HS CHEMISTRY: PERIODIC TABLE TRENDS

Introduction:

This task, students are asked to consider why lithium, magnesium, and sodium react with water in such different ways, focusing on patterns of element properties reflected by the periodic table and how they contribute to reactivity in chemical reactions. This task is intended to be used as an assessment of student understanding of an unpacked "part" (the learning performance described) of a performance expectation (PE).

STANDARDS:

This task is intended to assess learning performances (LPs) that was derived from the following NGSS PEs:

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

LPs:

- Students will construct an explanation why group 1 and group 2 elements lower in the same column of the periodic table are expected to react more vigorously with water than elements higher in that column.
- Students will construct a model that explains why elements in group 2 (alkaline earth metals) react less vigorously with water than group 1 (alkali) metals in the same row.

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 **task is grounded in potentially puzzling observations**: that lithium and sodium react very differently with water, and the predictions around how other elements might react.

The **task gives students several opportunities to demonstrate their understanding of the targeted DCI** by applying the DCI to the scenario(s) at hand. Opportunities to make predictions (e.g., 1.C) are clear opportunities for students to sense-make using the DCI and some parts of SEPs and CCCs.

Students can **make their thinking visible in multiple ways,** including diagrams as well as written responses.

The learning performances provides **clear targets for the assessment, specifying which aspects of the PEs are assessed.**

Part 2 of the task gives students opportunities to **make sense of the provided scenario using the three dimensions**.

Part 1 of the task **provides scaffolding** for Part 2, which can both **help students engage with the task as well as help educators interpret student understanding**.

! OPPORTUNITIES FOR IMPROVEMENT

In Part 1, students are generally using the SEPs and CCCs in service of representing the DCI, rather than making sense of a phenomenon.

Assuming students have received instruction on the targeted DCIs, **this task focuses on explicitly eliciting DCI understanding rather than asking students to make sense of a phenomenon** using the DCI. The task as a whole is more of a meaningful DCI-focused task than a multi-dimensional task that values all three dimensions equally in service of sense-making.

The task often asks students to engage with elements of each dimension at the elementary and MS levels without **describing how this should be interpreted relative to the HS PEs.**

How does this task support all students?

✓ The task includes some features to support diverse learners, including clear scaffolding throughout the task, well as language that can help students understand what is being investigated and why. The task also provides students with multiple ways to show their thinking, and several opportunities—across items—to make their understanding of the targeted content visible.

! The task would better support diverse students if it included a more relevant scenario, and focused on making sense of that scenario.

What are the major takeaways?

SUMMARY POINTS:

Overall, this task deeply probes student understanding of the targeted DCIs, but fails to require students to effectively use the SEPs or CCCs, or use the three dimensions together to make sense of a phenomenon or problem. The task asks students to explain trends in the periodic table—a confirmatory process, given assumed instruction—rather than asking students to use that understanding in service of a phenomenon or problem.

SUGGESTED IMPROVEMENTS

The task would be improved if the task was grounded in a better scenario—one that could be explained using the same DCI, but involved sufficient uncertainty (on the part of the students taking the assessment, not the fictional student in the scenario) that students would have to use the three dimensions together.

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 trends In the periodic table and their connection to the reactivity of elements, but should not be used as a summative assessment of three-dimensional performance without making the improvements suggested above. The task could certainly be used as part of a larger assessment instrument, with this part of the assessment being used to elicit evidence of DCI understanding. Teachers using this task should consider providing students with a periodic table, to ensure that student responses are not driven by memorization of the table.