Critical Reflection Questions
These are for you to consider both individually and in partnership with teachers before and/or after your observations

Questions for myself
(ongoing questions pre and post observation)

➢ What has my experience been with science? How has my racial, cultural and linguistic identity impacted how I relate to science? How is this relationship changing as I work to support critical and cultural approaches to science teaching?

➢ What are my beliefs about incorporating students' ideas, expertise and consequential concerns into lessons? Why is this important? How and when should this be done? How can this be more than a nice gesture, but a substantive part of learning?

➢ Which classroom and school structures/policies supported teachers and students in integrating students' ideas, consequential concerns and their cultural and family expertise? In positioning the teacher and students as both knowledge-holders and learners? What policies/structures may have prevented that work or made it more challenging?

➢ How am I shifting my perspective of what good science instruction looks and sounds like, and who holds scientific expertise? How did students and the teacher(s) help challenge and/or broaden my perspectives?

➢ Were there practices during this lesson that could be taken up in other disciplines, or used to inform equity initiatives within the school?

Prompts/Questions to discuss with teachers

Pre-Observation *[Suggested Framing: I'm trying to learn more about C^{2}AST and I appreciate you welcoming me into your classroom to support my learning. I want to get a sense for how you've been engaging with students' ideas and how they've pushed the unit thus far. This will help me better contextualize what I observe and broaden my own ideas about science. I also want to give you space to share how I could better support you as you take up critical approaches to science.]*

➢ Can you tell me a bit about the different experiences and expertise that your students have shared during the unit thus far? How are those contributions shaping the upcoming lesson?

➢ How will this lesson position non-dominant students as valued contributors and generators of science expertise in ways that differ from normal academic validation?

➢ What have been your successes and challenges with helping students engage with sense-making, particularly in supporting students who are culturally, racially or linguistically different than yourself?

➢ What were the different ways that students are illustrating their expertise during this unit? For students who are connecting with this unit, how are you planning to support their sensemaking? I'm happy to brainstorm with you about how the upcoming lesson could be designed to focus on their engagement.

➢ What are some aspects of the lesson that you'd like me to pay particular attention to? What are you hoping for feedback on?

Look-For Tool Part 1

Note: This tool is a good place to start if your teachers are just starting to engage in critical and cultural approaches to instruction. These discourse look-fors indicate the type of environment and teacher-student relationship that are important for engaging in C²AST.

"Look Fors"	Danielson Alignment & Notes (What are students saying? How is the teacher engaging with students? What are you learning?)
Discourse to Support Sensemaking Across Multiple Science Knowledge Systems	Domain 1: Planning and Preparation ❏ 1b. Demonstrating knowledge of students
The Teacher: These seek evidence that the teacher is positioning themselves as a co-learner in the classroom and eliciting and leveraging students' ideas and expertise.	Domain 2: The Classroom Environment ❏ 2a. Creating an env. of respect and rapport

• Questions are focused on engaging with students ideas, not towards getting students to a single answer (Hagenah et al., 2018; Thompson et al., 2016; Windschitl et al., 2018)
• Invites or offers different perspectives, especially alternatives to human-centric reasoning or positioning of nature and more than human life, and supports students to bring multiple perspectives together to construct scientific explanations (Bang et al., 2014)
• Authentically takes up and supports students' divergent ideas and/or the connections students make to consequential concerns (Calabrese Barton & Tan, 2010; Davis & Schaeffer, 2019; Thompson, 2014; Thompson et al., 2016)
	Domain 3: Instruction
	    ❏ 3b. Using questioning and discussion techniques
	    ❏ 3c. Engaging students in learning
	    ❏ 3e. Dem. flexibility & responsiveness

Students: These seek evidence of students' positioning themselves and each other as individuals with information to share and learn from, indicating their epistemic agency within the classroom. Ideally student discourse illustrates their rightful presence in the classroom.	**Notes:**
• Draw connections to or tensions between the phenomena/learning activity and their life experiences, expertise or consequential concerns (Calabrese Barton & Tan, 2010, 2019; Davis & Schaeffer, 2019; Thompson, 2014) • Drawing on their own and/or their peer's ideas and life experiences as sources of evidence and expertise (Bang & Medin, 2010; Calabrese Barton & Tan, 2010; Shea & Sandoval, 2020; Thompson et al., 2016)	
Level of Discourse: Provides a means for school leaders to understand the depth of discourse students are engaging in regardless of whether a critical or normative approach to science learning is being used (Windschitl et al., 2018).	
• What lens - Students use their observations to help them make sense of the phenomena • How/Why Lens - Students start to connect their observations to plausible processes or relationships and working to illustrate that on their revised models	

Look-For Tool Part 2

Note: This tool is a good place to start if your teachers and students are engaging in sensemaking conversations, preparing to revise their initial models and/or preparing to create their final models. These discourse look-fors indicate both the type of support and expansive interpretation of scientific sensemaking that recognizes and leverages the different experiences and ways of knowing students may use to make sense of the phenomenon.

"Look Fors"	**Danielson Alignment & Notes** (What are students saying? How is the teacher engaging with students? What are you learning?)
Scaffolded Supports and Expansive Use of Evidence to Revise Thinking	

- Varied sources of evidence are integrated to support students as they revise their thinking. Sources of evidence can include students' stories, life experiences, observations, data collected both within and outside school settings (e.g., community or family interviews), books or articles, → anything that is connected to the phenomenon, interpretable, and supports students' sensemaking in partnership with others (McNeill & Berland, 2017). - Students have their initial models and other evidence collected throughout previous lessons to support their thinking (Windschitl et al., 2008, 2018) - Students are welcomed and supported to use multiple modalities and languages to share different perspectives and expertise (e.g., drawing, gesturing, storytelling, translanguaging) - Both the teacher and students press each other to use the evidence they collected to explain their reasoning - Students interact with the evidence collected as they work to revise their thinking (e.g. adding their ideas to the class evidence tracker/model; using the tracking tool or other artifacts to prompt questions or class/small group discussions) (Windschitl et al., 2018)	Domain 1: Planning and Preparation
	    ❏ 1d: Demonstrating knowledge of resources
	    ❏ 1e: Designing coherent instruction
	
	Domain 2: The classroom environment
	    ❏ 2b: Establishing a culture for learning
	
	Domain 3: Instruction
	    ❏ 3a. Communicating with students
	    ❏ 3b. Using questioning and discussion techniques
	    ❏ 3c: Engaging students in learning
	    ❏ 3d: Using assessments in instruction *(monitoring student learning & student self monitoring of progress)*
	Notes:

Look-For Tool Part 3

Note: This tool is designed for teachers who have laid the groundwork for C2AST in their classrooms and are pushing the curriculum to further contextualize science, disrupting the idea that science is acultural and apolitical.

"Look Fors"	Danielson Alignment & Notes (What are students saying? How is the teacher engaging with students? What are you learning?)
Contextualizing Science Curriculum	Domain 1: Planning and Preparation ❏ 1e: Designing coherent instruction
Culturally	Domain 2: The classroom environment ❏ 2b: Establishing a culture for learning

● Students examine what and whose culture is represented in their scientific thinking, learning processes, and materials.
● Students and teachers offer other cultural perspectives and epistemologies to help each other make sense of the material. Multiple perspectives are recognized, valued and leveraged for sensemaking (Bang et al., 2012; Bang et al., 2014; Bang & Medin, 2010; Barajas-López & Bang, 2018).
	Domain 3: Instruction
	    ❏ 3c: Engaging students in learning
	    ❏ 3e: Demonstrating flexibility and responsiveness

Historically & Socio-politically	Domain 4: Professional Responsibilities
	    ❏ 4a: Reflecting on teaching
	    ❏ 4e: Growing and developing professionally

● Students consider the history of the topic, materials, land and/or more than human life they are learning about (Bang & Medin, 2010; Barajas-López & Bang, 2018; Shea & Sandoval, 2020). ● Students surface and critique the sociopolitical consequences of the phenomenon, consider power dynamics inherent within different modes of scientific inquiry (Davis & Schaeffer, 2019; Shea & Sandoval, 2020. ● Students consider how scientific inquiry can be and has acted as either oppressive and violent or liberatory and joyous (Barajas-López & Bang, 2018; Bang et al., 2012; Davis & Schaeffer, 2019). ● In their consideration of power dynamics and sources of knowledge and expertise they consider more than human life and land.	**Notes:**

Critical Reflection Questions
Post Observation

Post-Observation [_Suggested framing_: *Thank you so much for inviting me into your classroom, (consider positioning yourself racially or sharing your relationship with science) I really appreciate the opportunity to learn from you and your students and hope this conversation can be about sharing our learning from this lesson and thinking about ways I can help support you and your students as you keep doing this work]*

➢ During this observation I learned _____, _____ and _____ from both you and your students. I'd love to hear more about what you've learned throughout this unit.

➢ Look at your notes from the observation and identify an area that helped you learn from either the students or the teacher's instructional practice. The prompts below provide some options for structuring a post-observation debrief opening question that positions you as a co-learner.
   ○ [**Instructional Move**] During this lesson I noticed/learned more about _____, can you tell me more about your thinking behind that instructional move?
   ○ [**Student ideas that shaped the lesson/activity**] During this lesson I noticed _____ share ideas that seemed to direct the course of the lesson, can you tell me more about their participation throughout the unit? I'd like to hear more about their expertise.
   ○ [**Opportunity for student ideas to shape the lesson/activity**] During this lesson I noticed that ___ shared some interesting ideas. I wanted to take some time to brainstorm ideas for how you might circle back to that in an upcoming lesson.

➢ [Start with any connections you notice] What are some connections that you see students making between their lives and this unit? Is there anything I can do to support you to integrate expertise from students' families or community members in future lessons?

➢ How are you shifting your perspective on how ideas are shared or represented that either limit/encourage a range of voice, creativity, storying, divergent thinking and questioning?