Literacy Design Collaborative

Nuclear Sustainability

★TASK ★LADDER

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In this Project Based Learning unit, students are asked to answer the question, “Is nuclear energy sustainable?” First, students are introduced to their task through an entry event in which they are given a brief introduction to the nuclear energy controversy and are told they will be writing an Op-Ed arguing for or against nuclear power based on their knowledge of the atom, nuclear chemistry, and nuclear power. They are also tasked with creating a public service announcement to persuade others of their views. After identifying what they know and want to learn about nuclear chemistry and nuclear power, they research the topics, complete labs/ activities about atomic structure, read a number of different opinion pieces, and hear a presentation from an activist. They work collaboratively in groups for much of the process. Then they write the Op-Ed (individually) and complete public service announcement (in groups). The project concludes with presentations of their editorials and public service announcements to the class and community activists.

GRADES	DISCIPLINE	COURSE	PACING
11	Science	Integrated Chemistry and English	N/A

Section 1: What Task?

Teaching Task

Task Template 2 - Argumentation

Is nuclear energy sustainable? After reading articles and your chemistry textbook, write Op-Ed in which you address the question and argue if nuclear energy is sustainable. Support your position with evidence from the text(s). Be sure to acknowledge competing views. Give several example/s from past or current events or issues to illustrate and clarify your position.

Standards

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

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.1

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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.

Texts

- **NY Times Article: Faust and Fission Power**
- **Christian Scientist Monitor Article: What are spent fuel pools and why are they a threat?**
- **Lawrence Berkeley National Lab Website: ABC's of nuclear science**
- **HowStuffWorks.com Article: How nuclear bombs work**

Into Eternity youtube video: a documentary about nuclear waste storate

Chemistry: Matter and Change (textbook)
Glencoe/McGraw Hill

Sustainable Energy Choices for the 21st Century youtube video: short video about sustainable energy

Is Nuclear Energy Safe?
Tracy Staedter. Discovery News (article). http://news.discovery.com/tech/is-nuclear-energy-safe.html

The Natural Edge article: The Great Sustainability Debates

This American Life radio broadcast: See No Evil

TED Talk video: Does the world need nuclear energy?

World Nuclear Association article: Chernobyl Accident 1986

AlJazeera article: Fukushima - It's much worse than you think

Citizen's Environmental Coalition website

Rutherford Scattering simulation

Student Work Rubric - Argumentation Task - Grades 9-12

	Emerging	Approaches Expectations	Meets Expectations	Advanced
	1	2	3	4
Controlling Idea	Makes a general claim with an unclear focus.	Establishes a **clear** claim **that addresses the prompt**, with an **uneven focus**.	Establishes **and maintains** a **clear, specific, and credible claim** that addresses **all aspects** of the prompt.	Establishes and maintains a **precise, substantive** claim that addresses all aspects of the prompt. **Acknowledges limitations and/or the complexity of the issue or topic**.
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 claim**. **Inconsistently** cites sources.	Includes details, examples, and/or quotations from sources that **support** the claim and **supporting ideas**. **Consistently** cites sources **with minor formatting errors**.	Includes **well-chosen** details, examples, and/or quotations from sources that **fully support** the claim 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 argument**, with **some incomplete reasoning or explanations**.	**Accurately** explains ideas and source material and **how they support** the argument.	**Thoroughly** and accurately explains ideas and source material, **using logical reasoning to support and develop** the argument.
Organization	Lacks an evident structure. Makes unclear connections among claims, reasons, and/or evidence.	**Groups ideas and uses transitions** to develop the argument, with **some lapses in coherence or organization**.	**Groups and sequences** ideas to **develop a cohesive argument**. Uses transitions **to clarify the relationships among claim(s), reasons, and evidence**.	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 claim(s), reasons, and evidence.
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

With Japan's nuclear crisis in the wake of an earthquake and tsunami, a growing amount of nuclear waste, as well as ever rising oil prices and the need for clean energy, people all over the world are asking: is nuclear energy sustainable? Is it worth the price? With this project, you will be answering that question.

Extension

In your groups, create an ad campaign for a real audience (the format and audience is your group's choice), explaining the chemistry of nuclear energy and promoting a particular point of view regarding whether or not nuclear energy is a sustainable way to generate electricity.

Section 2: What Skills?

Preparing for the Project

IDENTIFYING KNOWS AND NEED TO KNOWS: Ability to identify what is already known and what needs to be learned and done in order to complete the task, as outlined in the entry document, background information sources, and rubrics

Gathering Information

RESEARCH SKILLS: Ability to evaluate and synthesize information from a variety of sources

READING SKILLS: Ability to draw inferences from text

ACTIVE READING > NOTE-TAKING: Ability to identify important information and use appropriate note-taking strategies

Other Content Skills

ATOMIC MODELS: Ability to describe the advancement of atomic models

SUBATOMIC PARTICLES: Ability to describe the kinds and characteristics of subatomic particles

CHARACTERISTICS OF ATOMS: Ability to describe the characteristics of atoms, including their atomic mass, mass number, and isotopes

NUCLEAR REACTIONS: Ability to describe how fission works, the main types of nuclear reactions, and which types are dangerous and why

RADIOACTIVITY: Ability to explain why some elements are radioactive and others are not

HALF-LIFE: Ability to define half-life, describe how it is calculated, and explain its relationship to nuclear reactors and waste

NUCLEAR REACTORS: Ability to describe how a nuclear reactor works, including the waste it generates

Transition to Creating Final Product/s

BRAINSTORMING: Ability to write quickly, brainstorming about an initial opinion

Creating Final Product/s

WRITING AN OPENING: Ability to write an introduction with a thesis

DEVELOPMENT: Ability to use textual evidence to support argument

REVISING AND EDITING: Ability to revise and edit for spelling, grammar, usage, format, and clarity errors

Communication

AUDIENCE: Ability to choose and communicate to an authentic audience

Information Literacy

AVOIDING PLAGIARISM: Ability to correctly cite sources

Collaboration

DELEGATION AND TASK DIVISION: Ability to use various strategies to delegate and divide tasks among group members

TASK COMPLETION: Ability to complete tasks in a timely fashion according to pacing chart

COMMUNICATION: Ability to communicate effectively with team

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Preparing for the Project				
Not provided	**IDENTIFYING KNOWS AND NEED TO KNOWS**: Ability to identify what is already known and what needs to be learned and done in order to complete the task, as outlined in the entry document, background information sources, and rubrics	**KWL CHART** Complete a Know/Want to Know/Learned/Still Need to Know chart based on the entry document, rubrics, and background sources, listing your prior knowledge and the questions you need to answer in order to complete the project.	Knows and need to knows are clearly reflective of information in rubric, background information sources, and entry document.	• **K**now, **W**ant to Know, **L**earned, **S**till Need to Know chart graphic organizer • Group share and discussion of items from chart • Revisit KWLS chart periodically throughout project
Gathering Information				
Not provided	**RESEARCH SKILLS**: Ability to evaluate and synthesize information from a variety of sources	**ANNOTATION OF CORNELL NOTES** Gather additional information from research and class presentations, annotating or completing Cornell notes of important evidence that supports your position as well as counterclaims against your position.	Annotations and Cornell notes highlight important information from articles that could be used to support Op-Ed argument, as well as counterclaims to address	• Workshop on using purpose to find important information • Guided reading in small groups of "Fukushima- It's Worse Than You Think" and "Chernobyl Accident - 1986" • Cornell notes from presentation by representative from Citizens' Environmental Coalistion, with group debrief Skill/s Assessed • Ability to evaluate and synthesize information from a variety of sources • Ability to draw inferences from text • Ability to identify important information and use appropriate note-taking strategies • Ability to use textual evidence to support argument
Not provided	**ACTIVE READING > NOTE-TAKING**: Ability to identify important information and use appropriate note-taking strategies	**CORNELL NOTES** Read the textbook chapters on the atom and nuclear chemistry, completing Cornell notes as you do so.	Cornell notes include notes in students' own words regarding above topics with appropriate summaries and questions.	• Workshop on Cornell notes • Cornell notes template • "Textbook circles" or small groups meeting to discuss and reflect on reading • Workshop (small group) on atomic models • Workshop (small group) on subatomic particles Skill/s Assessed • Ability to describe the advancement of atomic models • Ability to describe the kinds and characteristics of subatomic particles • Ability to describe the characteristics of atoms, including their atomic mass, mass number, and isotopes • Ability to describe how fission works, the main types of nuclear reactions, and which types are dangerous and why • Ability to explain why some elements are radioactive and others are not • Ability to define half-life, describe how it is calculated, and explain its relationship to nuclear reactors and waste • Ability to describe how a nuclear reactor works, including the waste it generates
Other Content Skills				
Not provided	**ATOMIC MODELS**: Ability to describe the	**SHORT RESPONSE** Write a description of	Description compares and	• Rutherford Scattering Simulation for CU Boulder • Sentence frames to support academic writing

	advancement of atomic models	the nucleus of an atom and Rutherford's scattering experiment that proved that atoms had a small "core"	contrasts "plum pudding" vs. charged nucleus theories of atom and explains how Rutherford's experiment disproves the "plum pudding" model	
Not provided	**HALF-LIFE**: Ability to define half-life, describe how it is calculated, and explain its relationship to nuclear reactors and waste	**SHORT REPONSE** Describe how pennium/pennyium labs simulated the isotopes, atomic mass, and half-life of an element.	Description is detailed and correctly identifies the peeny "isotopes," "atomic mass," and "half-life"	• "Isotopes of Pennium" lab: http://staff.fcps.net/jswango/unit2/atomic_structure/pennium%20lab.pdf • "Half-life of Pennyium" lab: http://bccp.lbl.gov/Academy/pdfs/Penny_HalfLife.pdf • Sentence frames for scientific language
Transition to Creating Final Product/s				
Not provided	**BRAINSTORMING**: Ability to write quickly, brainstorming about an initial opinion	**LIST AND ROUGH DRAFT** Brainstorm for and write a rough draft of your Op-Ed on nuclear sustainability that has an introduction with a thesis, evidence, and citations.	Rough draft includes an introduction with a thesis and evidence to support argument	• Workshop on introductions with thesis statements • Analysis of pro and con sides of debate • Quick write on initial opinion • Analysis of persuasive elements of Citizens Environmental Coalition website • Workshop (small-group) on persuasion using resources from http://www.hhs.helena.k12.mt.us/Teacherlinks/Oconnorj/persuasion.html Skill/s Assessed • Ability to write an introduction with a thesis • Ability to use textual evidence to support argument • Ability to write quickly, brainstorming about an initial opinion • Ability to correctly cite sources
Creating Final Product/s				
Not provided	**REVISING AND EDITING**: Ability to revise and edit for spelling, grammar, usage, format, and clarity errors	**REVISED ROUGH DRAFT** Revise your rough draft and write a final draft of your Op-Ed.	Final draft is almost error free	• Peer revision/editing, looking at spelling, grammar, usage, and format
Communication				
Information Literacy				
Collaboration				
Not provided	**DELEGATION AND TASK DIVISION**: Ability to use various strategies to delegate and divide tasks among group members	**FOLDER OF GOOGLE DOCS** Complete a group folder (a collection of Google Docs), that includes your group contract, task list, and notes from group meetings.	Group contract includes series of steps to use in order to hold group members accountable, with evidence of use of steps in notes. Task list divides tasks fairly and includes notes on completion and timliness.	• Team-building sessions • Pacing chart with list of benchmarks • Peer-collaboration assessments using collaboration rubric • Group meetings with teacher to review contract and notes • Group role divisions, with one member tasked with maintaining group folder • Structured, teacher provided task lists for struggling groups Skill/s Assessed • Ability to use various strategies to delegate and divide tasks among group members and check for completion • Ability to complete tasks in a timely fashion according to pacing chart • Ability to communicate effectively with team
Not provided	**TASK COMPLETION**: Ability to complete tasks in a timely	**PRESENTATION** Complete your public service campaign and	Public service campaign includes a clear	• Analyze models of other public service campaigns • Analysis of Citizens Environment Coalition website • Evaluation according to project rubric

	fashion according to pacing chart	deliver it to an authentic audience.	position with appropriate evidence and is directed at an authentic audience	• Workshop (small-group) on persuasion using resources from http://www.hhs.helena.k12.mt.us/Teacherlinks/Oconnorj/persuasion.html Skill/s Assessed • Ability to choose and communicate to an authentic audience • Ability to describe how a nuclear reactor works, including the waste it generates • Ability to use textual evidence to support argument

Instructional Resources

No resources specified

Section 4: What Results?

Student Work Samples

No resources specified

Teacher Reflection

Not provided