Student Thinking Lens Strategies Summary Chart

	1. Ask Questions to Elicit Student Ideas and Predictions	2. Ask Questions to Probe Student Ideas and Predictions	3. Ask Questions to Challenge Student Thinking	4. Engage Students in Analyzing and Interpreting Data and Observations	5. Engage Students in Constructing Explanations and Arguments	6. Engage Students in Using and Applying New Science Ideas in a Variety of Ways and Contexts	7. Engage Students in Making Connections by Synthesizing and Summarizing Key Science Ideas	8. Engage Students in Communicating in Scientific Ways
Purpose	The purposes of elicit questions are to • reveal a variety of student ideas, experiences, and predictions; • engage students' interest; and • allow students to see the different ideas their classmates hold.	The purposes of probe questions are to • understand how a student is thinking, • clarify what a student means, and • learn *more* about a student's way of making sense of something that was expressed in an initial response	The purposes of challenge questions are to • help students change their ideas and develop deeper understandings of science ideas, and • push students to think, reason, make new connections, and use new vocabulary.	The purposes of engaging students in analyzing and interpreting data are to • help them make sense of what they see in their observations or data, and • help them connect the things they see in the real world to the science ideas they are learning about.	The purposes of engaging students in constructing explanations and argumentation are to • give students a firsthand understanding of what science is all about— reasoning with evidence—and • deepen students' conceptual understandings through the use of evidence, not just memorization.	The purposes of use-and-apply activities are to • provide students with multiple opportunities to practice using and applying new concepts in order to reconcile the new ideas with prior knowledge, and • help students see the wide usefulness of new science ideas in a variety of contexts.	The main purpose of synthesize-and-summarize activities is to help students • make connections among science ideas and create a more-coherent framework for understanding a set of concepts rather than just separate ideas.	By communicating in scientific ways, students learn how to • express science ideas effectively; • understand the norms of presenting scientific arguments and evidence; and • share ideas with peers, build interpretive accounts of data, and work together to decide which accounts are most persuasive.
Key Features	Elicit questions • often occur at the beginning of a unit or lesson; • are related to things in students' lives; • use language students are familiar with, not scientific terms; and • are not evaluated as right or wrong; the teacher accepts all ideas while noting this is "current thinking" that can be revised later.	Probe questions • are addressed to one student or a small group in response to what was just said, • do *not* seek to guide students to a different way of thinking, • do *not* introduce new language or science ideas, and • are used frequently throughout a unit/lesson.	Challenge questions • do *not* lead students directly to the right answer but instead challenge them to go in a new direction; and • often ask how or why.	Interpret-and-analyze activities engage students in • organizing data in clear ways, • identifying patterns and relationships in the data, • making connections between their data and/or observations and science ideas, and • sometimes using computers, digital tools, and mathematics that can help them identify patterns.	When students construct explanations and arguments, • they go beyond observations to generate ideas about *why* a particular thing is happening; • they construct claims and support them with evidence and reasoning; and • they talk about their ideas, listen to each other's ideas, compare one another's ideas, justify and evaluate ideas, and seek the best explanation for their observations.	Use-and-apply activities involve students in • connecting the ideas they are learning to new scenarios, situations, or phenomena; • making connections among science ideas; and • engaging in a variety of activities, such as explaining a new situation or set of data, making a prediction, creating a diagram, or designing a solution to a new problem.	Synthesize-and-summarize activities • can be done individually or as a group, • might include creating a visual representation, • can occur at the end of a lesson or a series of lessons, and • can be the focus of an entire lesson (or lessons).	Learning to communicate in scientific ways involves students in • learning to differentiate among various aspects of scientific communication, and • using sentence stems to try out communicating in these ways themselves.

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Examples	"After it rains, we sometimes have big puddles on our playground. Later, those puddles are gone. Where did the water go?" "If a squirrel dies in the forest and isn't eaten by another animal, what eventually happens to its body? How does that happen?"	"What do you mean when you say …?" "Tell me more about that." "So you're saying [paraphrase student's response]. Tell me how I'm getting it wrong."	A student describes evaporation as water going up into the air. The teacher might ask a challenge question: "How can water go up into the air? Can you explain that in terms of what the molecules are doing?" A student says a bird gets energy from the food it eats, like seeds and worms. The teacher might ask a challenge question: "Where did the seeds and worms get energy from?"	Students watch several jars of decomposing material over a 10-day period, making observations and identifying patterns in the mass, volume, and temperature of the material in the jars. They discuss ideas related to food webs and decomposition and make connections between those ideas and the data they collected.	Students observe a classroom terrarium that has remained covered since the day it was created. They see some "white stuff" on the bottom of the terrarium that wasn't there at the beginning. In small groups, students use these observations and science ideas they've studied to construct explanations of what is happening. In a whole-class discussion, they compare their explanations and engage in scientific argumentation to identify strengths and weaknesses of the various explanations.	After learning about condensation on a can of soda, students are asked to think about instances in nature where condensation can be observed. They pick one of these instances and explain (or diagram) why they think condensation is occurring there. After being exposed to ideas about producers, consumers, and decomposers, students are given a rotting log and are asked to use these ideas to explain what's happening.	Summary and synthesis tasks can be short ("Write a couple of sentences in your science notebook that describe your best answer to today's focus question"), or they may take an entire class period ("Create a diagram showing how evaporation, precipitation, and condensation, and adding and taking away heat can explain how water moves around the world in the water cycle").	"**I wonder** why there's water on the outside of this cold soda can." "**My idea** is that water is coming from the inside of the can to the outside." "**I disagree with** that idea because the cola inside is brown, but the water on the outside is clear." "**I think that** when water vapor in the air gets cold next to the can, it turns from vapor to liquid." "**That idea makes sense to me because** it's like steam forming after leaving a teapot spout or clouds forming in the sky when it gets colder."