Introduction:

This task asks students to use data and their understanding of magnetic fields to account for the movement and relative of positions of magnets interacting at a distance. 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) derived from the NGSS PEs:

HS-PS3-5. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

HS-PS3-2. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

LPs:
- Students will develop a model to explain that the direction of the magnetic force being exerted depends on the shape of the magnetic field between the two objects.
- Students will analyze patterns in data to determine the relationship between the relative positions of magnetic objects based on the magnetic force exerted by the field.
- Students will use patterns in data to explain the relationship between the relative position of magnetic objects and the energy stored in the magnetic field.

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 students address throughout the task.

Task **scenarios leverage images, data tables, and text** to convey the necessary information.

The scenario **builds over time, introducing new information to students as they need it**—this provides some additional support and scaffolding for students, and serves to cue students toward the relevant features of the phenomenon/ scenario for a given question or set of questions.

The task **requires that students use SEPs and DCIs together to make sense of the observations provided in the scenario.**

Several questions in this task provides students with an **opportunity to meaningfully practice and use CCCs** to respond to the item.

The task **set-up and scoring guidance allow for students to make facets of their understanding visible, rather than only focusing on right and wrong answers**—and demonstrate how this can be possible even when there are clear right and wrong answers.

! 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.

While the task includes opportunities for CCCs to be an implicit part of student answers, **this task does not create opportunities to explicitly signal or evaluate students' understanding and use of grade-appropriate CCCs.**

The task is highly dependent on students' using **written language** to convey their thinking in open-ended questions, which might obscure some students' abilities.

How does this task support all students?

✓ The task introduces information gradually, as students need it, serving to support student thinking by cueing students toward the most relevant information. The task also provides opportunities for students to make their thinking, and not simply right and wrong answers, visible, which both supports students as well as supports teachers in better interpreting student progress.

❗ The task relies rather heavily on students' language abilities. While this is not necessarily a weakness, it would be helpful if both students and teachers were better supported in **distinguishing between students science understanding and their abilities to communicate that understanding.** Across the items in this task, students are frequently asked to explain/describe (presumably through written words) their thinking. It is clear why questions include this prompt: while increasing the language load, this clearly pushes students to make their reasoning —and, as a result, their ability to integrate practices with scientific understanding—visible. However, it might be helpful to include supports for non-written justifications (e.g., through a video or communication with the teacher or peers, in a context that is less concerned with independent student responses), or to include more questions that would require student reasoning to successfully answer, such that educators would have sufficient evidence to be comfortable with student understanding of the targeted concepts without the need for a written justification (e.g., give student more/increasingly complex data sets that require similar practice/DCI integration and have them make similar claims about what conclusions are supported by the data). For more information about features to support diverse learners, see this resource.

What are the major takeaways?

📝 SUMMARY POINTS:

Overall, this task heavily foregrounds the DCI in service of explaining a simple set of observations. While the SEP is present, it is used in service of making DCI understanding clear, rather than deeply making sense of a phenomenon.

🛠 SUGGESTED IMPROVEMENTS

1. The task scenario—especially initially—was more sophisticated, enabling a better focus on high-school level SEPs, CCCs, and DCIs.

2. The scoring guidance was modified to reflect when student responses are providing evidence of MS-level expectations, and when student responses were providing evidence of HS-level expectations.

3. The task—and particularly the task scenarios—were modified to provide more opportunities for students to engage CCCs. For example, the task could provide students with more complex data such that they need to organize the data into graphs and charts to identify more grade-appropriate patterns; the scenarios could be modified to include real uncertainty or multiple possible correct answers such that the CCCs could be more meaningfully reflected in student reasoning as part of proposing additional questions or experiments, distinguishing among patterns at different scales, etc.

How should this task be used?

This task can be used as a helpful check on student understanding of parts of PEs being addressed, particularly DCIs related to magnetic fields. Teachers using this task in HS should note:

1) That some student responses can be correct but reflect the MS DCIs—this should be accounted for when interpreting and acting on student performance; and

2) that while the task does elicit some sense-making using SEPs and DCIs, this task is primarily focused on asking students to demonstrate that they understand magnetic fields. Further assessments would be necessary to determine whether students can use this understanding to make sense of more authentic, real-world phenomena and problems, and to determine students' facility with the SEPs and CCCs.