TASK OVERVIEW

ELEMENTARY PHYSICAL SCIENCE: TOY ENGINEER

Three-Dimensional Claim

In this task, students will apply scientific ideas to solve design problems to explain how a device converts electrical energy to other forms of energy through using understanding of open and closed circuits to determine how their related parts make up a whole that will carry out their functions properly.

Disciplinary Core Ideas | Crosscutting Concepts | Science and Engineering Practices

Tennessee Academic Standards for Science

This task is intended to elicit student learning of the following Tennessee Science Standard:

3.PS3.2: Apply scientific ideas to design, test, and refine a device that converts electrical energy to another form of energy, using open or closed simple circuits.

Next Generation Science Standards

This task is intended to elicit student learning of the following NGSS elements for each of the three dimensions:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- *Grade 3-5 Element*: Apply scientific ideas to solve design problems

Crosscutting Concepts

Systems and System Models

- *Grade 3-5 Element*: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.

Disciplinary Core Ideas

3.PSA. Definitions of Energy

- *Grade 3-5 Element*: Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

3.PSB. Conservation of Energy and Energy Transfer

- *Grade 3-5 Element*: Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

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	STRENGTHS	OPPORTUNITIES FOR IMPROVEMENT
SCENARIO	The scenario is specific and provides an overall context that flows throughout the task.	The scenario focuses on introducing students to a problem embedded within a fictional design task. Student curiosity about the problem does not fully drive all task components.
SENSE-MAKING	Students are asked to explain the reasoning behind their answers in all three parts of the task.	Most of the task asks students to respond using rote knowledge and to use what they have most likely already experienced during the lesson or unit. Students are not necessarily connecting what they have learned in a new way as there is no phenomenon or problem that students are trying to explain or solve.
INTEGRATED DIMENSIONS	There are grade-appropriate uses of the disciplinary core idea in conjunction with pieces of the science and engineering practice and crosscutting concept in the task.	The target crosscutting concept element is largely implicit in the task. While the nature of circuits involves students' understanding of system components and interactions, the prompts could be modified to more explicitly elicit the target crosscutting concept element. Also, several of the prompts elicit surface-level understanding of the disciplinary core idea and could be modified to elicit deeper understanding.
EQUITY	The task incorporates multiple ways for students to respond (e.g., drawing and writing) as well as student choice. The prompts use accessible language with appropriately built scaffolds.	The task could improve coherence by centering the task around an authentic design problem that motivates the entire task.
FEEDBACK SUPPORT	The task's prompts and directions provide well thought out guidance for students to complete the task successfully and for teachers to administer it effectively.	The task elicits only surface-level understanding of the disciplinary core idea and the crosscutting concept is not explicitly elicited. Teachers may need more information to provide students with meaningful feedback in these areas.

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Suggestions for Use

This task should be used as formative assessment in the middle of a unit about energy and circuits to reveal students' abilities to apply their understanding of the flow of energy in a circuit to solve design problems.

What Are The Major Takeaways?

SUMMARY POINTS	SUGGESTIONS FOR IMPROVEMENT
The task has a coherent flow and the prompts use accessible language and ask students to share their reasoning. Students have opportunities to show their understanding through a variety of ways, including writing, drawing, and modifying diagrams. The Tennessee standard includes language that students will use open or closed circuits to show their understanding of energy, making it likely that both instruction and a classroom task have an emphasis on circuits. This may make the task repetitive with what students have experienced in the classroom and more likely they are able to use rote knowledge rather than true sense-making to complete it.	In the scenario, students are presented with a problem to solve, but solving the problem does not drive all parts of the task. Because of this, students may be using rote knowledge of how circuits work and are not always engaging in true problem-solving throughout the task. Modifying the task components so that students see closer connections to the design problem throughout the task can help strengthen how compelling and authentic the task is and can elicit better evidence of learning. The task could also be modified to be used within the context of an engineering learning sequence that might support and increase student engagement in the science and engineering practices.

What Should I Do Before Using This Task?

Users should review the provided guidance to familiarize themselves with instructions and disclosures before using these tasks.

How Were These Tasks Developed?

The tasks were developed and revised by teacher work groups from participating districts in the Tennessee District Science Network (TDSciN), which was launched in early 2019 and managed by NextGenScience. Tasks were evaluated using an adapted version of the Science Task Screener. Teachers worked collaboratively across districts to develop and revise these tasks after attending multiple professional learning sessions. Find out more about the development process here.

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