Literacy Design Collaborative

Radioactivity And The Search For New Elements

TASK LADDER

by Renee Boss and Michelle Buroker

Using Marie Curie's 1911 Nobel Prize Lecture as its text, this module takes students directly to the substance of a key scientific discovery. It is designed to be used when teaching about atoms, their structure, and nuclear chemistry.

Using a famous text by an honored scientist, this module is designed to take approximately seven hours of classroom time or eight 50-minute periods. This module was created in the Summer 2013 Science Design Jam and is shared with special thanks to the Kentucky Education Association for the use of their Lexington facilities.

GRADES	DISCIPLINE	COURSE	PACING
10 - 12	Science	Chemistry, Physical Science	N/A

Section 1: What Task?

Teaching Task

Task Template IE4 - Informational or Explanatory

In a time when radioactivity was an unknown, how did Marie Curie use her discoveries to prove radioactivity can be used as a new method for searching for elements? After reading her Nobel Prize Lecture„ write a report in which you analyze Curie's claim to have proved her own hypothesis that radioactivity is an atomic property. Support your discussion with evidence from the text/s.

Standards

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

CCR.R.3

Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

CCR.R.8

Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

CCR.R.9

Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

CCR.R.1

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCR.R.2

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

CCR.R.4

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

CCR.R.10

Read and comprehend complex literary and informational texts independently and proficiently.

CCR.W.2

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

CCR.W.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCR.W.5

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

CCR.W.9

Draw evidence from literary or informational texts to support analysis, reflection, and research.

CCR.W.10
Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

RST.11-12.1
Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.4
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11—12 texts and topics.

RST.11-12.6
Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

WHST.9-10.2.a
Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

WHST.9-10.2.b
Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

WHST.9-10.2.f
Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

WHST.11-12.5
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

RST.11-12.8
Focus

Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WHST.11-12.2
Focus

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Next Generation Science Standards

HS-PS1-8
Focus

Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Texts

Marie Curie, "Radium and the New Concepts in Chemistry," Nobel Lecture delivered December 11, 1911

Student Work Rubric - Informational or Explanatory Task - Grades 9-12

	Emerging	Approaches Expectations	Meets Expectations	Advanced
	1	2	3	4
Controlling Idea	Presents a general or unclear controlling idea.	Presents a **clear** controlling idea **that addresses the prompt**, with an **uneven focus**.	Presents **and maintains a clear, specific** controlling idea that addresses **all aspects** of the prompt and **takes into account the complexity of the topic**.	Presents and maintains a **precise, substantive** controlling idea that addresses all aspects of the prompt, **takes into account the complexity of the topic** and, where appropriate, **acknowledges gaps in evidence or information**.
Selection & Citation of Evidence	Includes minimal details from sources. Sources are used without citation.	Includes **details, examples, and/or quotations** from sources that are **relevant to the controlling idea**. **Inconsistently** cites sources.	Includes details, examples, and/or quotations from sources that **support** the controlling **and supporting ideas**. **Consistently** cites sources **with minor formatting errors**.	Includes **well-chosen** details, examples, and/or quotations from sources that **fully support** the controlling and supporting ideas. Consistently cites sources **using appropriate format**.
Development / Explanation of Sources	Explanation of ideas and source material is irrelevant, incomplete, or inaccurate.	Explains ideas and source material **to support the controlling idea**, with **some incomplete reasoning or explanations**.	**Accurately** explains ideas and source material and **how they support** the controlling idea.	**Thoroughly** and accurately explains ideas and source material **to support and develop** the controlling idea.
Organization	Lacks an evident structure. Makes unclear connections among ideas, concepts, and information.	**Groups ideas and uses transitions** to develop the controlling idea, with **some lapses in coherence or organization**.	**Groups and sequences** ideas to **develop a cohesive explanation**. Uses transitions **to clarify the relationships among complex ideas, concepts, and information**.	Groups and sequences ideas **in a logical progression in which ideas build to create a unified whole**. Uses **varied** transitions to clarify the **precise** relationships among complex ideas, concepts, and information.
Conventions	Major errors in standard English conventions interfere with the clarity of the writing. Language or tone is inappropriate.	Errors in standard English conventions **sometimes interfere** with the clarity of the writing. Uses language and tone that are **sometimes inappropriate** for the audience and purpose.	**Consistently applies** standard English conventions; **minor errors**, while noticeable, **do not interfere** with the clarity of the writing. Uses language and tone **appropriate to the audience and purpose**.	Consistently applies standard English conventions, **with few errors**. Demonstrates **varied syntax** and **precise word choice**. **Consistently** uses language and tone appropriate to the audience and purpose.
Content Understanding (Generic)	Attempts to include disciplinary content in explanation or argument but understanding of content is weak; content is irrelevant, inappropriate, or inaccurate.	Briefly notes disciplinary content relevant to the prompt; shows basic or uneven understanding of content; minor errors in explanation.	Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding.	Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding.

Background for Students

Marie Curie said, “Nothing is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.” When she began looking at radioactivity, little was known about the subject; in fact, it was known as “the chemistry of the imponderable.” Curie believed that if we knew about and could understand radioactivity, it could be used as a useful tool in science to unlock hidden mysteries of yet to be discovered elements.

Extension

Not provided

Section 2: What Skills?

Preparing for the Task

TASK ANALYSIS: Ability to understand and explain the teaching task prompt.

SCORING EXPECTATIONS: Ability to understand and explain what will count as a strong response to the teaching task prompt.

Reading Process

UNDERSTANDING SYMBOLS AND TERMS: Ability to determine meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific context. (RST.11-12.4)

DETERMINING CENTRAL IDEAS: Ability to determine central ideas or conclusions of a text. (RST.11-12.1)

ANALYZING PURPOSE: Ability to analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment, defining the question the author seeks to address. (RST.11-12.6)

Transition to Writing

CONNECTING IDEAS: Ability to begin linking what has been learning in reading to what will be shared in writing.

Writing Process

INTRODUCTION: Ability to introduce a topic. (WHST.11-12.2a)

ORGANIZATION: Ability to organize ideas, concepts, and information to make important connections and distinctions. (WHST.11-12.2a)

DEVELOPMENT: Ability to develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. (WHST.11-12.2b)

CONCLUSION: Ability to provide a concluding statement that follows from and supports the information or explanation presented. (WHST.11-12.2f)

REWRITING: Ability to develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. (WHST.11-12.5)

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Preparing for the Task				
15 mins	**TASK ANALYSIS**: Ability to understand and explain the teaching task prompt.	**TASK ANALYSIS** Prompt: Think about the prompt and list every property of elements you can think of; what are the things all elements have in common? In other words, if you found and unknown substance, what are some characteristics that if it displayed, would let you know it's an element? Product: Short response and class discussion	No scoring guide.	This teaching task asks students to understand properties of elements, the structure of an atom, and basic nuclear chemistry in order to successfully answer the question. After students have had time to think about properties of elements they are aware of, have them share with a partner and ask for volunteers to share with the class.
10 mins	**SCORING EXPECTATIONS**: Ability to understand and explain what will count as a strong response to the teaching task prompt.	**SCORING EXPECTATIONS** Prompt: given a timeline- discuss with students Product: Student Discussion	No scoring guide.	Discuss with students the timeline of when they are expected to hand in their first draft of their essay and the eventual, final draft.
Reading Process				
20 mins	**UNDERSTANDING SYMBOLS AND TERMS**: Ability to determine meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific context. (RST.11-12.4)	**UNDERSTANDING SYMBOLS AND TERMS** Prompt: On the back of the color coded note-card containing a word, write your initial impressions about the word's meaning as well your initial thoughts about the text we will read (The cards will list: (Radioactivity, Atom, Nucleus, Isotope, Unstable vs. stable, Scientific model, Pure substance, Element, Proton, Neutron, Electron, Atomic mass, Atomic number, Alpha particle,) Product: Text Impressions written on note-cards	Scoring Guide:work meets expectations if students have original and revised predictions based on activity.	This activity builds background knowledge, activates prior knowledge and increases comprehension by focusing on key vocabulary to be encountered in Curie's speech. 1) Give student teams color coded note cards with a words on them. Tell them to think about the words and their prior knowledge/experience with the vocabulary. Have them record their thoughts on the back of the note card. 2) Tell them to exchange their ideas with a different team. Ask them to record thoughts regarding what they discussed with each other and then share out with the rest of the class to come up with a group explanation of each word.
1 hr	**DETERMINING CENTRAL IDEAS**: Ability to determine central ideas or conclusions of a text. (RST.11-12.1)	**DETERMINING CENTRAL IDEAS** Prompt: Read the text and make annotations or notes about the ideas represented in the margins (or on post its).	Notes meet expectations if thoughtful and reflective ideas about the text are included. Annotations might include questions to aid understanding of text.	First Reading of text: Students and teacher will read silently through the text one time individually Second reading: Teacher models thinking aloud while annotating the first page of the text (using document camera or other appropriate technology). This might include using a dictionary to look up unfamiliar

		Product: Annotations/notes in margins or on post-its		words for which meaning cannot be determined using context clues. Working with a partner, students will follow the same procedure the teacher modeled to annotate the second and third pages of the text, including using a dictionary to determine meanings to unfamiliar words if the word meanings cannot be determined using context clues. Working individually, students will follow the same procedure as the teacher modeled and as students completed with a partner to read and annotate the final page of the text. Debrief the experience by having students share their overall understanding of the text they read.
30 mins	**ANALYZING PURPOSE**: Ability to analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment, defining the question the author seeks to address. (RST.11-12.6)	**ANALYZING PURPOSE** Prompt: With a partner, work through a first read of Marie Curie's speech and use the piece to answer the given questions. Product: a short constructed response in which the following questions are answered: 1) In her speech, what hypotheses did she claim her work backed up? 2) Why was radioactivity considered the "science of the improbable?" 3) In what ways did radioactivity benefit scientists at this time?	The work meets expectations if it provides an answer based on the text.	Direct students to work with a partner, and ask them to thoroughly answer the posed questions. Once students have completed the task, ask each group to share their summaries with the class. *This would be a good time to emphasize respectful peer review and the important role it plays within the science community.
Transition to Writing				
20 mins	**CONNECTING IDEAS**: Ability to begin linking what has been learning in reading to what will be shared in writing.	**CONNECTING IDEAS** Prompt: In a paragraph or two, summarize your feelings at this time to the question being asked in the prompt: How did Marie Curie use her discoveries to prove radioactivity can be used as a new method for searching for elements? Use evidence from your readings to solidify your ideas. Product: Short response and Class Discussion	No scoring guide	Remind students of the teaching task The students have had at least three reads through their piece, it's now time for them to begin to construct an answer to the prompt. Ask the students in quick write to jot down their initial responses to the question based on what they've been reading. Ask students that are comfortable doing so, to share with the class.
Writing Process				
1 hr	**INTRODUCTION**: Ability to introduce a topic. (WHST.11-12.2a)	**INTRODUCTION** Prompt: Write an introductory paragraph that includes a viable thesis and explains Curie's assertion.	Meets expectations if paragraphs includes appropriate thesis statement and an accurate explanation of Curie's assertion that radioactivity is an elemental property.	Begin class by reviewing the teaching task and inform students that the goal is to produce a usable introductory paragraph. Review the qualities of a strong opening paragraph: HOTT: hook, overview, thesis, transition.

		Product: Paragraph		Ask students to trade their opening paragraph with another student to peer review; then provide students time to revise their paragraphs. Walk around the room and supervise this process giving comments of your own for revision.
30 mins	**ORGANIZATION**: Ability to organize ideas, concepts, and information to make important connections and distinctions. (WHST.11-12.2a)	**ORGANIZATION** Prompt: Create an outline for your essay including key elements drawn from your reading, notes, and outline of scientific process Product: essay outline	Meets expectations if outline is organized and includes appropriate components to clearly explain the relevance of scientific data.	Provide a "topic outline organizer" for students to use as they create their own essay outline. Ask students to work with a partner to ensure that their organization of details makes sense and can be easily followed.
1 hr	**DEVELOPMENT**: Ability to develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. (WHST.11-12.2b)	**DEVELOPMENT** Prompts: Write an initial draft of the body parts of your essay. Insert appropriate textual evidence from text. Product: Complete draft of body paragraphs.	Meets expectations if it provides complete draft with all parts and supports the opening in the later sections with evidence and citations.	Remind students to re-read the task to ensure they are explaining Curie's assertion that radioactivity is a fundamental elemental property and to ensure they are referring to the text as it appropriately supports their discussion within the essay.
45 mins	**CONCLUSION**: Ability to provide a concluding statement that follows from and supports the information or explanation presented. (WHST.11-12.2f)	**CONCLUSION** Prompt: Write a concluding paragraph where you wrap up your thoughts about Fleming's assertions on importance of scientific data Product: Concluding paragraph	Meets expectations if it includes final thoughts on importance of scientific data and provides a general conclusion to the essay as a whole.	Begin instruction with an open class discussion about the elements of a proper concluding paragraph. Provide examples of poor conclusions and ask students for ways to improve each one. Together, the class will then come up with a list of strategies for writing a concluding paragraph. Students should then begin working on their concluding paragraph and then trade with apartner for peer review. Instruct the students that when reviewing the paragraph, could you get an idea of what the paper will be about from this paragraph alone? (This can be done overnight with the review the next day if students are not ready at the end of 45 minutes to trade with one another or if you believe it would be easier for the reviewers to take the paragraph home to do the review.)
50 mins	**REWRITING**: Ability to develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. (WHST.11-12.5)	**REWRITING** Prompt: Refine your essay's explanation and synthesis as well as your organization of ideas. Decide what to include and not include in your final draft. Product: Final essay	Meets expectations according to the LDC Informational rubric.	Provide samples of essays if students want to see a finished product. Review the rubric again with students so they can self-assess their results.

Instructional Resources

No resources specified

Section 4: What Results?

Student Work Samples

No resources specified

Teacher Reflection

Not provided