TASK OVERVIEW

HIGH SCHOOL CHEMISTRY: SPY POISONING

Three-Dimensional Claim

Students will make scientific claims by analyzing mathematical data and/or models focusing on the cause and effect relationships to determine the types and nature (half-life) of radioactive decay.

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:

CHEM1.PS1.9: Draw models (qualitative models such as pictures or diagrams) to demonstrate understanding of radioactive stability and decay. ~~Understand and differentiate between fission and fusion reactions~~. Use models (graphs or tables) to explain the concept of half-life and its use in determining the age of materials (such as radiometric dating).

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

Developing and Using Models

- *High School Element*: Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types [based on merits and limitations].

Disciplinary Core Ideas

PS1C: Nuclear Processes

- *High School Element*: Nuclear processes, ~~including fusion, fission,~~ and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.
- *High School Element*: Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.

Crosscutting Concepts

Cause and Effect: Mechanism and Prediction

- *High School Element*: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Note: The strikeout language is not targeted in this assessment.

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	STRENGTHS	OPPORTUNITIES FOR IMPROVEMENT
SCENARIO	A specific real-world "true crime" example is used in the scenario. Due to the details of the assassination and the modern-day setting, the scenario is relevant and engaging to the students.	The initial scenario establishes that Agent Z dies as a result of being poisoned with Polonium-210. Throughout the task, students engage in a series of questions that this radioactive heavy metal was indeed the cause of death for Agent Z, confirming what has already been established rather than figuring something new out. The task may be more compelling if what they are trying to figure out is better established at the beginning of the task.
SENSE-MAKING	Students use what they know about radioactive decay to confirm the cause of death for Agent Z. They make their thinking visible through models, writing, and graphs.	While students do engage with various questions to confirm Polonium-210 as the poison used, their purpose for doing so is unclear due to the lack of uncertainty established and conflicting statements between the student copy and teacher guidance.
INTEGRATED DIMENSIONS	Students have several opportunities to show their understanding that spontaneous radioactive decays follow a characteristic exponential decay law, one of the targeted disciplinary core ideas.	Students are not engaging in the targeted **Developing and Using Models** practice, but they are engaging in elements of other practices (often at a lower grade band). Additionally, students may be engaging in elements of the targeted crosscutting concept, but due to the way the task is structured, there is no clear evidence that they are using this dimension to make sense of the death of Agent Z.
EQUITY	The task includes multiple ways for students to respond and show what they know and can do (e.g., write explanations, draw a model, sketch a graph).	The scenario is based on a true story, but it was adapted to avoid perpetuating stereotypes and biases about those from a particular country. If students look up the true story, consider have a conversation to reinforce that a country's government does not always represent the values of its people.
FEEDBACK SUPPORT	Each question within the task has a rubric and guidance for the teacher. Examples of feedback that could be provided to students are also included.	The teacher guide does not always provide sufficient guidance for interpreting student responses for the targeted elements. The scoring components could be separated or color-coded so that they show exactly what is needed in an answer to show understanding for each of the three dimensions.

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Suggestions for Use

This task could be used as summative assessment to assess student understandings of radioactive decay laws. Teachers using this task should make sure students are given additional opportunities to demonstrate that they can use the targeted three dimensions to make sense of phenomena or problems before making any claims about student proficiency with three-dimensional sense-making with these assessment targets.

What Are The Major Takeaways?

SUMMARY POINTS

This task has a real-world scenario that allows students to apply what they know about radioactive decay in a unique way. The task includes options for students to respond in multiple ways, increasing accessibility. The task's prompts and directions provide sufficient guidance for students to complete the task successfully and for teachers to administer it effectively. However, students' purpose for engaging with the task may be unclear due to the lack of uncertainty established and conflicting statements between the student copy and teacher guidance.

SUGGESTIONS FOR IMPROVEMENT

Students are not engaging in the targeted **Developing and Using Models** practice, but they are engaging in elements of other practices (often at a lower grade band). Additionally, the task may be more compelling if they are figuring something new out rather than confirming what has already been established.

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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