any housekeeping issues.
			**Display Slide 2.** Trends in Reflections (5 min) a. Give participants time to review your summary of their reflections from day 1 and offer reactions and comments or ask follow-up questions.
			**Display Slide 3.** Norms for Working Together: The Basics (5 min) a. **Provide context:** "Since we'll be working together throughout the Summer Institute and the academic year, we need norms that will enable us to build trust and productivity as a group. Today we'll start our analysis of other teachers' classroom videos. In the fall, we'll analyze videos from each other's classrooms. For this work to be

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	booklet to identify probe and challenge questions. • Review and contrast the purposes and key features of probe and challenge questions. **Posters and Charts** • STeLLA Framework and Strategies poster • Norms for Working Together (chart) • Day-2 agenda (chart) • Day-2 focus questions (chart) **PD Resources** • STeLLA strategies booklet • Half-page sheet of norms (pasted into science notebooks)		meaningful, we'll need to push and challenge each other. This will require mutual respect and a common understanding of our goals." b. "Do you want to clarify or revise any of these norms?" **Note:** Have participants locate the half-page sheet of norms they pasted into their science notebooks on day 1. Remind them to leave space for revising the norms. c. Encourage participants to ask clarifying questions regarding the meaning of any of the norms and jot notes in their science notebooks. d. Ask participants if they're willing to live with these norms today, and let them know they'll have an opportunity to revise them tomorrow. Remind them of this at the end of the session.
			**Display Slide 4.** Norms for Working Together: The Heart (5 min) a. "Now let's review the norms at the heart of the RESPeCT PD program." b. "Do you want to clarify or revise any of these norms?" c. "Do you want to add any norms to this list?" d. Ask participants if they're willing to live with these norms today, and announce that they'll have an opportunity to revise them tomorrow.

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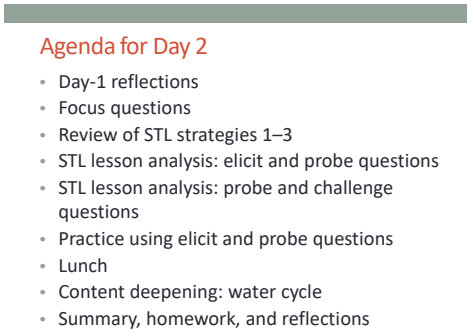
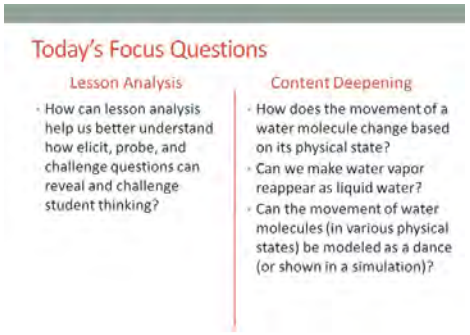
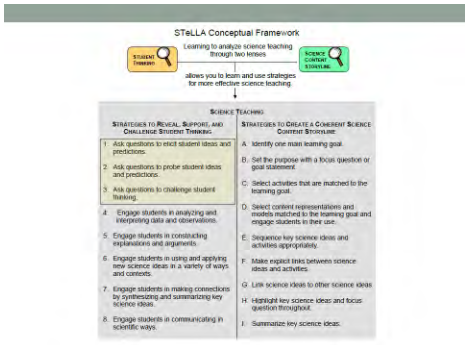
			**Display Slide 5.** Agenda for Day 2 (Less than 1 min) a. Talk through the agenda for the day.
			**Display Slide 6.** Today's Focus Questions (1 min) a. Introduce the focus questions that will guide today's session. b. "Each day we're going to have at least one lesson analysis focus question and one content deepening focus question." c. "Here are our focus questions for today's session."
			**Display Slide 7.** The STeLLA Conceptual Framework (Less than 1 min) a. Point out the strategies highlighted on the slide. b. "During today's session, we'll focus again on the first three Student Thinking Lens strategies: elicit, probe, and challenge questions."

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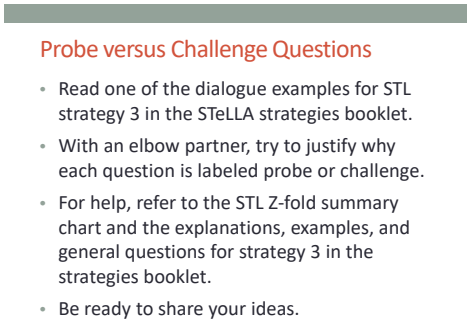
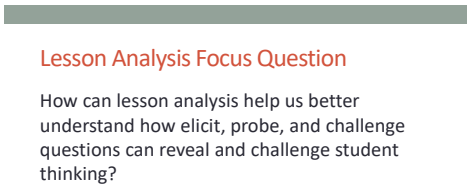
			**Display Slide 8.** Probe versus Challenge Questions (15 min) a. Have participants look in the STeLLA strategies booklet at a dialogue example for STL strategy 3 that highlights probe and challenge questions. b. The purposes of this activity are as follows: 1. To get participants' heads back into the questioning strategies discussed on day 1. 2. To make sure participants understand the distinct purposes of probe and challenge questions: • **Probe questions** seek to understand what students are saying/writing and encourage them to explain their ideas more clearly or fully (not to change their thinking). • **Challenge questions** seek to engage students in ways that will challenge them to think, reconsider their ideas, change their initial ideas, and move toward more-scientific understandings.
8:35–9:20 45 min **STL Lesson Analysis: Elicit and Probe Questions**	**Purpose** • Begin to develop an understanding of the RESPeCT lesson analysis process. • Deepen understandings of elicit and probe questions (STL strategies 1 and 2) and how they reveal student thinking. • Deepen science-content knowledge of the water cycle		**Display Slide 9.** Lesson Analysis Focus Question (Less than 1 min) a. "Today we'll explore this focus question: How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?" b. "But first let's discuss what lesson analysis involves."

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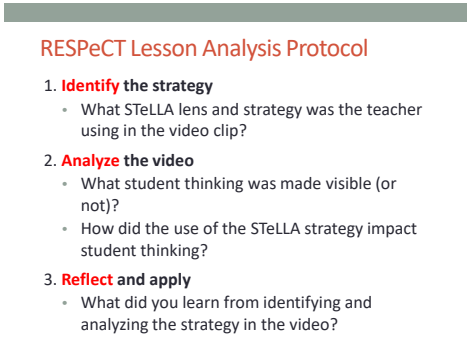
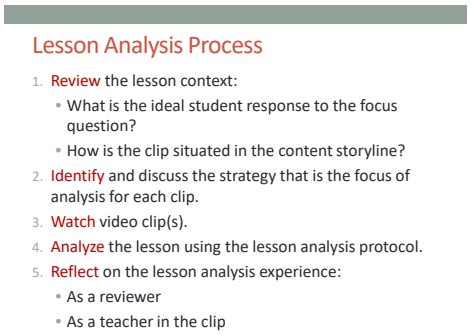
Slides 9–15	through lesson analysis. **Content** • Elicit questions are designed to reveal a variety of ideas, misconceptions, and experiences that students bring with them when learning new science content. • Probe questions follow up on student statements to find out more about what students are trying to say. • Lesson analysis involves a three-step protocol: (1) Identify the strategy, (2) analyze the use of the strategy in classroom videos, and (3) reflect on learning from the lesson analysis. • The lesson analysis protocol follows a five-step process: (1) Review the lesson content, (2) identify and discuss the STeLLA strategy in focus, (3) watch the video clip, (4) analyze the clip using the three-step protocol, and (5) reflect on the lesson analysis experience. • The analysis phase of lesson analysis involves making claims related to the STeLLA framework and providing evidence and reasoning to support the claims. **What Participants Do** • Review the lesson analysis video viewing basics.		
			**Display Slide 10.** RESPeCT Lesson Analysis Protocol (Less than 1 min) a. "This is the three-step protocol that will guide our video-based lesson analysis work. Although we'll follow the protocol a bit more loosely during the Summer Institute, we'll rely heavily on this explicit three-step format as we move into the fall study groups." b. Review the steps on the slide; then tell participants, "Framing our analysis in this way and following specific steps will help us focus more holistically on the teaching and the impact of the STeLLA strategies on student thinking and learning and the storyline students are constructing (i.e., the Student Thinking Lens and the Science Content Storyline Lens)."
			**Display Slide 11.** Lesson Analysis Process (Less than 1 min) a. "The lesson analysis protocol includes this five-step process." b. Review the steps on the slide and note that in the study groups, these steps will be followed more explicitly than they will be during the Summer Institute.

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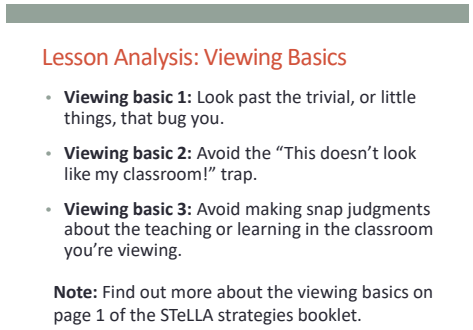
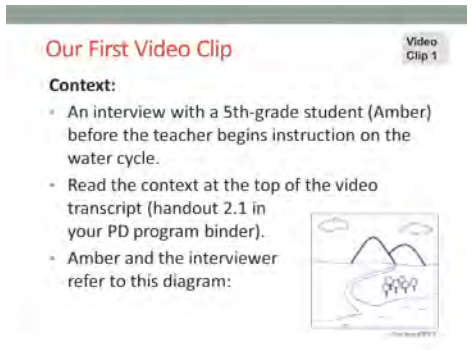
	• Use the five-step lesson analysis process to identify and analyze the use of elicit and probe questions in a student interview (video clip 1). **Videos** • Video Clip 2.1, Amber interview **Handouts in PD Binder** • 2.1 Transcript for Video Clip 2.1 **PD Leader Masters** • PD Leader Master: 5th-Grade Guide to Video Clips for Day 2 **Supplies** • Science notebooks **PD Resources** • STeLLA strategies booklet • STL Z-fold summary chart		**Display Slide 12.** Lesson Analysis: Viewing Basics (2 min) a. **Ask:** "Why is each of these viewing basics important? Which will be hardest for you?" b. Tell participants they can find further details on the viewing basics in the STeLLA strategies booklet and refer to this information later. c. **Highlight:** "The videos we'll be viewing throughout the program aren't necessarily exemplary, but rather they provide real-world examples of teachers implementing the STeLLA strategies. Examples like these deepen our thinking because we can see the sometimes unintended results of teacher decisions and consider missed opportunities." d. **Honor the videocase teachers!** All of these courageous teachers are not only working hard to improve their own teaching practice but are also willing to make their practice public so that others can learn from it. None of them would claim to be exemplary science teachers.
			**Display Slide 13.** Our First Video Clip (2 min) a. Describe the context of the first video clip participants will watch. (See the top of the transcript—handout 2.1 in the PD program binder.) b. "This student interview showcases the use of elicit and probe questions. Even though this clip doesn't take place in the context of an actual classroom, the idea is to look at the quality and form of the questions. Our second video clip will feature probe and challenge questions in a

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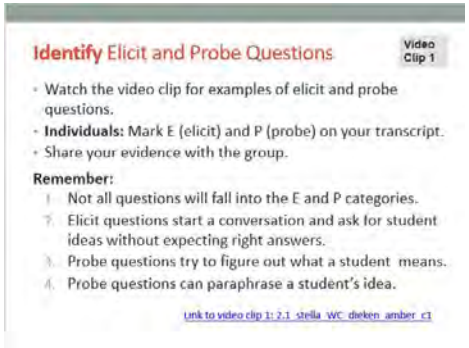
			classroom context.”
			**Display Slide 14.** Identify Elicit and Probe Questions, Video Clip 1 (20 min) a. Provide instructions for watching video clip 1 and using the transcript to identify questions that elicit (E) and probe (P) student ideas and predictions. b. Remind participants that the purpose of watching the video clip is to deepen their shared understandings of these strategies and to build their individual and collective lesson analysis skills. c. **Individuals:** Allow time for participants to review the video transcript and mark E and P questions. d. **Whole group:** Discuss what participants found in the transcript. Encourage them to use evidence from the transcript and reasons from their Z-fold summary charts or the STeLLA strategies booklet to support their ideas. Participants should work to differentiate elicit and probe questions and distinguish them from other types of teacher questions or statements. **Note:** For examples of elicit and probe questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.

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		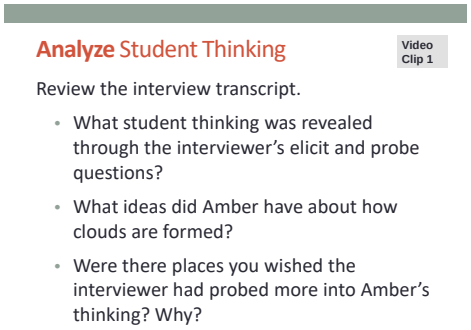	**Display Slide 15.** Analyze Student Thinking, Video Clip 1 (20 min) a. Give participants time to review the video transcript and develop an answer to one of the analysis questions on this slide. Encourage them to write down their answers in their science notebooks. b. For this first video analysis, do a round-robin and have each participant share. Ask probe and challenge questions to support participants in communicating their ideas clearly and completely: • **Probe question:** "Can you say more about what you mean by …?" • **Challenge question:** "Can you point to a specific place in the transcript that supports your idea?" c. As participants share, encourage others to respond by asking questions like these: • Do others have additional evidence to support (or challenge) this idea? • Do others have a different interpretation? **Note:** For examples of elicit and probe questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.

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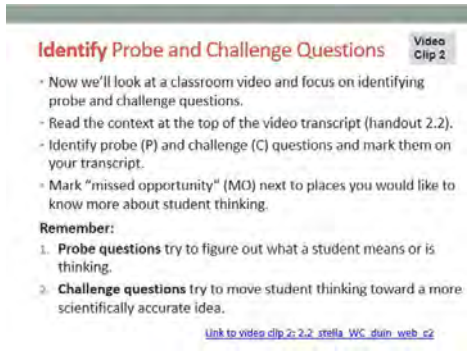
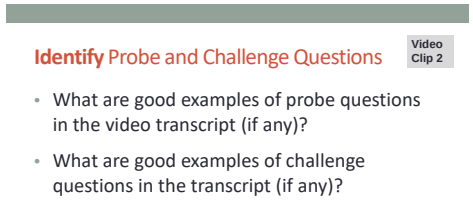
9:20–11:20 120 min (Includes 10-min break) **STL Lesson Analysis: Probe and Challenge Questions** Slides 16–26	**Purpose** • Develop a deeper understanding of the RESPeCT lesson analysis process. • Deepen understandings of probe and challenge questions (STL strategies 2 and 3), how they reveal student thinking, and how they move student thinking forward. • Deepen science-content knowledge of the water cycle through lesson analysis. • Understand that science-content knowledge in essential for using probe and challenge questions effectively in the classroom. **Content** • Probe questions follow up on student statements to find out more about what they're trying to say. • Challenge questions are designed to push students to think hard, make new connections, change their ideas, and move toward more-scientific understandings. • The lesson analysis process involves making claims related to the STeLLA framework and providing evidence and reasoning to support those claims. • Viewing basics and analysis basics guide the lesson analysis process.		**Display Slide 16.** Identify Probe and Challenge Questions, Video Clip 2 (15 min) a. Provide instructions for watching video clip 2 and using the transcript to identify questions that probe student ideas and predictions and challenge student thinking. b. Encourage participants to refer to the strategy charts from day 1 (STL strategies 1–3), their Z-fold summary charts, and the STeLLA strategies booklet for help differentiating probe and challenge questions. Remind them that other types of questions (such as elicit questions) may appear in this video clip. c. **Set the context:** Read the context for video clip 2 (at the top of the transcript). d. Emphasize that the students in this class haven't yet studied anything about molecules, evaporation, or the water cycle. e. Show the video clip and allow time for participants to study the transcript before advancing to the next slide.
			**Display Slide 17.** Identify Probe and Challenge Questions, Video Clip 2 (5 min) a. After each suggested probe or challenge question, ask participants the following: • "What makes this a probe/challenge question?" • "Did others mark this as a probe/challenge question?" • "Can you point to any of our resources (the Z-fold summary chart, our strategy charts from day 1, or the STeLLA strategies

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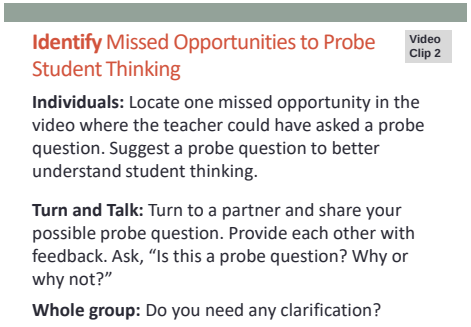
	What Participants Do • Identify probe and challenge questions in a classroom video (video clip 2). • Review common student ideas about the water cycle. • Analyze the use of probe and challenge questions in a classroom video (video clip 2). • Identify and analyze the use of probe and challenge questions in another classroom video (video clip 3). • Discuss the importance of science-content knowledge in using probe and challenge questions effectively in the classroom. **Posters and Charts** • Strategy charts from day 1 (STL strategies 1–3) • Common Student Ideas chart • Parking Lot poster **Videos** • Video Clip 2.2, Duin classroom • Video Clip 2.3, Dieken classroom **Handouts in PD Binder** • 2.2 Transcript for Video Clip 2.2 • 2.3 Transcript for Video Clip 2.3 **PD Leader Masters** • PD Leader Master: 5th-Grade Guide to Video Clips for Day 2 **Supplies**		booklet) to support your answer?" b. Don't worry about debate and lack of agreement on some questions. **The important thing** is that participants clearly understand the difference between the purposes of probe and challenge questions. Sometimes it's hard to tell whether the teacher in the video intended to find out what a student meant (probe) or move student thinking toward more-scientific understandings (challenge). The teacher may also be asking elicit questions to reveal student ideas and misconceptions. **Note:** For examples of probe and challenge questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.
			**Display Slide 18.** Identify Missed Opportunities to Probe Student Thinking, Video Clip 2 (10 min) a. **Individuals:** "Identify a missed opportunity for a probe question in the video transcript." b. **Turn and Talk:** Have participants pair up and discuss their suggested probe questions. Listen to their conversations to assess whether they truly comprehend that a probe question is designed to help them understand what students are thinking. c. **Whole-group share-out:** Participants may need guidance about when to ask probe questions. Remind them that probe questions are appropriate when students make vague or abbreviated statements, or when they simply use a vocabulary term without saying what it means. Do they really understand the term or concept, or do they have misconceptions? Ask a probe

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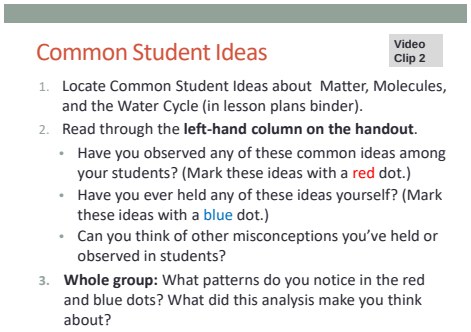
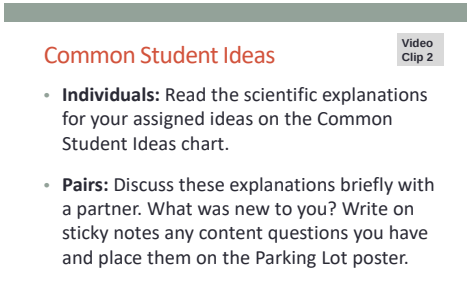
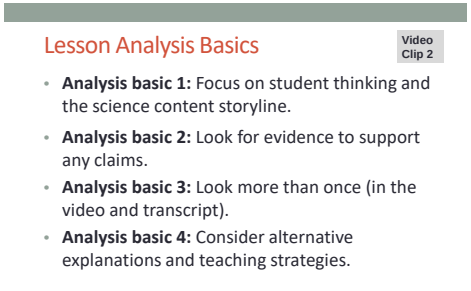
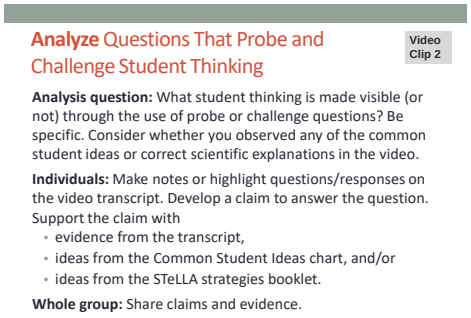
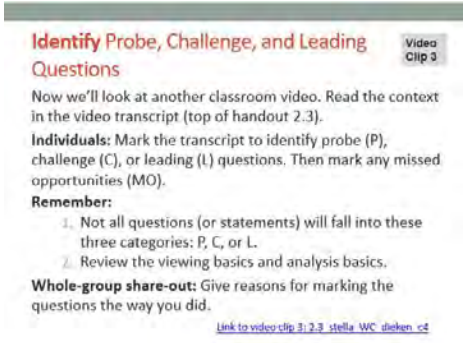
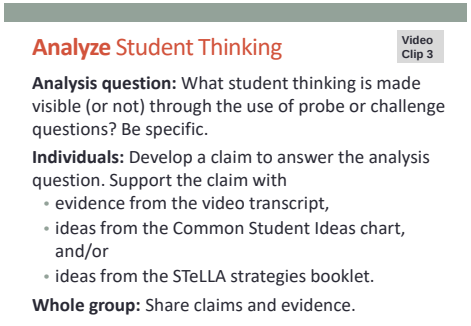
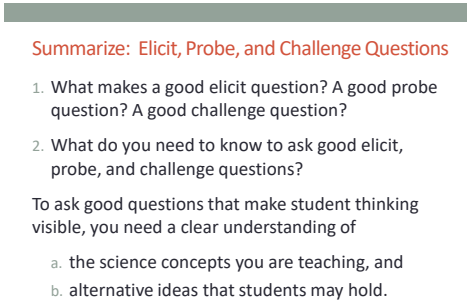
	• Red and blue sticker dots (or pencils) • Sticky notes **PD Resources** • STeLLA strategies booklet • STL Z-fold summary chart **Resources in Lesson Plans Binder** *Resources section:* • Common Student Ideas		question to find out! d. **Remind participants:** "Don't probe everything a student says. Just probe responses that seem relevant to the lesson's main learning goal and might reveal interesting student thinking." **Note:** For examples of missed opportunities, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.
	10-MINUTE BREAK		
			**Display Slide 19.** Common Student Ideas, Video Clip 2 (12 min) a. "Now let's consider some commonly held student ideas (misconceptions). Then we can analyze whether any of these ideas appear in our video clips." b. Have participants locate the Common Student Ideas chart in the resources section of their lesson plans binders. c. "This Common Student Ideas chart shows some commonly held student ideas that are interesting but aren't scientifically accurate." d. **Individuals:** Have participants mark with a red sticker dot any ideas they've observed among their students, and mark with a blue sticker dot any ideas they've had themselves. e. **Pairs:** Have participants discuss their

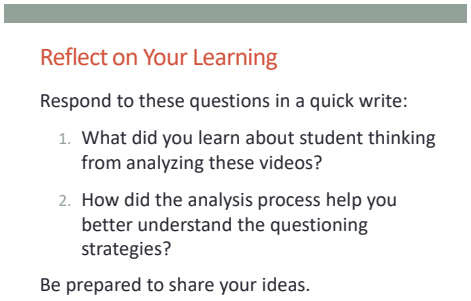
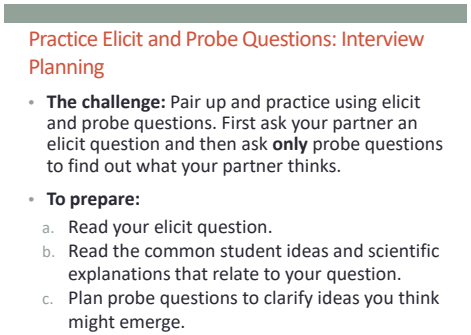
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			observations with a partner. f. **Whole group:** Ask participants to share which ideas they've observed in their students and themselves. During this share-out, apply sticker dots to the Common Student Ideas chart at the front of the room as participants to highlight patterns in the results. Then discuss the following questions: • "What conceptual patterns do you notice in the red and blue dots?" • "What reactions do you have to this analysis? What did it make you think about?" **Note:** If time is short, skip this pattern analysis and discussion. g. "We've recognized these common ideas in students or held them ourselves. It's important to be aware of them when we're analyzing student thinking in the video clips or planning and teaching lessons in the future." h. "Now let's look for evidence of these common student ideas in a video clip."
			**Display Slide 20.** Common Student Ideas, Video Clip 2 (10 min) a. Have participants count off in ones and twos (1, 2, 1, 2). "Ones" will focus on ideas 1–7 on the Common Student Ideas chart, and "twos" will focus on ideas 8–15. b. **Individuals:** "Read the scientific explanations for your assigned ideas on the Common Student Ideas chart." c. **Pairs:** "Discuss these explanations briefly with a partner. What was new to you? Write on sticky notes any content questions you have, and place

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			the notes on the Parking Lot poster."
			**Display Slide 21.** Lesson Analysis Basics (5 min) a. "Before we analyze the video clip, let's think about our lesson analysis process." b. Review the analysis basics on the slide. **Note:** Direct participants to page 2 in the strategies booklet if they have specific questions that require more information. c. **Why the analysis basics are important:** "The analysis basics will help us dig deeper and learn more from our videocase analyses while keeping us focused on the ultimate goal of improved student learning." **Note:** This lesson analysis process is **not** about critiquing teachers but about improving student learning. d. "We'll use a more structured lesson analysis protocol when we begin reviewing each other's videos in the fall study-group sessions."
			**Display Slide 22.** Analyze Questions That Probe and Challenge Student Thinking, Video Clip 2 (15 min) a. Remind participants of the purposes of video analysis: to deepen understandings of STeLLA strategies; to develop their ability to analyze student thinking; and, ultimately, to improve student learning. b. **Tell participants:** "Remember to refer to your Common Student Ideas chart as you analyze the video clip."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			c. **Individuals:** Review the slide instructions before participants begin working independently on the tasks. d. **Whole group:** • Have several participants share their claims and evidence. • **Ask:** "Did you recognize any of the common student ideas in the students' responses?" • **Ask:** "What probe or challenge questions might you ask to better understand student thinking?" **Note 1:** Remember to use probe and challenge questions as you interact with participants. **Note 2:** For examples of probe and challenge questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.
			**Display Slide 23.** Identify Probe, Challenge, and Leading Questions, Video Clip 3 (15 min) a. Read the context for this video clip (at the top of the transcript). Make sure participants understand that the students in this clip have previously studied how molecules behave in evaporation and condensation, but they haven't yet addressed any ideas about the water cycle. b. Provide instructions for watching video clip 3 and using the transcript to identify questions that probe student ideas and predictions and challenge student thinking. **Participants should also be on the lookout for leading questions and missed opportunities.** (**Note:** Leading questions provide hints or make it easy for

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			students to give the "right" answer.) Remind participants that other types of questions (such as elicit questions) may appear in this video clip. c. **Individuals:** Review the slide instructions before participants begin working independently on the tasks. d. **Whole group:** • Challenge participants to clearly state their reasons for identifying a question as probe, challenge, or leading. • Encourage participants to provide evidence from the STeLLA strategies booklet to support their claims. **Note:** For examples of probe, challenge, and leading questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.
			**Display Slide 24.** Analyze Student Thinking, Video Clip 3 (15 min) a. **Emphasize:** "Remember to refer to your Common Student Ideas chart as you analyze the video." b. **Individuals:** Review the slide instructions before participants begin working independently on developing a claim to answer the analysis question. c. **Whole group:** • Have several participants share their claims and evidence. • **Ask:** "Did you recognize any of the common student ideas in the students' responses?"

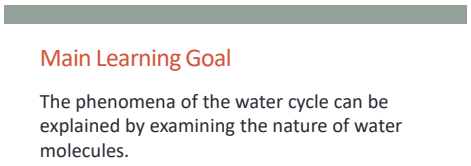
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			• **Ask:** "What probe or challenge questions might you ask to better understand student thinking?" **Note 1:** Remember to use probe and challenge questions as you interact with participants. **Note 2:** For examples of probe and challenge questions, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 2.
			**Display Slide 25.** Summarize: Elicit, Probe, and Challenge Questions (3 min) a. Pose the first question on the slide. If participants need support, point them to the descriptions of strategies 1, 2, and 3 in the STeLLA strategies booklet (especially the Summary of STeLLA Student Thinking Lens Strategies). b. Pose the second question. Do participants come up with the idea that science-content knowledge is essential for asking good elicit, probe, and challenge questions? c. Use the rest of the time to highlight the importance of knowing science content and being aware of common student ideas.

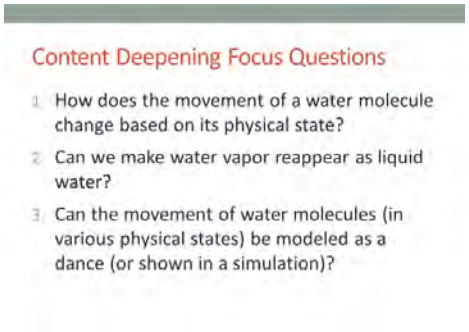
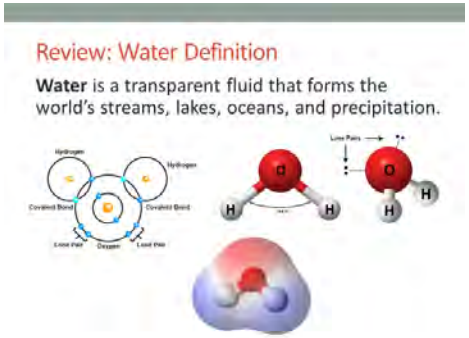
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 26.** Reflect on Your Learning (5 min) a. Ideally, participants will first respond to the questions in a quick write and then share their ideas with the group. But if time is running short, you can have them simply think for a minute and then share their ideas. But be sure to give them time to think before opening up the discussion.
11:20–12:00 40 min **Practice Using Elicit and Probe Questions: Interviews** Slides 27–29	**Purpose** • Deepen understandings of elicit and probe questions. • Begin to develop the ability to ask elicit and probe questions effectively. • Appreciate that science-content knowledge is essential for using elicit and probe questions effectively in the classroom. **Content** • Understanding the purposes and key features of elicit and probe questions is essential for implementing the STeLLA questioning strategies effectively in the classroom.		**Display Slide 27.** Practice Elicit and Probe Questions: Interview Planning (10 min) a. **Describe the challenge:** "Next, you and a partner will practice using elicit and probe questions by interviewing each other. The challenge is to ask your partner an elicit question and then follow up by asking **only** probe questions." b. Give each participant a different elicit question (from the PD leader master cards). c. Direct participants to prepare for the interviews by following the slide instructions. **Note:** Participants may refer to the Common Student Ideas chart as a resource for this activity.

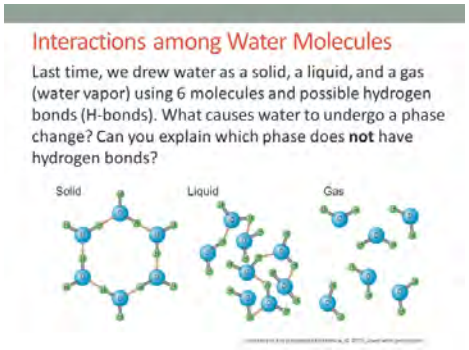
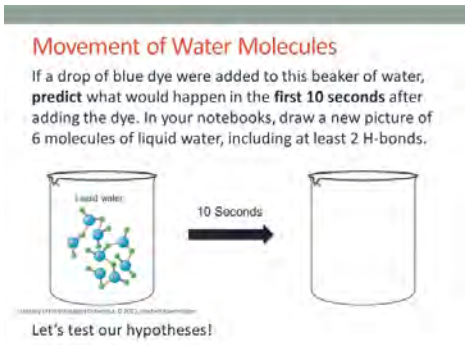
<table>
<tr><th>PD Model:
Time/Phase</th><th>Purpose, Content, and
What Participants Do</th><th>Slides</th><th>Process</th></tr>
<tr><td rowspan="2"></td><td rowspan="2">What Participants Do
Consider possible responses an elicit question (related to the water cycle) might produce, and plan probe questions to follow up on these responses.
Work in pairs, taking turns being the interviewer and asking each other an elicit question and then following up with only probe questions.
Participate in a group discussion afterward that focuses on the difficult aspects of the pairs work and the interesting thinking it revealed.
Posters and Charts
Common Student Ideas chart
PD Leader Masters
PD Leader Master: Elicit Question Cards (cut apart)
Resources in Lesson Plans Binder
Resources section:
Common Student Ideas</td><td>Practice Elicit and Probe Questions: Interview Process
1. Ask your partner the elicit question.
2. Probe your partner’s thinking without providing any new information. (Keep going for at least 2 minutes!)
3. Debrief with your partner:
• What probe questions did you ask?
• Did you ask questions that weren’t probe questions?
• What did your probe questions reveal about your partner’s understanding of the concept?
4. Switch roles and repeat the interview process, with the other partner asking the questions.</td><td>Display Slide 28. Practice Elicit and Probe Questions: Interview Process (15 min)

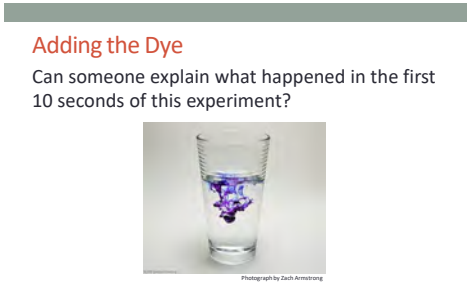
a. Review the instructions on the slide.
b. “Each interviewer will have 5 minutes to ask questions. Try to keep going with your probe questions for at least 2 minutes.”
c. Interviewees: “Don’t pretend to be an elementary student; be yourself. Help your partner by pushing yourself to explain things in more depth than you actually understand. Try to come up with possible explanations that go beyond the surface vocabulary. Don’t worry about being wrong; this will actually make the task more like what you might encounter in the classroom.”</td></tr>
<tr><td>Group Discussion
1. How did the interviews go? What did you find difficult as an interviewer? As a responder?
2. Which probe questions revealed some interesting clarifications or elaborations?
3. Did any of your questions end up challenging your partner’s thinking? (Did your questions move your partner’s thinking toward a more scientifically accurate response?)</td><td>Display Slide 29. Group Discussion (15 min)

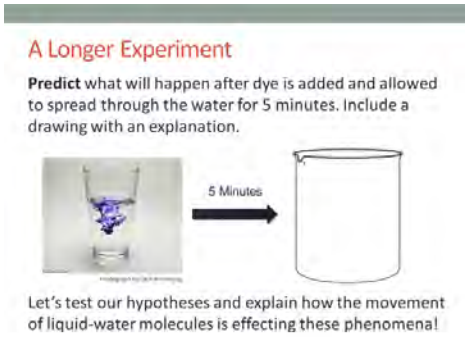
a. Whole group: Discuss the questions on the slide.
b. If there’s time, ask participants, “How might it help your teaching to do more of this type of practice (with a partner or small group)?”</td></tr>
<tr><td>12:00–12:45
45 min</td><td colspan="3">LUNCH</td></tr>
</table>

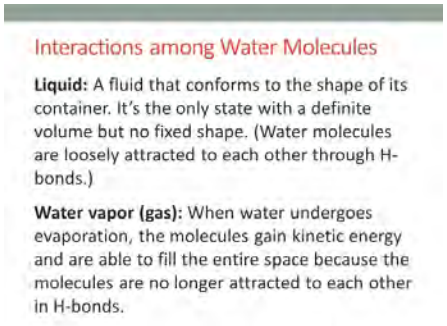
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
12:45–3:15 150 min (Includes 10-min break) **Content Deepening: Water Cycle** Slides 30–46	**Purpose** • Develop an understanding of the movement of water in various phases of the water cycle. (This is essential for understanding the interactions of water molecules in Water Cycle lessons 2a/b and 3a/b. **Content** • Water molecules move differently in the processes of evaporation and condensation as heat energy is added or removed. **What Participants Do** • Explore the movement of water molecules as heat energy is added and removed through experimentation, dancing, and visualization of water molecules in a simulation. **Posters and Charts** • Common Student Ideas chart **Supplies** • Science notebooks • Plastic cups • Ice • Food-coloring dye • Hula-Hoop for dancing simulation • 2–3 laptops with *States of Matter* PhET simulation (download)		**Display Slide 30.** Science Content Deepening **PD leader talk:** "Next, we'll begin the content deepening phase on the water cycle." **Timing note:** To keep things moving so you don't run out of time during this phase, adhere as closely as possible to the time you've allotted for each slide. If you're running short on time, you may need to abridge or skip some of the group discussion.
			**Display Slide 31.** Main Learning Goal **PD leader talk:** "The main learning goal for this content deepening phase is to explain the phenomena of the water cycle by examining the nature of water molecules." **Note:** Throughout this content deepening phase, refer as needed to the Water Cycle Content Background Document and Common Student Ideas about Matter, Molecules, and the Water Cycle.

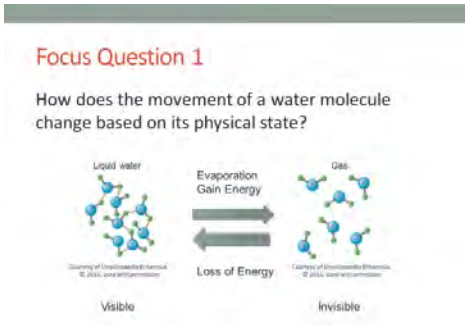
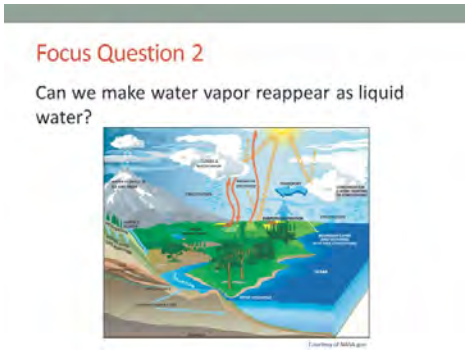
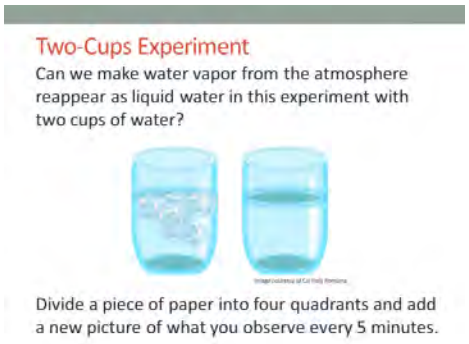
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Resources in Lesson Plans Binder *Resources section:* • Content background document • Common Student Ideas		**Display Slide 32.** Content Deepening Focus Questions **PD leader move:** Read each content deepening focus question on the slide and assure participants that they've acquired knowledge about water over the years, and you hope to enrich their ability to teach the Water Cycle lessons. To ensure that everyone feels prepared to elicit, probe, and challenge student thinking that will be made visible during the actual lessons, some topics covered will exceed the students' level of knowledge.
			**Display Slide 33.** Review: Water Definition **PD leader talk:** "Remember, **water** is 'a transparent fluid that forms the world's streams, lakes, oceans, and precipitation.' Please review the charts around the room, as well as your notes, to recall the physical and chemical properties of water we discussed yesterday." **PD leader move:** After participants have shared their observations, ask probe and challenge questions to advance group knowledge.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 34.** Interactions among Water Molecules **PD leader talk:** "Yesterday we defined *water* as 'a transparent fluid that can exist in a solid, liquid, or gaseous state.' To review our learning, I have two questions: 1. "What causes water to undergo a phase change? 2. "Which phase does **not** have hydrogen bonds?"
			**Display Slide 35.** Movement of Water Molecules **PD leader talk:** "Yesterday we defined a *liquid* as 'a fluid that conforms to the shape of its container. It's the only state with a definite volume but no fixed shape.' We also drew a few diagrams showing how liquid-water molecules were attracted to one another. Let's begin by redrawing six molecules of **liquid** water interacting through at least two H-bonds." **PD leader talk:** "In lesson 2, you'll be helping students explore the movement of water molecules through experiments and simulations. The first experiment involves adding a drop of food-coloring dye to a cup of water. Without moving the cup, you'll observe what happens to the drop of food dye. Let's predict what will happen in the first 10

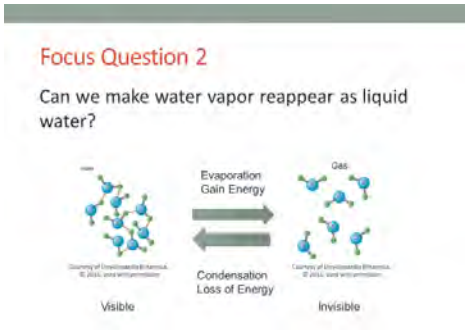
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			seconds after the dye is added to the water. Please write your predictions in a complete sentence in your science notebooks." **PD leader move:** A possible sentence starter could be, "I believe _____ will happen in the first 10 seconds after the dye is added to the water.
			**Display Slide 36.** Adding the Dye **PD leader move:** After participants have shared their predictions, add the dye to the cup of water. **Be sure not to bump the cup.** Tell participants to carefully observe what happens to the water as you perform a 10-second countdown. Then have them draw a picture in their notebooks of what they observed. Remove the cup from the table after a minute while participants are drawing. **PD leader talk:** "Be sure to draw a new picture of six liquid-water molecules with at least two H-bonds, and include the dye." **PD leader move:** Allow participants enough time to finish their drawings. Then say, "Let's do a gallery walk around the room to see what other team members have drawn." **PD leader move:** Once the walk is complete, ask someone to share an interesting insight gained while viewing the work of other participants. **PD leader talk:** "Now that we've updated our drawings, can someone explain what happened in the first 10 seconds of this experiment?"

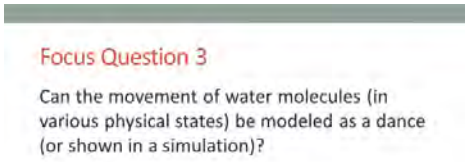
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 37.** A Longer Experiment **PD leader move:** After participants have shared their ideas about the previous experiment, set up another cup of water and explain that in this experiment, a drop of dye will be added and allowed to spread through the water for 5 minutes. **Note:** Caution everyone not to bump the table or disturb the cup after the dye is added. **PD leader talk:** "Before we add the dye to the water, let's predict what will happen during the initial 5 minutes after the dye has been added. Please write your predictions in a complete sentence in your science notebooks." **PD leader move:** Ask participants to share their predictions. (Don't add anything to the sharing at this point; just let participants express their ideas.) **PD leader move:** After participants have shared, add the dye to the water. **Make sure to watch the clock so you'll know when 5 minutes have elapsed.** **Note:** Remind participants not to bump the table or disturb the cup. Emphasize that this is a common mistake students make. **PD leader talk:** "Now that 5 minutes have passed, draw a new picture of what you observed. Be sure to include in your picture six water molecules and two H-bonds along with the dye." **PD leader talk:** "Can you explain how the dye spread through the water?" **PD leader move:** Push participants to use the

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			words *molecules*, *liquid*, and *flowing* in their explanations. After the discussion, develop a group understanding of the movement of liquid-water molecules. **PD leader talk:** "In this experiment, we observed that liquid-water molecules are moving. In fact, we can think of them as flowing past each other like beads. They are loosely attracted through temporary H-bonds when the lone-pair electrons of an oxygen molecule come into close proximity with a hydrogen molecule. This tumbling effect happens at room temperature. The use of dye made this phenomenon visible. Does anyone want to add thoughts or observations on this topic?" **PD leader talk:** "Think about yesterday's demonstration of boiling water as it applies to the movement of liquid-water molecules. How does this comparison affect your thoughts about water-vapor (gas) molecules?" **PD leader move:** Have participants review their drawings of boiling water from yesterday if they can't think of anything. **Note:** Allow everyone to share before advancing to the next slide.
			**Display Slide 38.** Interactions among Water Molecules **PD leader move:** Ask someone to read the water-vapor definition and share any thoughts.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 39.** Focus Question 1 **PD leader talk:** "Now it's time to answer our first focus question of the session: *How does the movement of a water molecule change based on its physical state?* Please be sure to use scientific vocabulary in your response." **PD leader move:** Have participants share their thoughts with an elbow partner.
	10-MINUTE BREAK		
			**Display Slide 40.** Focus Question 2 **PD leader talk:** "Now let's consider our second focus question: *Can we make water vapor reappear as liquid water?* Basically we're asking whether we can make the opposite of evaporation occur."
			**Display Slide 41.** Two-Cups Experiment **PD leader talk:** "In this experiment, we're going to observe two cups (or jars) for 15 minutes. Both cups contain liquid water, but I'll add ice to one of them." **PD leader move:** Add ice to one of the cups and set a timer for 15 minutes. **PD leader talk:** "Now please take out a sheet of

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			paper and divide it into four quadrants (boxes). Apply the labels Start, 5 Minutes, 10 Minutes, and 15 Minutes to each quadrant. Then draw your beginning observations in the first quadrant (the upper-left box). As always, be sure to include six water molecules and some H-bonds in your diagrams of the water in each cup." **PD leader move:** It's fine if participants focus on the inside of each cup. Encourage them to state one interesting observation. **PD leader talk:** "Now that the first 5 minutes have passed, begin drawing your observations for the next 5 minutes in the second box (or quadrant) of your chart." **PD leader move:** If some condensation is appearing on a cup, simply respond, "That's interesting" and continue asking participants for their insights. **PD leader talk:** "Now that 10 minutes have elapsed, begin drawing your observations for the next 5 minutes in the third box (or quadrant)." **PD leader move:** During this 5-minute period, encourage participants to begin touching the outside of each cup and noting the differences. Use simple probe questions, such as "Where is that liquid coming from on the cup of ice water?" If someone says it's from water in the air, see whether that detail was included in the participant's drawing. Ask probe questions to determine whether anyone will call the water droplets *condensation*. **PD leader talk:** "Now that the entire 15 minutes have elapsed, begin drawing your final observations in the fourth box. It may be a good idea to include water vapor (gas) in your drawing as

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			well." **PD leader move:** Allow participants time to explain what has happened. Encourage them to build on discussions from the previous session that connect heat energy, molecular movement and attractions, and H-bonds with the current activity. **Note:** Many students have misconceptions that water droplets are attracted to a cold cup, that water droplets diffuse through a cold cup to the outside, or that some water droplets "jump" out of a cold cup and land on the outside of the cup (instead of collecting on the outside of the cup from the surrounding air).
			**Display Slide 42.** Focus Question 2 **PD leader talk:** "It's time to answer our second focus question, *Can we make water vapor reappear as liquid water?* Be sure to use scientific vocabulary, such as the words *energy loss* and *H-bonds*, in your response." **PD leader move:** Have participants share their thoughts with the group.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 43.** Focus Question 3 **PD leader talk:** "Now let's consider the final focus question of the session: *Can the movement of water molecules (in various physical states) be modeled as a dance (or shown in a simulation)?* The first part of this question is asking, 'Can you design a dance where the water molecules in the air condense on the side of the cold cup of water?'"
			**Display Slide 44.** Extending Content Representations: Part 1 **PD leader talk:** "In a few minutes, we'll go into the hallway and extend our learning by engaging in a role-play that illustrates the movement of water molecules during condensation as water vapor changes to liquid water. A Hula-Hoop on the ground will represent a cold cup of water, and you'll act like water molecules. Your bodies will be oxygen atoms, and your extended arms will be hydrogen atoms. As you design your dance, remember to show H-bonding between two water molecules at some point. Do you have any questions?" **PD leader move:** Once participants have some time to work on designing a dance, remind them to use their mouths as well as their bodies by saying

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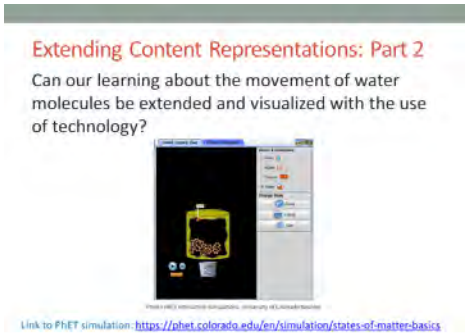
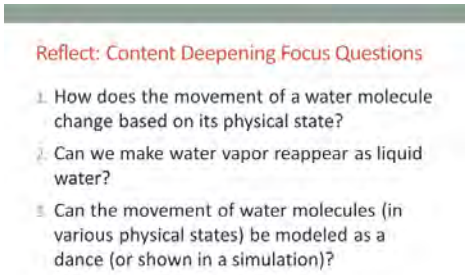
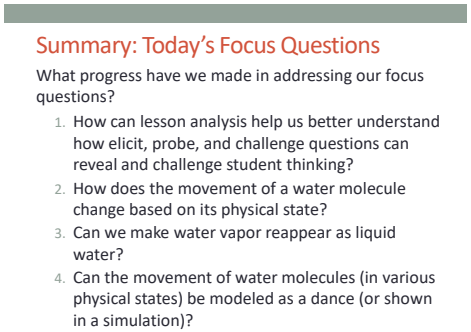
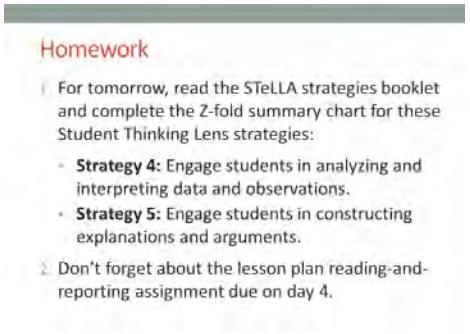
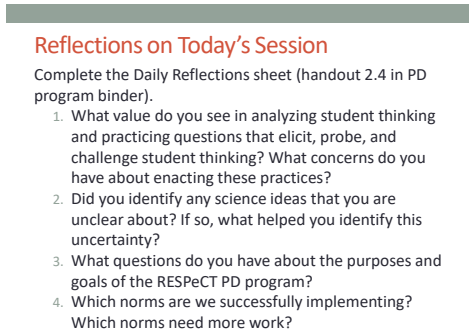
			phrases like “I’m gaining heat energy” or “I’m losing heat energy” as they move around, so everyone will know what is going on. **Note:** Perform the role-play two or three times.
			**Display Slide 45.** Extending Content Representations: Part 2 **PD leader talk:** “That demonstration was pretty fun, wasn’t it? We modeled the STELLA strategies by extending our learning to another context. We can also extend content by using computer technology and a PhET simulation from the University of Colorado, Boulder. Now break up into small groups and download the PhET simulation onto your group’s laptop using the link on the slide.” **PD leader talk:** “Let’s start the simulation and cool the system to 3 kelvin.” **PD leader move:** Engage the whole group in discussing the following questions: • What do you notice about the movement/spacing of the water molecules? • Can you see the H-bonds? • What is the definition of a **solid**? **PD leader talk:** “Now let’s warm the system to 300 kelvin (liquid water).” **PD leader move:** Engage the whole group in discussing the following questions: • What do you notice about the entire system as heat energy is added? • What do you notice about the movement/spacing of the water molecules? • Can you see the H-bonds?

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			• What is the definition of a **liquid**? **PD leader talk:** "Slowly heat the system to 361–365 kelvin." **PD leader move:** Engage the group in discussing the following question: • What do you notice about the movement/spacing of the water molecules? **PD leader talk:** "Now heat up the system extremely high." **PD leader move:** Engage the group in discussing the following questions: • What do you notice about the entire system as heat energy is added? • What do notice about the movement/spacing of the water molecules? • Can you see the H-bonds? • What is the definition of a **gas**?
			**Display Slide 46.** Reflect: Content Deepening Focus Questions **PD leader talk:** "Reflect on your learning for the entire day. What aspect of today's content deepening stretched your thinking the most?" **PD leader talk:** "Discuss with an elbow partner the strengths of implementing the activities from lessons 2 and 3 in your classrooms."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
3:15–3:30 15 min **Wrap-Up: Summary, Homework, and Reflections** Slides 47–49	**Purpose** • Summarize and reflect on the day's learning, including progress made in understanding the water cycle and the relationship between lesson analysis and asking effective elicit, probe, and challenge questions. **What Participants Do** • Synthesize key ideas about the science content, questioning strategies, and lesson analysis. • Copy down the homework assignment for day 3. • Write reflections on STeLLA strategies 1, 2, and 3 and the science content. **Handouts in PD Binder** • 2.4 Daily Reflections—Day 2 **Supplies** • Science notebooks		**Display Slide 47.** Summary: Today's Focus Questions (8 min) a. Divide participants into two groups. Have Group 1 come up with some conclusions/key ideas related to focus questions 1 and 2. Have Group 2 do the same thing for focus questions 3 and 4. b. Give each group 3 minutes to come up with ideas and conclusions. c. Allow a 2-minute share-out for each group.
			**Display Slide 48.** Homework (1 min) a. Forecast that tomorrow you'll tackle two new, closely interconnected Student Thinking Lens strategies. b. Have participants copy the homework assignment into their science notebooks. c. Remind participants about their homework for Friday (becoming experts on the lesson plans assigned to them).

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 49.** Reflections on Today's Session (6 min) a. Make sure participants have **at least 5 minutes** to think about the questions on the reflections sheet (handout 2.4 in the PD program binder) and write down their reflections.