Achieve

HS CHEMISTRY: EVAPORATIVE COOLING

Introduction:

This task asks students to address how particle motion is changing as the temperature of ice changes over the course of a hot day by describing how particles behave at different points on a temperature/time graph. This task is intended to be used as an assessment of student understanding of an unpacked "part" (learning performance) of a performance expectation (PE).

STANDARDS:

This task is intended to assess a learning performance (LP) that was derived from the following NGSS PEs:

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).

LP: Students will explain the relationship between energy, particle motion, and temperature.

ANNOTATION KEY

EQUITY
Supporting a wide range of diverse students.

SCENARIOS
Information provided to elicit performances.

SEPs
Opportunities to demonstrate science and engineering practices.

DCIs
Opportunities to demonstrate understanding of disciplinary core ideas.

CCCs
Opportunities to demonstrate understanding of crosscutting concepts.

SENSE-MAKING
Opportunities for reasoning about phenomena and problems.

ASSESSMENT PURPOSE
Highlights how the task features connect to intended assessment use.

✓ STRENGTHS

The **scenario is grounded in specific sets of observations** that are sufficient to elicit student understanding throughout the task.

Task **scenarios leverage models, data tables, and text** to convey the necessary information, limiting the reading load of the assessment.

The **task surfaces student understanding of parts of PS1.A, PS2.B, and PS3.A**, providing educators and students with a clear check on student thinking related to the DCI.

The task provides opportunities for students to **practice using parts of the SEPs** as they explore molecular motion.

The task provides opportunities for students to **make their thinking visible in multiple ways, rather than focusing on written responses**—this can help a wide range of students show what they understand and can do.

The task is concise and to-the-point, providing educators and students a task that r**eveals student understanding of the DCI without requiring a lot of time to administer or provide feedback on the task**.

The learning performance provides a **clear target for the assessment**.

! OPPORTUNITIES FOR IMPROVEMENT

The scenario **grounding the task is not particularly puzzling, intriguing, or engaging**—it is not clear why this is a phenomenon that needs to be addressed, from the student perspective.

The task and scenario are extremely **similar to traditional tasks that ask students to restate the fact that particle motion increases with temperature, and changes in state happen at the plateaus in a temperature/time graph**. While students have to justify their answers and the task can surface more sophisticated thinking, this task is largely confirmatory and asks students to represent their DCI understanding, rather than eliciting student understanding of the DCIs (and other dimensions) by asking them to use those ideas to make sense of a phenomenon or problem.

The **SEPs are backgrounded, often at the MS level, and are largely used in service of representing the DCI, not sense-making about a phenomenon**.

The task does **not require students to demonstrate their understanding of the CCCs**.

The learning performance **emphasizes one dimension (DCIs) without describing how this should be interpreted relative to the HS PEs.**

How does this task support all students?

✓ The task uses simple language and scaffolding to ensure all students can engage with the task. Additionally, the task provides students with multiple ways to make their thinking visible throughout the task, including diagrams and written responses.

! This task would better serve all students if it was grounded in a specific, engaging phenomenon, the relevance and uncertainty of which were made clear to students through text, images, and real data. In general, the lack of sense-making poses a major challenge for both supporting all students as well as for eliciting three-dimensional performances.

What are the major takeaways?

SUMMARY POINTS:

Overall, this task probes student understanding of DCIs, but fails to require students to sense-make with the DCIs, SEPs, or CCCs. The clear focus of the task is to surface student understanding related to an unpacked part of the DCI by using parts of the SEPs to make that thinking visible. While students use parts of the SEPs, students rarely need to bring an understanding beyond the skills associated with the SEP to the table to respond successfully because the task is largely confirmatory. While the CCCs may be in the task (e.g., considering particles inherently involves scale), but grade-band-specified understanding of the CCC elements is rarely required to respond to the task (i.e., the CCCs remain implicit).

SUGGESTED IMPROVEMENTS

The task would be improved if:

1. The task was grounded in a more intriguing scenario that involved a certain degree of uncertainty that students could make sense of.

2. The items themselves asked students to move beyond representation of a core idea and into sense-making about a phenomenon or problem, demonstrating deeper grasp of the DCIs.

3. The task made clear how the learning performance connects with the HS PEs from which it is derived.

How should this task be used?

This task can be used as a helpful check on student understanding of parts of the DCIs related to particle motion and states of matter. However, the task should not be used as a summative assessment of three-dimensional performance; as evidence of students' proficiency with the SEPs, CCCs; or using the three dimensions together to make sense of phenomena.