Literacy Design Collaborative

Comparing the Chemistry Behind Electricity Generation

★TASK ★LADDER

by Christopher King

In this reading and writing unit, students are asked to answer the question. “Should nuclear energy be generated from nuclear power or fossil fuels?" Specifically, for this module, students will focus on coal and natural gas as the fossil fuels in question. First, students are introduced to their task through an entry event in which they are given time to “tour" pictures of disasters that relate to each generation method. They will then be given readings that have information about each method. Students will be asked to organize evidence from each of the readings. In a Socratic seminar, students will be asked to speak to each of the three methods and identify the chemistry that speaks to the benefits and drawbacks of each of the methods. Finally, in the writing, students will be asked to select two methods and compare the chemistry between the two, while making a claim as to which of the two is the best method to generate electricity.

GRADES	DISCIPLINE	COURSE	PACING
9 - 10	Science	Regents Chemistry	N/A

Section 1: What Task?

Teaching Task

Task Template 4 - Argumentation

Should electrical energy be generated from nuclear power or fossil fuels?After reading informational texts on how electrical energy is generated from these fuels, write an essay in which you compare the chemistry behind the two methods to generate electricity and argue which is the better method for production of electricity in an urban environment Support your position with evidence from the text(s). Be sure to consider competing views.

Standards

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

RST.9-10.1

Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.9-10.2

Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

RST.9-10.4

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 9—10 texts and topics.

RST.9-10.7

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.9-10.9

Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RST.9-10.10

By the end of grade 10, read and comprehend science/technical texts in the grades 9—10 text complexity band independently and proficiently.

WHST.9-10.1

Focus

Write arguments focused on discipline-specific content.

WHST.9-10.4

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

WHST.9-10.5

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.

WHST.9-10.6

Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

WHST.9-10.9

Focus

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

WHST.9-10.10

Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Learning Standards for Mathematics, Science, and Technology - Standard 4

Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Energy exists in many forms, and when these forms change energy is conserved.

Energy and matter interact through forces that result in changes in motion.

Custom Standards

Physical Setting/ Chemistry Core Curriculum Standard 4 Performance Indicator 3.1

3.1o Stability of an isotope is based on the ratio of neutrons and protons in its nucleus. Although most nuclei are stable, some are unstable and spontaneously decay, emitting radiation. 3.1p Spontaneous decay can involve the release of alpha particles, beta particles, positrons, and/or gamma radiation from the nucleus of an unstable isotope. These emissions differ in mass, charge, ionizing power, and penetrating power.

Physical Setting/ Chemistry Core Curriculum Standard 4 Performance Indicator 4.4

4.4a Each radioactive isotope has a specific mode and rate of decay (half-life). 4.4b Nuclear reactions include natural and artificial transmutation, fission, and fusion. 4.4c Nuclear reactions can be represented by equations that include symbols which represent atomic nuclei (with mass number and atomic number), subatomic particles (with mass number and charge), and/or emissions such as gamma radiation. 4.4d Radioactive isotopes have many beneficial uses. Radioactive isotopes are used in medicine and industrial chemistry for radioactive dating, tracing chemical and biological processes, industrial measurement, nuclear power, and detection and treatment of diseases. 4.4e There are inherent risks associated with radioactivity and the use of radioactive isotopes. Risks can include biological exposure, long-term storage and disposal, and nuclear accidents. 4.4f There are benefits and risks associated with fission and fusion reactions.

Physical Setting/ Chemistry Core Curriculum Standard 4 Performance Indicator 5.3

5.3a A change in the nucleus of an atom that converts it from one element to another is called transmutation. This can occur naturally or can be induced by the bombardment of the nucleus with high-energy particles. 5.3b Energy released in a nuclear reaction (fission or fusion) comes from the fractional amount of mass that is converted into energy. Nuclear changes convert matter into energy. 5.3c Energy released during nuclear reactions is much greater than the energy released during chemical reactions.

Next Generation Science Standards (NGSS Comprehensive)

HS-ETS1-1.

Focus

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Texts

- **"Clean Coal Gets a Sponge" (Campbell, Whitney - 2013)**
- **"Cleaning Up Coal" (Der, V.)**
- **“Energy Content of Fuels (in Joules)" King, C. (unpublished)**
- **"Nuclear Fallout" (National Resource Defense Council - 2012)**
- **"Natural Gas" (Naturalgas.org - 201 l)**
- **"Natural Gas and the Environment" (Naturalgas.org - 2011)**
- **"The Pro and Cons of Nuclear Power" (Smith, Jeffery M.)**
- Chemical Reactions: Types of Chemical Reactions- Combustion
  Wilbraham, Anthony C„ et al. (2008). Chemical Reactions: Types of Chemical Reactions-Combustion. Chemistry (pp. 320-351). Boston: Prentice Hall.
- Nuclear Chemistry: Fission and Fusion of Atomic Nuclei
  Wilbraham, Anthony C., et al. (2008). Nuclear Chemistry: Fission and Fusion of Atomic Nuclei-Nuclear Fission, Nuclear Fusion. Chemistry (pp. 798-825). Boston: Prentice Hall.

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

A very common debate in the field of energy generation, is what is the best source to generate energy? With science and technology improving, there are many ways that energy can be generated. In this task, you will make a claim about the best way to generate electricity by comparing the chemistry between two of three methods: nuclear, coal or natural gas.

Extension

Not provided

Section 2: What Skills?

Preparing for the Task

TASK ENGAGEMENT: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.

TASK ANALYSIS: Ability to understand and explain the task's prompt and rubric.

Reading Process

ACTIVE READING: Ability to identify the central point and main supporting elements of a text; ability to identify and analyze competing arguments; ability to make clarifying connections and/or provide examples.

ESSENTIAL VOCABULARY: Ability to identify and master terms essential to understanding a text.

ACADEMIC INTEGRITY: Ability to use and credit sources appropriately.

Writing Process I

CLAIM: Ability to establish a claim and consolidate information relevant to task.

Transition to Writing (Socratic Seminar)

PRE-SEIMNAR PROCESS: Ability to reflect on personal communication habits and select appropriate speaking and listening goals.

SEMINAR: Ability to think critically and collaboratively in a group about concepts and ideas of a text through a structured Socratic seminar.

POST-SEMINAR PROCESS: Ability to self-assess on speaking and listening skills practiced in the seminar and note relevant communication goals for future discussions.

Writing Process II

CLAIM: Ability to establish a claim and consolidate information relevant to task.

COUNTERCLAIM: Ability to establish and attach a counterclaim to the claim in general and subclaim(s), and information relevant to task.

PLANNING: Ability to develop a line of thought and text structure appropriate to an argumentation task.

DEVELOPMENT: Ability to construct an initial draft with an emerging line of thought and structure; Ability to analyze competing arguments; Ability to make clarifying connections and/or provide examples.

REVISION: Ability to refine text, including line of thought, language usage, and tone as appropriate to audience and purpose.

EDITING: Ability to proofread and format a piece to make it more effective.

COMPLETION: Ability to submit final piece that meets expectations.

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Preparing for the Task				
25 mins	**TASK ENGAGEMENT**: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.	**SEE, THINK, WONDER OF DISASTER PICTURES (SHORT RESPONSES ON POSTERS)** Short writings around pictures on individual student sheets and then students have the opportunity to respond about "their" pictures as they are projected on the SMART Board.	• Completion	• Go around with students and discuss with them their comments in the See, Think, Wonder sections of each picture. **PACING:** *Day 1*
	Additional Attachments: **Appendix 1: See, Think, Wonder Pictures**			
25 mins	**TASK ENGAGEMENT**: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.	**LOW STAKES SOCRATIC SEMINAR (RESPOND)** Student responses and participation in the seminar.	• Evaluation of participation and contribution to discussion	• Ask students what they found interesting about the pictures and See, Think, Wonder • Have students use 1 saw..., 1 thought../ wondered... as sentence starters at each of the pictures. • Push Socratic Seminar Protocols in order to establish ground rules for later use **PACING:** *Day 1*
25 mins	**TASK ANALYSIS**: Ability to understand and explain the task's prompt and rubric.	**RUBRIC AND TASK ANALYSIS (BULLETS)** In your own words, what are the important features of a good response to this prompt?	• Students must have 5 of their own thoughts and then record at least 3 of their peers' thoughts	• Identify or invite students to identify key features of examples. • Create a classroom list: Choose one student to share a few ideas on the board, and ask others to add to it. • Share out for group thoughts to make more comprehensive list **PACING:** *Day 2*
	Additional Attachments: **Appendix 2: Task Analysis and Calendar Review**			
25 mins	**TASK ANALYSIS**: Ability to understand and explain the task's prompt and rubric.	**CALENDAR REVIEW** Students will be presented with a calendar of the unit and asked to annotate important dates.	*No Scoring*	**PACING:** *Day 2*
	Additional Attachments: **Appendix 2: Task Analysis and Calendar Review**			
Reading Process				
3 hrs and 40 mins	**ACTIVE READING**: Ability to identify the central point and main supporting elements of a text; ability to identify and analyze competing arguments; ability to make clarifying connections	**SOAR PROTOCOL** Students complete a close reading protocol that requires them to Skim to Set an Objective (SO), Annotate Actively (A) and Review and Reflect (R), for each article.	• Students will complete the three required readings outlined in the protocol for each of the six articles. • The seventh article will be analyzed in	• One class period should be completely devoted to teaching the SOAR process if this is not something that is active at the institution • Model active reading strategies and note taking using organizer for students • Have students complete the graphic organizer as teacher is completing to develop a model for independent use later on

	and/or provide examples.	• What competing arguments have you encountered or can you think of? • What historical or current examples can you note that relate to the task prompt?	a CER format	**PACING:** *4-5 class periods (Days 3-6)*
	Additional Attachments: **Appendix 3: SOAR Protocol**			
Not provided	**ESSENTIAL VOCABULARY**: Ability to identify and master terms essential to understanding a text.	**VOCABULARY LIST** Students will be provided with an essential vocabulary list (i.e., a glossary that will assist them in their reading of the reading passages after the modeling is over.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Lists appropriate phrases. • Provides accurate definitions	• Ask some students to share definitions of terms they found difficult and had to look up on their own because they were not listed in the glossary. **PACING:** *Ongoing*
	Additional Attachments: **Appendix 4: Vocabulary Support**			
Not provided	**ACADEMIC INTEGRITY**: Ability to use and credit sources appropriately.	**DEFINITIONS AND STRATEGIES** Define "plagiarism" and list ways to avoid it.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Provides accurate definition. • Lists several appropriate strategies.	• Discuss respect for others' work to assemble evidence and create texts. • Discuss academic penalties for stealing others thoughts and words. • Citation modeling provided at end of some texts, students are responsible for citing the other texts properly based on the modeling. **PACING:** *Ongoing*
	Additional Attachments: **Appendix 5: Academic Integrity (Lesson Plan and Student Handout)**			
Writing Process I				
45 mins	**CLAIM**: Ability to establish a claim and consolidate information relevant to task.	**OPENING PARAGRAPH** Write an opening paragraph that includes a controlling idea and sequences the key points you plan to make in your composition.	**SCORING (STUDENT "MEETS EXPECTATIONS" IF HE/SHE...):** • Writes a concise summary statement or draft opening • Provides direct answer to main prompt requirements • Establishes a controlling idea • Identifies key points that support development of argument	• Use claim worksheet to address major required components of a claim • Use a claim graphic organizer to establish overall claim and subclaims • GO should have space next to each subclaim to address counterclaim **PACING:** *Day 7*
	Additional Attachments:			

	Appendix 6: Claim Graphic Organizer			
Transition to Writing (Socratic Seminar)				
45 mins	**SEMINAR**: Ability to think critically and collaboratively in a group about concepts and ideas of a text through a structured Socratic seminar.	**SOCRATIC SEMINAR** Students use what they learned about how to participate in a Socratic Seminar on day 1. Additionally, students will use the claim they established on day 5 as a frame of reference for their conversation.	• Evaluation of participation and contribution to discussion	Three questions to drive discussion: Keeping the chemistry of each process in mind: 1. What are the benifits and drawbacks to coal-generated electricity? 2. What are the benifits and drawbacks to natural gas-generated electricity? 3. What are the benifits and drawbacks to nuclear-generated electricity? Students will be asked at the end of the seminar to evaluate and, if necessary, re-write their claim. **PACING:** *Day 8*
	Additional Attachments: **Appendix 7: Socratic Seminar Notes**			
Writing Process II				
45 mins	**CLAIM**: Ability to establish a claim and consolidate information relevant to task.	**OPENING PARAGRAPH** If necessary, rewrite an opening paragraph that includes a controlling idea and sequences the key points you plan to make in your composition.	**SCORING (STUDENT "MEETS EXPECTATIONS" IF HE/SHE...):** • Writes a concise summary statement or draft opening. • Provides direct answer to main prompt requirements. • Establishes a controlling idea. • Identifies key points that support development of argument	• Use claim worksheet to address major required components of a claim • Use a claim graphic organizer to establish overall claim and subclaims • GO should have space next to each subclaim to address counterclaim **PACING:** *Day 9*
	Additional Attachments: **Appendix 6: Claim Worksheet** **Appendix 8: Counterclaim Worksheet**			
45 mins	**COUNTERCLAIM**: Ability to establish and attach a counterclaim to the claim in general and subclaim(s), and information relevant to task.	**OPENING PARAGRAPH** Write an counterclaim paragraph that addresses the opposing point(s) of view and prepares reader to consider both sides.	**SCORING (STUDENT "MEETS EXPECTATIONS" IF HE/SHE...):** • Writes a concise summary statement of the counterclaim. • Use key points from claim and finds a counterclaim to address each point • Identifies key points that support development of opposing	• Teach/review concept of counterclaim • Go over examples of counterclaim for students • Using the claim organizer, for each subclaim, students should integrate a counterclaim into the worksheet in the space provided • Students should be able to list a counter for each subclaim by the end of the class • Inform students that the counterclaim for each subclaim needs to be addressed in the same paragraph **PACING:** *Day 10*

			argument	
	Additional Attachments: **Appendix 8: Counterclaim worksheet**			
45 mins	**PLANNING**: Ability to develop a line of thought and text structure appropriate to an argumentation task.	**OUTLINE/ORGANIZER** Create an outline based on your notes and I reading in which you state your claim, sequence your points, and note your supporting evidence. • Include competing argument(s). • Include 2 example(s) of historical or current connections to topic/issue.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Creates an outline or organizer. • Supports opening claim. • Uses evidence from texts read earlier. • Identifies competing argument(s). • Provides appropriate number of sound connections.	• Provide and teach an outline examples. • Give students free time to plan their essay in the outline format • Have paired students review each other's outines and provide feedback. **PACING:** *Day 11*
	Additional Attachments: **Appendix 9: Outline**			
1 hr and 30 mins	**DEVELOPMENT**: Ability to construct an initial draft with an emerging line of thought and structure; Ability to analyze competing arguments; Ability to make clarifying connections and/or provide examples.	**INITIAL DRAFT** Write an initial draft complete with opening, development, and dosing; insert and ate textual evidence. • Identify competing arguments). • Provide appropriate number of sound connections.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations.	• Encourage students to re-read prompt partway through writing, to check that they are on track. • Using Doctopus, teacher will have access to all writings on GoogleDocs and will have the ability to make comments, suggestions, and question student writing as they are in progress. **PACING:** *Days 12-13*
45 mins	**REVISION**: Ability to refine text, including line of thought, language usage, and tone as appropriate to audience and purpose.	**MULTIPLE DRAFTS** Refine composition's analysis, logic, and organization of ideas/points. Use textual evidence carefully, with accurate citations. Decide what to include and what not to include.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations. • Improves earlier edition. • Provides draft free from distracting surface errors. • Uses format that supports purpose.	• Teacher review of drafts using Doctopus. Additionally, teacher will assess the assignment using the LDC rubric to give students feedback on their progress. • GoogleDocs will allow in-text comments to address specific concerns. • Teacher mil notify students that changes are suggested on first instance of error, but should be addressed throughout the paper. • Teacher will provide sample pieces of writing (not from this assignment) and have students assess the writing on the categories in the LDC rubric Students will be engaged in a minitask on how to use a rubric properly. • After minitask is complete, students can share a partner on their paper and assess their partner's paper against the LDC rubric. **PACING:** *Day 14*
45 mins	**EDITING**: Ability to proofread and format a piece to make it more effective.	**CORRECTED DRAFT** Revise draft to have sound spelling, capitalization, punctuation, and grammar.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):**	• Teacher review of drafts using Doctopus. Additionally, teacher will assess the assignment using the LDC rubric to give students feedback on their progress. • GoogleDocs will allow in-text comments to address specific

		Adjust formatting as needed to provide clear, appealing text	• Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations. • Improves earlier edition. • Provides draft free from distracting surface errors. • Uses format that supports purpose.	concerns. • Teacher mil notify students that changes are suggested on first instance of error, but should be addressed throughout the paper. • Teacher will provide sample pieces of writing (not from this assignment) and have students assess the writing on the categories in the LDC rubric Students will be engaged in a minitask on how to use a rubric properly. • After minitask is complete, students can share a partner on their paper and assess their partner's paper against the LDC rubric. **PACING:** *Day 15*
1 hr and 30 mins	**COMPLETION**: Ability to submit final piece that meets expectations.	**FINAL DRAFT** Turn in your final drafts, plus the final version of your piece.	**SCORING (PRODUCT "MEETS EXPECTATIONS" IF IT...):** • Fits the "Meets Expectations" category in the rubric for the teaching task.	• Final Drafts will be graded using Goobric in conjunction with Doctopus. • All drafts will be locked on day 17 at 8:00PM to prevent student manipulation after the deadline; permissions will be re-granted after assessment is complete. • If the unit is started on a Monday, day 17 will occur on a Sunday, affording students opportunity outside of class to complete the assignment. **PACING:** *Days 16-17 (in and outside of class)*

Instructional Resources

No resources specified

Section 4: What Results?

Student Work Samples

Meets Expectations

Large collection of scored student work (includes some mini-tasks)

Teacher Reflection

The following programs were used:

- Management Scripts
- Doctopus V3.0.2
- Goobric