RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

Grade Level	5	Day	4	STeLLA Strategy	STL Strategy 6: Use and Apply New Science Ideas	Subject Matter Focus	Water Cycle

Focus Questions	• Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts? • How will the Student Thinking Lens strategies help you teach the Water Cycle lessons? • What are the two basics steps of cloud formation? • How does the process of distillation simulate the overall water cycle?
Main Learning Goals	Participants will understand the following: • In order to develop meaningful understandings of science ideas, students need multiple opportunities to try using and applying new science ideas in a variety of ways and contexts. • Explore how a distillation apparatus simulates the water cycle on Earth by highlighting cloud formation and precipitation.

Preparation

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 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 3 and create a summary slide.
- Watch video clips and anticipate participant responses.
- Prepare charts for the day's agenda and focus questions.
- Using PPT slide 24 as a model, prepare a chart of the STL strategies highlighted in the Water Cycle lesson plans.

Materials

Posters and Charts

- STeLLA Framework and Strategies poster
- Day-4 Agenda (chart)
- Day-4 Focus Questions (chart)
- Norms for Working Together (chart)
- Strategy charts from days 1–3 (STL strategies 1–5)
- Chart of STL strategies highlighted in Water Cycle lesson plans (see PPT slide 24 for model)
- Parking Lot poster

Handouts in RESPeCT PD Binder Front Pocket

- Z-fold summary chart: Student Thinking Lens Strategies

Handouts in RESPeCT PD Binder, Day 4

- 4.1 Importance of Engaging Students in Constructing Scientific Explanations (task sheet)
- 4.2 Student Work from Zembal-Saul Book *What's Your Evidence?*
- 4.3 Benefits of Engaging Students in Constructing Scientific Explanations
- 4.4 Transcript for Video Clip 4.1
- 4.5 Transcript for Video Clip 4.2

Videos

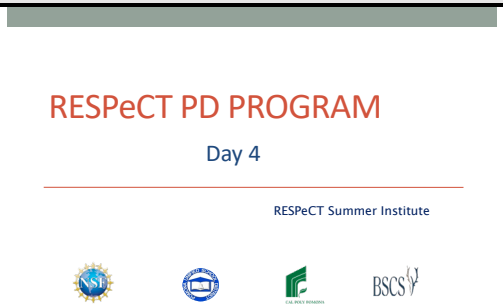
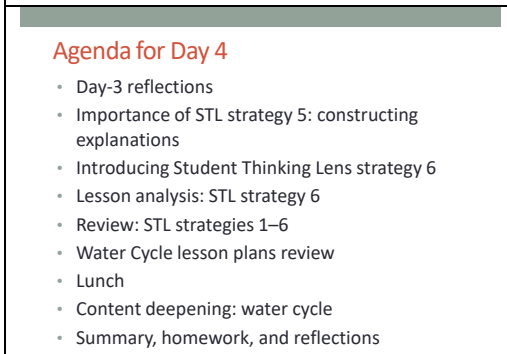
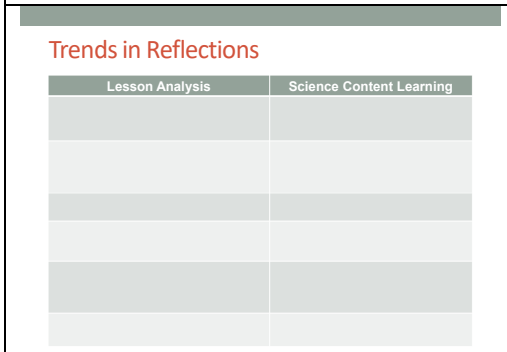
- Hershberger video clip, *Introducing the CER* (on companion DVD for Zembal-Saul book *What's Your Evidence?*)
- Video Clip 4.1: Dieken classroom (use and apply: explaining water on a cold soda can); 4.1_stella_WC_dieken_c1
- Video Clip 4.2: Anderson classroom (review Student Thinking Lens strategies); 4.2_stella_WC_anderson_c1
- Happy Scientist *Cloud Formation* YouTube video.

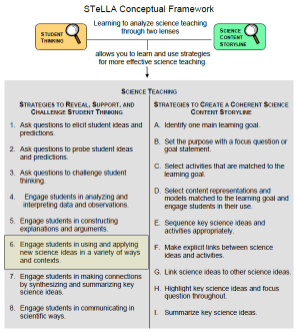
• Content deepening:
  • Assemble supplies for the distillation apparatus (beaker, stopper, aquarium tubing, water, hot plate, and collection tube).
  • Set up the Happy Scientist *Cloud Formation* YouTube video.
	• 4.6 Identifying Student Thinking Lens Strategies
	• 4.7 Daily Reflections—Day 4
	
	PD Leader Masters, Days 1–4
	• PD Leader Master: 5th-Grade Guide to Video Clips for Day 4
	
	Supplies
	• Science notebooks
	• Chart paper and markers
	• Lesson materials kit (water cycle)
	• Ball-and-stick model kits (with magnets)
	• Distillation apparatus (beaker, stopper, aquarium tubing, water, hot plate, and collection tube)
	
	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 4 SESSION OUTLINE

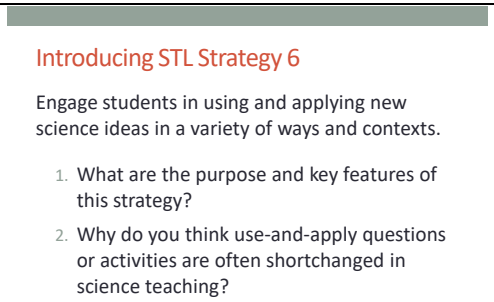
Time	Activities	Purpose
8:00–8:15 15 min	**Getting Started: Housekeeping, Agenda, Day-3 Reflections, Focus Questions**	• Build community by sharing participants' reflections from day 3. • Set the stage for a day of learning.
8:15–8:50 35 min	**Importance of STL Strategy 5: Constructing Explanations**	• Develop an appreciation for the multiple ways in which engaging students in constructing scientific explanations can have an impact on student learning within and beyond science.
8:50–9:10 20 min	**Introducing Student Thinking Lens (STL) Strategy 6**	• Develop an initial understanding of the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts.
9:10–10:10 60 min	**Lesson Analysis: STL Strategy 6**	• Use lesson analysis of classroom videos to better understand strategy 6. • Deepen science-content knowledge of the water cycle through lesson analysis.
10:10–10:55 45 min (Includes 10-min break)	**Review: STL Strategies 1–6**	• Review and deepen understandings of key similarities and differences among STL strategies 1–6.
10:55–12:00 65 min	**Water Cycle Lesson Plans Review**	• Understand why the Water Cycle lesson plans are so scripted and how they should be used before and during the lessons. • Understand the conceptual flow within and across the Water Cycle lessons. • Understand the focus question, main learning goal, and main activity in each lesson. • Understand how STL strategies 1–6 are embedded in the lessons.
12:00–12:45 45 min	**LUNCH**	
12:45–3:15 150 min (Includes 10-min break)	**Chemistry Content Deepening: Water Cycle**	• Explore how a distillation apparatus simulates the water cycle on Earth and highlights cloud formation as a two-step process central to the water cycle.
3:15–3:30 15 min	**Wrap-Up: Summary, Homework, and Reflections**	• Summarize and reflect on key ideas from today's learning and preview the transition to the Science Content Storyline Lens (SCSL) strategies.

DAY 4

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
8:00–8:15 15 min **Getting Started** Slides 1–5	**Purpose** • Build community by sharing participants' reflections from day 3. • Set the stage for a day of learning. **What Participants Do** • Review the day's agenda. • Discuss the reflections from day 3. • Read today's focus questions. **Posters and Charts** • STeLLA Framework and Strategies poster • Day-4 Agenda (chart) • Day-4 Focus Questions (chart)		**Display Slide 1.** RESPeCT PD Program (5 min) a. Take care of any housekeeping issues.
			**Display Slide 2.** Agenda for Day 4 (3 min) a. Talk through the agenda for the day.
			**Display Slide 3.** Trends in Reflections (5 min) a. Invite participants to look at your feedback on their reflections from day 3 and offer reactions, comments, or follow-up questions.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Today's Focus Questions 1. Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts? 2. How will the Student Thinking Lens strategies help you teach the Water Cycle lessons? 3. What are the two basic steps of cloud formation? 4. How does the process of distillation simulate the overall water cycle?	**Display Slide 4.** Today's Focus Questions (1 min) a. Introduce the focus questions that will guide today's work. b. "Like STeLLA strategies 4 and 5, the goal of strategy 6 is to move student thinking forward toward deeper understandings of science ideas."
			**Display Slide 5.** STeLLA Conceptual Framework (1 min) a. Draw participants' attention to the new strategy highlighted on the slide. b. "Strategy 6 is the third STL strategy that is a type of activity designed to move student thinking forward."
8:15–8:50 35 min **Importance of STL Strategy 5: Constructing Explanations** Slides 6–7	**Purpose** • Develop an appreciation for the multiple ways in which engaging students in constructing scientific explanations can have an impact on student learning within and beyond science. **Content** • Engaging students in constructing scientific explanations helps them develop meaningful understandings of science ideas	The Importance of Engaging Students in Constructing Scientific Explanations Read handout 4.1 and your group-specific handout. Then complete the assigned task: **Group 1:** Analyze a student explanation (handout 4.2). **Group 2:** Summarize benefits for students of constructing scientific explanations (handout 4.3). **Group 3:** Summarize the benefits for teachers of engaging students in constructing scientific explanations (handout 4.3).	**Display Slide 6.** The Importance of Engaging Students in Constructing Scientific Explanations (25 min) **Note:** If you need some time to catch up on day-3 activities, you can skip this slide. However, this activity is beneficial for reviewing strategy 5 (constructing explanations) and helping participants understand why explanation building is such important work in science and beyond. **Timing note:** For this segment, allot 5 minutes for reading, 10 minutes to prepare for a group share-

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	and how scientists work. **What Participants Do** • Review jigsaw-strategy readings about the importance of scientific explanations and examine a sample of student work. • Share key ideas about constructing scientific explanations. • Watch and discuss a lesson video in which the teacher explicitly teaches 3rd graders how to construct explanations that include a claim, evidence, and reasoning that connects to science ideas. **Posters and Charts** • STeLLA Framework and Strategies poster • Strategy charts from days 1–3 (STL strategies 1–5) **Videos** • Hershberger video clip, *Introducing the CER* **Handouts in PD Binder** • 4.1 Importance of Engaging Students in Constructing Scientific Explanations (task sheet) • 4.2 Student Work from Zembal-Saul Book *What's Your Evidence?* • 4.3 Benefits of Engaging Students in Constructing Scientific Explanations **PD Resources** • STeLLA strategies booklet		out, and 10 minutes for the share-out. a. Divide participants into three groups or pairs. Assign each group a number (1, 2, 3). b. Direct participants to three handouts: 1. Importance of Engaging Students in Constructing Scientific Explanations (handout 4.1 in PD program binder) (This handout describes what groups are to do with the following two handouts.) 2. Student Work from Zembal-Saul Book *What's Your Evidence*? (handout 4.2 in PD binder) (Group 1's task is linked to this handout.) 3. Benefits of Engaging Students in Constructing Scientific Explanations (handout 4.3 in PD binder) (Tasks for Groups 2 and 3 are linked to this handout.) c. After participants have read the designated handouts for their groups and completed their assigned tasks, invite them to share out.
		The CERA Framework for Constructing Scientific Explanations • Next, we'll watch video clip of a 3rd-grade teacher instructing students how to construct scientific explanations. • Think about ideas this clip gives you for helping your students learn to construct scientific explanations by making a claim, supporting it with evidence and reasoning, and considering alternative explanations and strategies (CERA). Link to *Introducing the CER* video clip.	**Display Slide 7.** The CERA Framework for Constructing Scientific Explanations (10 min) **Note:** This activity is optional but powerful. a. "Let's watch how one 3rd-grade teacher taught her students to construct scientific explanations. This is the teacher whose student writing Group 1 just read about. The class in this video clip has been studying simple machines (such as pulleys and levers)." b. "We're not going to analyze this video clip in terms of STeLLA strategies. Instead, think about ideas this clip gives you as to how you might introduce your students to the CERA framework for constructing scientific explanations, which

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			involves making a claim, supporting it with evidence and reasoning, and considering alternative explanations and strategies." c. After watching the clip, discuss participants' reactions and any ideas it gave them about how they might help their students learn to construct strong scientific explanations. **Note:** Make sure participants are aware that in addition to using the CERA framework as a tool for teaching students how to develop scientific explanations and arguments (STeLLA strategy 5) in the classroom, they will be using the same framework for videocase-based lesson analysis of their science teaching in RESPeCT study groups throughout the school year.
8:50–9:10 20 min **Introducing Student Thinking Lens (STL) Strategy 6** Slide 8	**Purpose** • Develop an initial understanding of the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts. **Content** • After students encounter new science ideas, they need opportunities to practice them and see their usefulness in explaining a variety of phenomena. Activities that challenge students to use and apply new ideas give them the time and space to really make sense of the concepts. **What Participants Do** • Make and discuss charts highlighting the purpose and key		**Display Slide 8.** Introducing STL Strategy 6 (20 min) a. **Small groups (10 min):** Divide participants into two groups to make charts highlighting the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts. Encourage participants to refer to the STeLLA strategies booklet and STL Z-fold summary chart for this activity. b. **Whole group (10 min):** Have groups present their charts in a whole-group share-out and compare them. Ask participants, "What differences and similarities do you notice when you compare your charts with those of other groups?" **Key ideas:** • Strategy 6 is a time for "strategic telling" and making sure students are using science ideas

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	features of strategy 6. **Supplies** • Chart paper and markers **PD Resources** • STeLLA strategies booklet • STL Z-fold summary chart (front pocket of PD binder)		accurately. • A use-and-apply question or activity is introduced *after* students have experienced/encountered a new science idea. It provides an opportunity for students to use and apply the idea in a new context or novel way and/or link two or more science ideas together. • A common misconception is that use-and-apply questions or activities *assess* student learning. Teachers often talk about asking these kinds of questions on tests. However, according to research findings published in *How People Learn* (National Academy of Sciences, 2000), *application* is part of the learning process, or developing a conceptual framework. If application is treated like assessment, students may encounter a use-and-apply question on a test without ever having had the opportunity to practice this way of thinking as part of their learning.
9:10–10:10 60 min **Lesson Analysis: STL Strategy 6** Slides 9–14	**Purpose** • Use lesson analysis of classroom videos to better understand strategy 6. • Deepen science-content knowledge of the water cycle through lesson analysis. **Content** • Strategy 6 involves engaging students in using and applying	Lesson Analysis: Focus Question 1 Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts?	**Display Slide 9.** Lesson Analysis: Focus Question 1 (Less than 1 min) a. Highlight the focus question that will guide the lesson analysis work during this phase.

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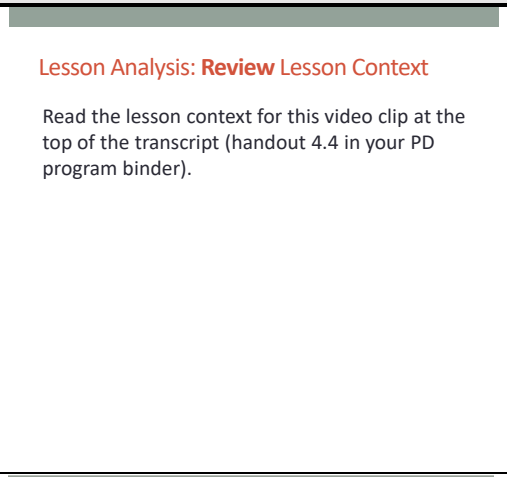
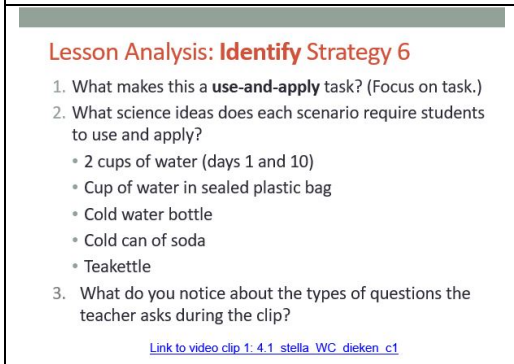
	new science ideas in a variety of ways and contexts. • Condensation occurs when water-vapor molecules in the air lose heat energy (cool), slow down, and join together to form liquid-water droplets. Water vapor in the air (a gas) is invisible, but liquid water is visible because many, many molecules of water are gathered close together. • Evaporation occurs when water molecules in the liquid state gain heat energy, speed up, move apart, escape from the surface of the liquid, and spread out into the air. • Water molecules in boiling water in a teapot can evaporate out of the spout as invisible water vapor, but when they hit the cooler air outside the teapot, they lose heat energy, slow down, and form tiny droplets of liquid water called *steam*. Over time, these droplets evaporate again as they encounter higher-energy water-vapor molecules in the air. **What Participants Do** • Watch a classroom video clip to identify strategy 6 and analyze student thinking that is revealed and challenged from using this strategy. • Check their understandings of strategy 6 by taking a quick multiple-choice quiz.	 	**Display Slide 10.** Lesson Analysis: Review Lesson Context (2 min) a. "Read the lesson context at the top of the video transcript (handout 4.4 in your PD program binders)." b. Make sure participants understand the science content and activity that are the focus of this video clip. **Note:** Refer to the Water Cycle Content Background Document as needed throughout the lesson analysis. **Display Slide 11.** Lesson Analysis: Identify Strategy 6 (25 min) a. "As you watch the video, think about what makes the activity in this clip a use-and-apply task. What science ideas should students be using and applying in each scenario? Also notice what kinds of questions the teacher asks." b. Show the video clip. c. **Individuals:** "Think about the questions on the slide and mark the transcript as you identify the use of strategy 6." d. **Whole group:** Discuss participants' responses to the questions. **Ideal observations:** a. This is a use-and-apply task because students in the video clip are using science ideas they have previously studied to explain five different scenarios. Thus, they are using new science

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	Videos • Video Clip 4.1, Dieken classroom **Handouts in PD Binder** • 4.4 Transcript for Video Clip 4.1 **PD Leader Masters** • PD Leader Master: 5th-Grade Guide to Video Clips for Day 4 **PD Resources** • STeLLA strategies booklet **Resources in Lesson Plans Binder** *Resources section:* • Content background document		ideas to explain a variety of contexts. b. All of the scenarios challenge students to think about changes in heat energy and how they affect water molecules and changes of state in the water cycle. • **Scenario 1** focuses on evaporation. • **Scenario 2**, the cup of water in the plastic bag, demonstrates both the evaporation of water molecules from the cup and the condensation of water on the inside of the baggie (changing from water vapor back to liquid water as heat energy is lost). • **Scenarios 3 and 4** (cold water bottle/cold soda can) both demonstrate condensation. Water-vapor molecules in the air near the cold can or bottle lose heat energy, slow down, and join together to form droplets of liquid water. • **Scenario 5**, the teakettle, illustrates both evaporation and condensation. As the water boils, water molecules in the liquid state speed up, move apart, and escape into the air as water vapor. At the end of the spout, you see nothing—water vapor is there but invisible. Then the water vapor cools (loses heat energy) as it hits the cooler air above the spout, causing the molecules to slow down, join together, and form liquid-water droplets in the air above the spout. This cloud of liquid-water droplets is called *steam*. As these droplets collide with faster-moving water-vapor molecules in the air, they quickly gain energy, speed up, and evaporate again. c. The video clip appropriately includes **challenge questions** (and statements) because the goal of strategy 6 is to move student thinking forward. (See examples of the teacher challenging students in video segments 19:58, 21:10, 21:25,

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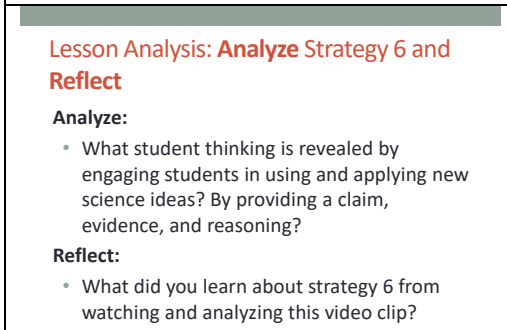
			22:32, 22:37, 22:41, 23:17, 23:26, 24:35, 24:44, 24:46, 24:50, 25:05, and 25:20.) **Note:** For examples of strategy 6, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 4.
			**Display Slide 12.** Lesson Analysis: Analyze Strategy 6 and Reflect (25 min) a. **Individuals:** "For the analysis question on the slide, study the video transcript and come up with a claim, evidence, and reasoning to support your claim." b. **Whole-group share-out:** As participants share their claims, evidence, and reasoning, encourage them to challenge one another by asking questions, disagreeing, and suggesting improvements or alternative explanations and arguments. (Refer to the norms at the heart of the RESPeCT program.) **Note:** You may also want to ask participants whether they noticed in the transcript any missed opportunities for engaging students in using and applying new science ideas. c. **Reflect (1 min):** Give participants time to think about the reflection question on the slide. d. **Whole-group discussion:** Discuss the reflection question as a group. Make sure participants note specifically what they learned about strategy 6 from watching and analyzing this video clip. **Note:** For examples of strategy 6, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 4.

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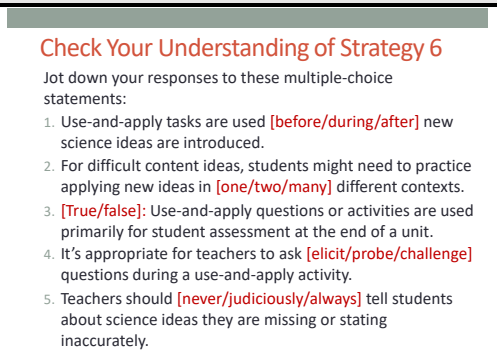
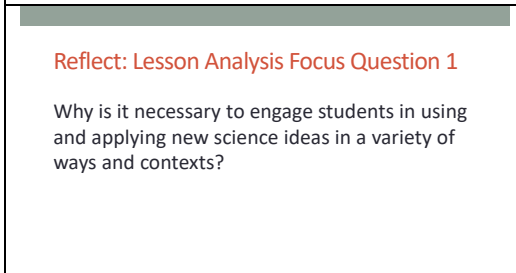
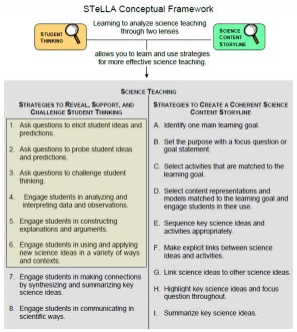
			**Display Slide 13.** Check Your Understanding of Strategy 6 (5 min) **Note:** This activity is optional if time is running short. a. "To check your understanding of STL strategy 6, jot down your responses to this multiple-choice quiz." b. Have participants discuss their answers either in pairs or as a group. (If time is short, just read the answers aloud.) **Answer key:** 1. After 2. Many 3. False 4. Challenge (and probe) 5. Judiciously (defined as "good or discriminating judgment; wise, sensible, or well advised")
			**Display Slide 14.** Reflect: Lesson Analysis Focus Question 1 (3 min) a. **Individuals (1 min):** "Think for a moment about how you would answer the focus question on this slide." b. **Whole-group share-out (2 min):** Have a few participants share their ideas.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
10:10–10:55 45 min (Includes 10-min break) **Review: STL Strategies 1–6** Slides 15–19	**Purpose** • Review and deepen understandings of key similarities and differences among STL strategies 1–6. **Content** • STL strategies 1–6 reveal, support, and challenge student thinking. **What Participants Do** • Study the Summary of STeLLA Student Thinking Lens Strategies chart in the STeLLA strategies booklet. • Discuss patterns, similarities, and differences among STL strategies 1–6. • Watch a classroom video clip and identify any STL strategies used during the lesson. Discuss observations and missed opportunities. **Posters and Charts** • Strategy charts from days 1–3 (STL strategies 1–5) **Videos** • Video Clip 4.2, Anderson classroom **Handouts in PD Binder** • 4.5 Transcript for Video Clip 4.2 • 4.6 Identifying Student Thinking Lens Strategies **PD Leader Masters**	Lesson Analysis: Focus Question 2 How will the Student Thinking Lens strategies help you teach the Water Cycle lessons?	**Display Slide 15.** Lesson Analysis: Focus Question 2 (Less than 1 min) a. **Transition:** "Now we'll shift our attention to the second lesson analysis focus question and spend some time summarizing what we've learned so far about Student Thinking Lens strategies 1–6. Then we'll review the Water Cycle lesson plans and highlight how these strategies are used in the lessons you'll start teaching in January."
			**Display Slide 16.** STeLLA Conceptual Framework (Less than 1 min) a. "These are the Student Thinking Lens strategies we've explored so far. You'll get practice using them as you teach the Food Webs and Water Cycle lessons next year."
		Review: Student Thinking Lens Strategies Review the STL summary chart in the STeLLA strategies booklet and discuss these questions: 1. What pattern(s) do you see in this arrangement (organization) of the STL strategies? 2. How does this arrangement (organization) highlight the differences and similarities among the Student Thinking Lens strategies?	**Display Slide 17.** Review: Student Thinking Lens Strategies (3 min) a. **Individuals:** Have participants review STL strategies 1–6 on the summary chart in the strategies booklet (Summary of STeLLA Student Thinking Lens Strategies). b. **Whole group:** Discuss the questions on the slide. **Key ideas:** • Strategies 1–3 are types of questions, and strategies 4–6 are activities designed to move student thinking forward toward more-scientific

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	• PD Leader Master: 5th-Grade Guide to Video Clips for Day 4 **PD Resources** • STeLLA strategies booklet		understandings. • Some strategies are used at any time during the lesson (e.g., probe questions); others are used at specific times (e.g., elicit questions used *before* students have been introduced to new science ideas; use-and-apply activities used *after* students have been introduced to new science ideas). • Each strategy has its own specific purpose(s), but the strategies are closely connected to one another. That is, these strategies aren't used in isolation; they're complementary.
		Lesson Analysis: **Review** Lesson Context Read the lesson context for this video clip at the top of the transcript (handout 4.5 in your PD program binder).	**Display Slide 18.** Lesson Analysis: Review Lesson Context (1 min) a. "Read the lesson context at the top of the video transcript (handout 4.5 in your PD program binders)." b. Make sure participants understand the science content and activity that are the focus of this video clip.
		Lesson Analysis: **Identify** Student Thinking Lens Strategies • What Student Thinking Lens strategies can you identify in this video clip? • After watching the video, study the transcript (handout 4.5) and fill in handout 4.6 (Identifying Student thinking Lens Strategies). • Be ready to share your findings with the group, including any missed opportunities. Link to video clip 2: 4.2_stella_WC_Anderson_c1	**Display Slide 19.** Lesson Analysis: Identify Student Thinking Lens Strategies (30 min) **Note:** If absolutely necessary, you can skip this video analysis. a. Orient participants to handout 4.6, Identifying Student Thinking Lens Strategies. b. Make sure participants understand the context of the video clip (from the transcript). Emphasize that students in the clip have already learned about molecules gaining and losing energy during evaporation and condensation. Also emphasize

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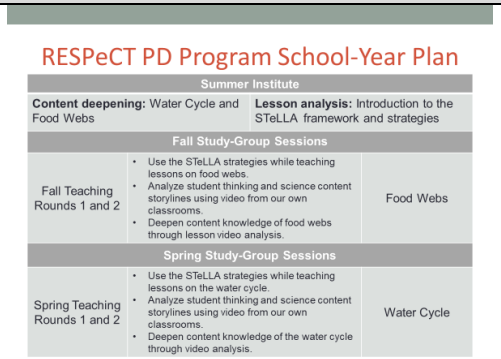
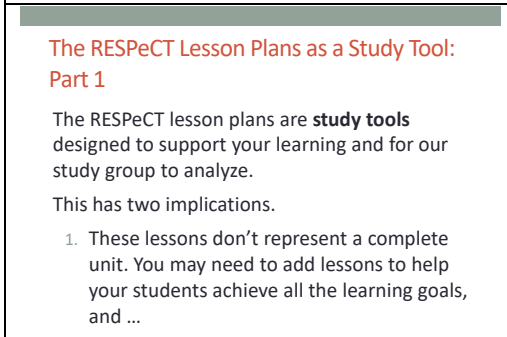
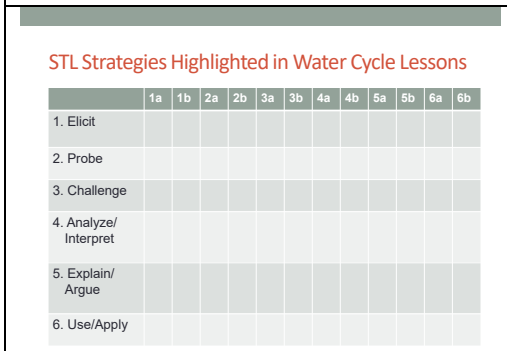
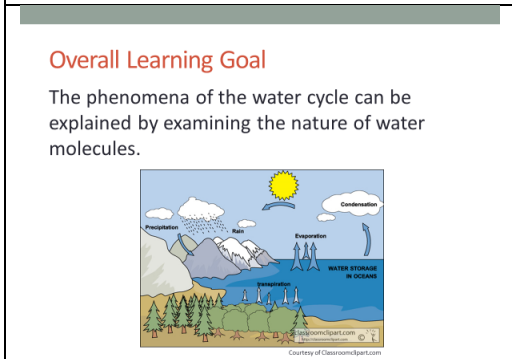
			that students are making predictions about the water-changes system, but they haven't yet observed this system in action. c. Show the video clip. d. **Individuals:** "Study the video transcript and complete handout 4.6, Identifying Student Thinking Lens Strategies." e. **Whole group:** "What STL strategies did you identify in the video transcript? Did you spot any missed opportunities?" **Note:** For examples of STL strategies, see PD Leader Master: 5th-Grade Guide to Video Clips for Day 4.
10:45–10:55 10 min	**BREAK**		
10:55–12:00 65 min **Water Cycle Lesson Plans Review** Slides 20–24	**Purpose** • Understand why the Water Cycle lesson plans are so scripted and how they should be used before and during the lessons. • Understand the conceptual flow within and across the Water Cycle lessons. • Understand the focus question, main learning goal, and main activity in each lesson. • Understand how STL strategies 1–6 are embedded in the lessons. **Content** • All lessons are designed to support the science content storyline within and across		**Display Slide 20.** RESPeCT PD Program School-Year Plan (2 min) a. "Before we share our reports about each of the Water Cycle lesson plans and how they support you in practicing these Student Thinking Lens strategies, let's review the plan for the school year." b. "In the fall you'll teach the **Food Webs** lessons, and we'll meet in our study group to analyze video clips and student work from these lessons. This analysis will help us deepen our understandings of the STeLLA strategies, the science content, the lesson plans, and our students' thinking and learning." c. "Starting in January, you'll teach the **Water Cycle** lessons, and we'll meet in our study group to

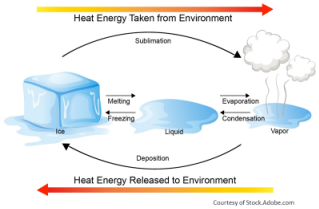
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process

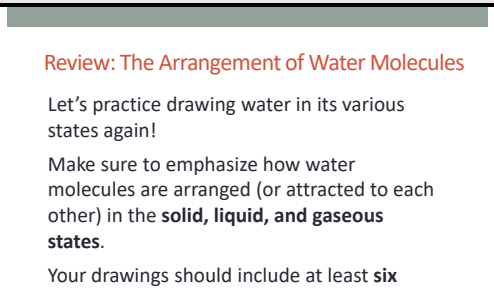
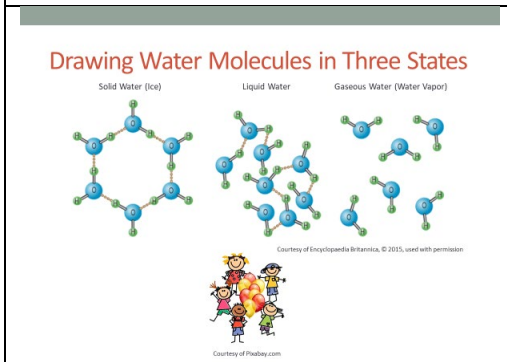
	lessons. Each lesson contains a focus question, a main learning goal, and an activity.
	• The Student Thinking Lens strategies work together across lessons according to the following pattern:
	  • Elicit and probe strategies are very important in lesson 1.
	  • Probe and challenge strategies are used throughout all the lessons.
	  • Strategies 4 and 5 are highlighted in the middle lessons.
	  • Strategy 6 is highlighted toward the end of the lesson, after students encounter new science ideas but before final unit assessments.
	
	What Participants Do
	• Review the plans for school-year study groups.
	• Listen to the PD leader describe the lesson plans for the study groups and how they should be used/adapted.
	• Present a summary of an assigned lesson plan to help their peers understand the lesson.
	• Raise questions and concerns about the lesson plans and make suggestions.
			analyze video clips and student work from these lessons. Do you have any questions?"
			d. **Important reminder:** "Remember that we're analyzing video clips of our own classroom teaching to help us all learn, not to evaluate and critique one another. Everyone is learning to use both new strategies and new lesson plans, so it's predictable that our first attempts at teaching these lessons will have rough spots. We need to appreciate and acknowledge the courage each of us is demonstrating in sharing our initial efforts to teach these lessons. Please be assured that our analyses of the videos will focus on the strategies, the science content, and most importantly, how students are making sense of the lessons. We're not going to focus on rough spots or management problems. We're here to support one another and to learn and grow as science teachers."
			
			Display Slide 21. The RESPeCT Lesson Plans as a Study Tool: Part 1 (1 min)
			
			a. Read through the information on this slide.
			b. Elicit and respond to any comments or questions from participants.

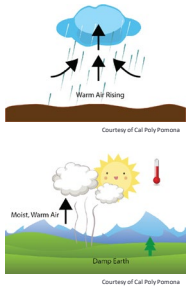
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Supplies • Chart paper and markers **PD Resources** • RESPeCT lesson plans binder	The RESPeCT Lesson Plans as a Study Tool: Part 2 2. As a study tool, the lesson plans are highly scripted to model how they might be implemented. a. Study this script in your lesson planning. b. Adapt the plans and PowerPoint slides to make them work for you and your students (but don't add or drop main activities). c. You don't have to be tied to the script as you teach! Using the slides as a guide can help free you from the script.	**Display Slide 22.** The RESPeCT Lesson Plans as a Study Tool: Part 2 (2 min) a. Read through the information on this slide. b. Elicit and respond to any comments or questions from participants.
		Lesson Plan Conversation 1. **The science content storyline across lessons** • Review the main learning goal for each lesson sequentially. 2. **The science content storyline within lessons** (5–8 min for each two-part lesson) • How does this lesson fit into the arc of all the lessons? • What are the main learning goal and focus question? • What is the main activity (or activities)? • How will the activity help students better understand the learning goal for the day? • What STeLLA strategies are highlighted in the activity? • What concerns or suggestions do you have regarding the activity? 3. **Practical issues and questions**	**Display Slide 23.** Lesson Plan Conversation (60 min in conjunction with next slide) a. For step 1 on the slide, have participants describe the main learning goal for their assigned two-part lesson (parts A and B) and how it connects to the lessons that precede and follow it. (5 min) b. For steps 2 and 3, have participants report on their assigned two-part lesson. **Note:** Rather than walking through every step in the lesson plan, participants should present the *big picture* using the questions in step 2 on the slide. They should bring up details only when they have some concern, question, or suggestion about a modification. c. As participants give their reports, mark on a chart the Student Thinking Lens strategies that are highlighted in each lesson. (Use the chart on the next slide as a model.) **Note:** Encourage participants to pick just one or two Student Thinking Lens strategies that are highlighted in the lesson. (Several strategies may

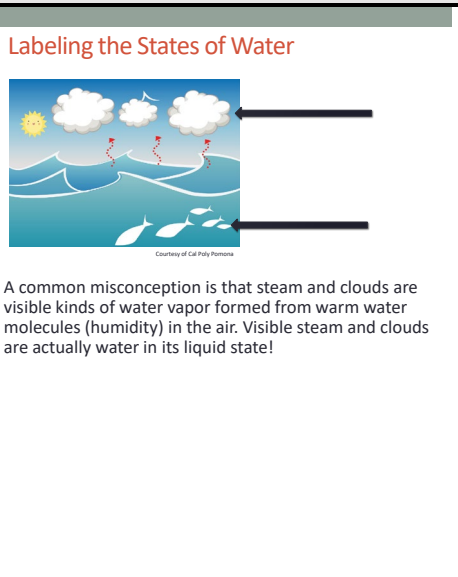
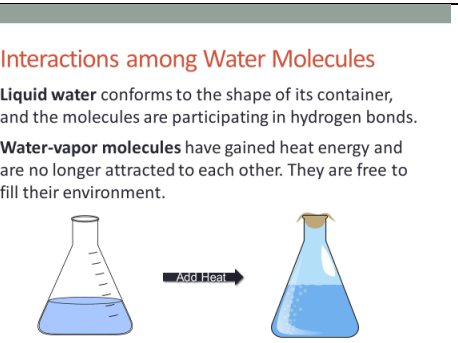
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			be used in a lesson.) d. Highlight the following ideal pattern and how the STL strategies work together across lessons: • Elicit and probe strategies are very important in lesson 1. • Probe and challenge strategies are used throughout all the lessons. • Strategies 4 and 5 are highlighted in the middle lessons. • Strategy 6 is highlighted toward the end of a lesson, after students encounter new science ideas but before final unit assessments. **Timing note: Make sure you limit the time allotted for each lesson** so you can get through them all. If you have 6 two-part lessons, you'll have approximately 8 minutes for each lesson (4 minutes for part A, and 4 minutes for part B). If your lesson series has more than 6 two-part lessons, you'll have to decrease the time for each lesson.
			**Display Slide 24.** STL Strategies Highlighted in Water Cycle Lessons a. Use this slide in conjunction with the previous slide.
12:00–12:45 45 min	**LUNCH**		

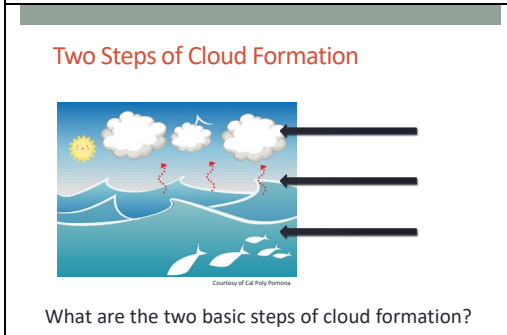
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
12:45–3:15 150 min (Includes 10-min break) **Chemistry Content Deepening: Water Cycle** Slides 25–45	**Purpose** • Explore how a distillation apparatus simulates the water cycle on Earth and highlights cloud formation as a two-step process central to the water cycle. **Content** • The movement of water molecules during the water cycle highlights cloud formation as a major source of student misconceptions. **What Participants Do** • Observe a video clip and distillation demonstration on cloud formation as heat energy is added and removed during the water cycle. **Supplies** • Science notebooks • Distillation apparatus (beaker, stopper, aquarium tubing, water, hot plate, and collection tube) • Ball-and-stick model kits (with magnets) **Video** • Happy Scientist *Cloud Formation* YouTube video		**Display Slide 25.** Science Content Deepening **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 leader move:** This slide marks the transition to the content deepening phase. **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 26.** Overall Learning Goal **PD leader talk:** "This week, we've been using science ideas about the nature of water molecules to explain the phenomena of the water cycle."

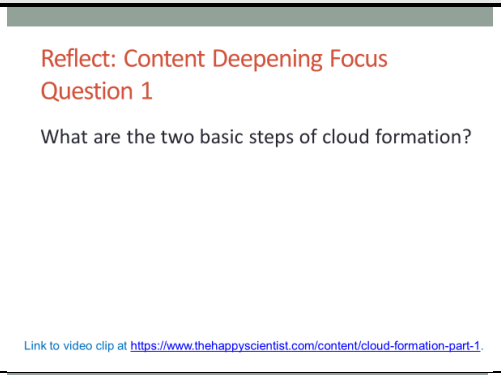
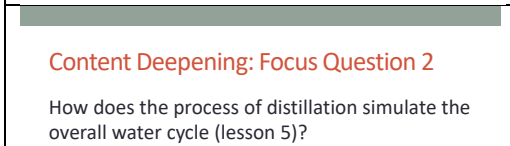
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Resources in Lesson Plans Binder *Resources section:* • Content background document • Common Student Ideas	Content Deepening Focus Questions • What are the two basic steps of cloud formation? • How does the process of distillation simulate the overall water cycle?	**Display Slide 27.** Content Deepening Focus Questions **PD leader move:** Read each focus question and continue emphasizing that participants have previous knowledge about water that they've acquired over the years, and you hope this content deepening work will 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.
		The Role of Energy in Phase Changes **Phase changes** in water occur as energy is gained or lost. Using science ideas from the past few lessons, draw a diagram illustrating this concept.  	**Display Slide 28.** The Role of Energy in Phase Changes **Note:** Hide the diagram on the PPT slide until participants have completed their drawings. **PD leader talk:** "Phase changes in water occur as energy is gained or lost. Using science ideas from the past few lessons, draw a diagram illustrating this concept." **PD leader move:** Make sure participants use arrows in their diagrams, name the phases, and add the words *energy loss* and *energy gain*. **PD leader move:** After participants have finished their drawings, reveal the diagram on the slide and discuss participants' previous knowledge of the various states of matter.

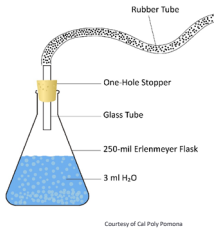
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 29.** Review: The Arrangement of Water Molecules **PD leader talk:** "Let's practice drawing water in its various states again. Make sure to emphasize how water molecules are arranged (or attracted to each other) in the solid, liquid, and gaseous states. Your drawings should include at least six water molecules." **PD leader move:** Give participants 1 minute to draw water molecules in all three states, using at least six water molecules. Look at some of the diagrams and remind participants to include hydrogen bonds (H-bonds). **PD leader move:** Have two volunteers share their drawings and another few volunteers use various molecular models (e.g., a ball-and-stick model with magnets) to demonstrate water molecules in the solid and liquid states.
			**Display Slide 30.** Drawing Water Molecules in Three States **Note:** Hide the photo on the slide until after participants discuss the question. **PD leader talk:** "What similarities or differences do you see in your diagrams compared to those on the slide?" **PD leader move:** After the discussion, reveal the photo of students engaged in a role-play. Have participants role-play water molecules gaining heat energy and undergoing a phase change into a gas and then back to a liquid. Tell participants that their torsos represent one oxygen atom, and their

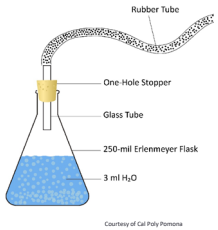
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			outstretched hands represent two hydrogen atoms.
		Content Deepening: Focus Question 1 What are the two basic steps of cloud formation?	**Display Slide 31.** Content Deepening: Focus Question 1 **PD leader move:** Read the first content deepening focus question and ask participants to engage in a 2-minute quick write on cloud formation. **PD leader move:** After a few minutes, have participants share their answers with an elbow partner.
		Cloud Formation Students typically refer to cloud formation as a one-step process involving water vapor. They view energy as a kind of invisible crane that picks up the warm water molecules as they change to a gas and carries them into the sky to form a cloud. 	**Display Slide 32.** Cloud Formation **Note:** Hide the second image on the slide until participants have discussed the cloud-formation model. **PD leader talk:** "This is a graphical representation of cloud formation based on scientific studies. How might your students explain what is happening in this model?" **PD leader move:** After the discussion, reveal the second graphic on the slide. **PD leader talk:** "Students typically refer to cloud formation as a one-step process involving water vapor. They view energy as a kind of invisible crane that picks up the warm water molecules as they change to a gas and carries them into the sky to form a cloud."

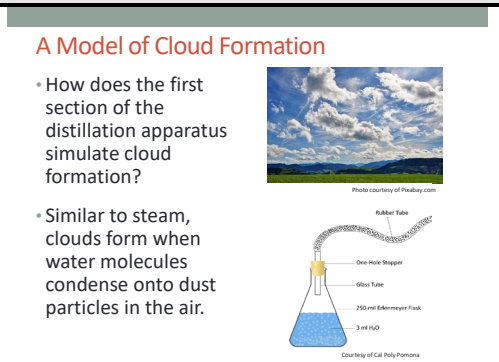
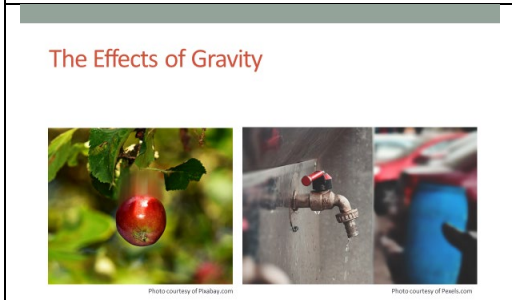
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 33.** Labeling the States of Water **Note:** Hide the explanation at the bottom of the PPT slide until participants have labeled the diagram. **PD leader talk:** "The slide shows another model of the water cycle. Let's label the states of water in the ocean and the clouds that are identified with the black arrows." **PD leader move:** Don't correct participants if they label the state of water in the clouds as a gas or steam. (This reflects how their students will think, and participants need to approach this topic as learners. Allow them to struggle with it!) **PD leader move:** After participants have applied labels, reveal the misconception at the bottom of the slide. **PD leader talk:** "A common misconception is that steam and clouds are visible kinds of water vapor formed from warm water molecules (humidity) in the air. Visible steam and clouds are actually water in its liquid phase!" **PD leader move:** Ask how participants might help their students overcome this conceptual hurdle.
			**Display Slide 34.** Interactions among Water Molecules **PD leader talk:** "One idea to advance student understanding is to emphasize their learning from lesson 1 and their observation of boiling water, which showed that water vapor is invisible." **PD leader move:** Read the statements on the slide; then have participants draw two flasks in their science notebooks, one containing water molecules

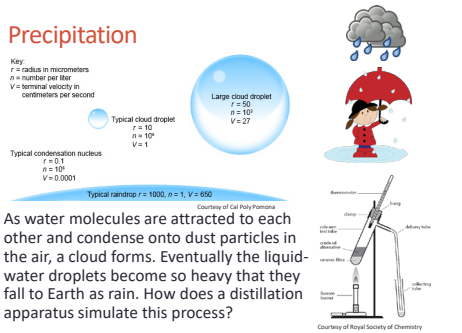
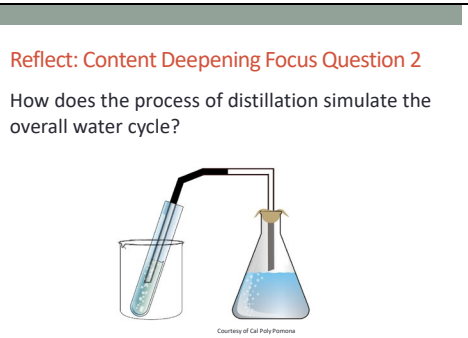
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			in the liquid phase, and one containing molecules in the gas phase. Make sure they include at least six water molecules in each flask.
			**Display Slide 35.** Two Steps of Cloud Formation **Note:** Hide the question on the PPT slide until participants have labeled the diagram. **PD leader talk:** "Let's revisit this diagram and label the states of water in **three** places now: in the ocean, in the warm air above the ocean, and in the clouds. Make sure to use six water molecules for each phase. Once you complete this task, share your work with an elbow partner and discuss your insights." **PD leader move:** After the Turn and Talk, reveal the focus question below the PPT diagram. **PD leader talk:** "Now take a moment or two and answer the focus question in your notebooks." **PD leader move:** Facilitate a group discussion on the topic of cloud formation. It's OK if there is still some disagreement.
	10-MINUTE BREAK		

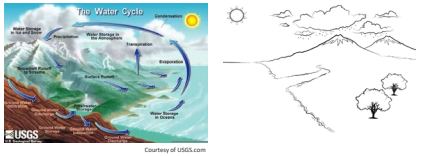
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 36.** Reflect: Content Deepening Focus Question 1 **PD leader talk:** "Next we'll watch a video clip to see if we can find common ground on this topic." **PD leader move:** After participants have viewed the clip, ask them to reflect on the focus question and consider how the video has influenced their thinking about cloud formation.
			**Display Slide 37.** Content Deepening: Focus Question 2 **PD leader move:** Read the focus question on the slide. **PD leader talk:** "Now we're going to build on our previous knowledge as we learn about the process of distillation. This content deepening will support our ability to elicit, probe, and challenge student thinking that will be made visible during the actual lesson."

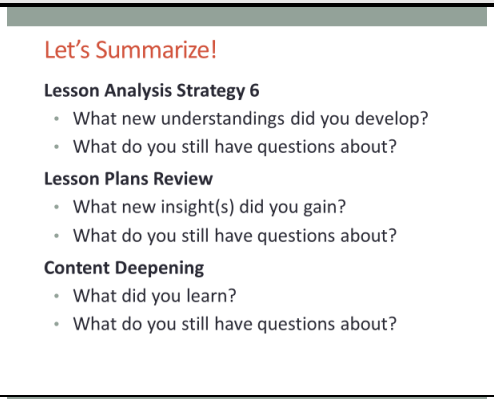
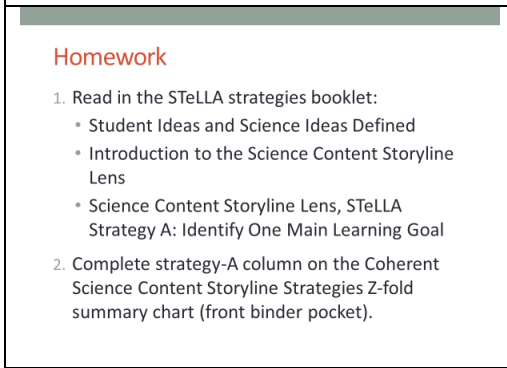
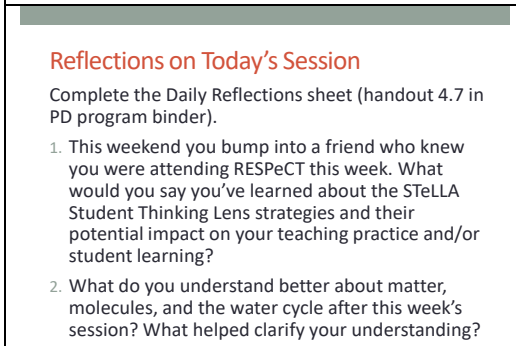
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Distillation • Distillation is the process of **heating a liquid until it boils**, and then **condensing** and collecting the resulting hot vapors. The principles of distillation have been used for thousands of years. Ancient Arab chemists may have been the first to use distillation to isolate perfumes. • In modern organic chemistry, distillation is a powerful tool not only for identifying organic compounds but also for purifying them. The boiling point of a compound is one of the physical properties used to identify it. • The thermometer wasn't invented until the early 1700s.	**Display Slide 38.** Distillation **PD leader talk:** "For thousands of years, distillation was a common tool used to identify and purify a compound in organic chemistry well before the modern thermometer was invented."
		Distillation Apparatus • Draw this distillation apparatus in your science notebooks. • When the water in this system has heated to a boil, what happens to the water-vapor molecules the farther they rise from the heat source? 	**Display Slide 39.** Distillation Apparatus **Note:** Hide the question on the PPT slide until participants have finished their drawings. **PD leader talk:** "Displayed here is a distillation apparatus consisting of an Erlenmeyer flask, water, a stopper, aquarium tubing, and a collection tube." **PD leader move:** As you assemble the apparatus and start heating the water, tell participants how the various parts of the apparatus are used. **PD leader talk:** "While we're waiting for the water in the flask to reach a boiling point, I'd like you to draw the apparatus in your notebooks. Make your drawings large because we're going to add more details." **PD leader move:** Ask participants to observe the water in the system. **Note:** Keep the heat low enough so the boiling water doesn't distill into the collection tube. Once some condensation appears in the aquarium tubing, turn off the heat! **PD leader move:** After participants have finished

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			their drawings, reveal the question on the slide. **PD leader talk:** "Now that your drawings are complete and our system has been heated, explain what happens to the water-vapor molecules as they rise from the heat source." **PD leader move:** Participants should observe that the water-vapor (gas) molecules lose heat energy (cool) and slow down as they move to the top of the beaker and enter the tubing. Don't discuss what is happening beyond the entrance to the tubing.
		Distillation Apparatus • How does this loss in energy eventually affect the movement and arrangement of the water molecules? • Add to your diagram by drawing water molecules in their various states.  Courtesy of Cal Poly Pomona	**Display Slide 40.** Distillation Apparatus **Note:** Hide the instruction at the bottom of the PPT slide until participants have responded to the question. **PD leader talk:** "How does this loss of heat energy eventually affect the movement and arrangement of the water molecules?" **PD leader move:** Participants should explain that the gas (water-vapor) molecules lose kinetic (heat) energy in the cooler environment, slow down, and undergo a phase change from a gas to liquid-water droplets through condensation. **Note:** Don't mention cloud formation yet! **PD leader move:** After this discussion, display the instruction at the bottom of the slide. **PD leader talk:** "Now I'd like you to add to your diagrams by drawing water molecules in their various states." **PD leader move:** Be sure participants show the liquid-water molecules forming hydrogen bonds in the tubing.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 41.** A Model of Cloud Formation **Note:** Hide the explanation at the bottom of the PPT slide until participants have responded to the question. **PD leader talk:** "Can someone please explain how the first section of this distillation apparatus simulates cloud formation?" **PD leader move:** Use elicit, probe, and challenge questions to push participants toward explaining the formation of a cloud in the tubing (evaporation → condensation). **PD leader move:** After the discussion, reveal the explanation at the bottom of the slide. **PD leader move:** Allow participants to discuss the statement on the slide: Similar to steam, clouds form when water molecules condense onto dust particles in the air.
			**Display Slide 42.** The Effects of Gravity **PD leader talk:** "We're all familiar with Newton's law of gravity. When an apple ripens and gains enough mass, it falls from a tree. When a leaky faucet collects enough water to form a droplet, the droplet falls from the faucet."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 43.** Precipitation **Note:** Hide the PPT diagram of the collection tube in a distillation apparatus until after the discussion. **PD leader talk:** "Gravity has a similar effect on condensation in a cloud. As water molecules are attracted to each other and condense onto dust particles in the air, a cloud forms. Eventually the liquid-water droplets become so heavy that they fall to Earth as rain in a process called *precipitation*." **PD leader talk:** "Now I'd like you to identify how a distillation apparatus simulates this process." **PD leader move:** Use probe, elicit, and challenge questions to facilitate a discussion of how a distillation apparatus simulates precipitation. **PD leader move:** At the end of the discussion, display the PPT diagram of the collection tube in a distillation apparatus.
			**Display Slide 44.** Reflect: Content Deepening Focus Question 2 **PD leader talk:** "Take a few moments to reflect on the second content deepening focus question; then jot down your ideas in a 2-minute quick write."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		The Water Cycle Water is abundant in our environment. The movement and arrangement of water molecules as they gain and lose energy is fascinating and dynamic!  Courtesy of USGS.com How might students draw and label a diagram showing how water molecules interact in the water cycle?	**Display Slide 45.** The Water Cycle **PD leader talk:** "As we've observed in our demonstrations and experiments, water is abundant in our environment. The movement and arrangement of water molecules when they gain and lose energy is fascinating and dynamic!" **PD leader talk:** "Our overall goal this week has involved using science ideas about the nature of water molecules to explain the phenomena of the water cycle. How might students draw and label a diagram showing how water molecules interact in the water cycle?" **PD leader move:** As participants share their ideas, draw and label a sample diagram on chart paper. **Note:** You may also want to display a marked copy of the Water in the World around Us diagram (handout 5.3) from Water Cycle lesson 5b in the lesson plans binder.
3:15–3:30 15 min **Wrap-Up: Summary, Homework, and Reflections**	**Purpose** • Summarize and reflect on key ideas from today's learning and preview the transition to the Science Content Storyline Lens (SCSL) strategies. **What Participants Do** • Review today's focus questions. • Share key ideas from the lesson analysis (strategy 6), lesson plan	Today's Focus Questions • Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts? • How will the Student Thinking Lens strategies help you teach the Water Cycle lessons? • What are the two basic steps of cloud formation? • How does the process of distillation simulate the overall water cycle?	**Display Slide 46.** Today's Focus Questions (2 min) a. Review today's focus questions. b. **Individual think time (1 min):** Ask participants to reflect on these questions and think about how they might revise their answers.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
Slides 46–49	review, and content deepening work. • Copy down the homework assignment. • Write their reflections on today's learning. **Handouts in PD Binder** • 4.7 Daily Reflections—Day 4 **Supplies** • Science notebooks		**Display Slide 47.** Let's Summarize! (5 min) a. **Individual think time (1 min):** Give participants a minute to think about the questions on the slide and consider questions they still have. Challenge them to formulate a statement summarizing what they learned in each area. b. **Whole-group share-out:** Have participants share at least two different statements about each of the areas on the slide. Elicit more if time allows.
			**Display Slide 48.** Homework (3 min) a. "Next week we'll focus on the Science Content Storyline Lens strategies and explore a new content area: food webs. To prepare, complete the homework tasks on the slide." b. Make sure participants copy the assignment into their science notebooks.
			**Display Slide 49.** Reflections on Today's Session (5 min) a. Give participants time to reflect on today's session and write their responses to the questions on the Daily Reflections sheet (handout 4.7 in PD program binder).