**Introduction:**

The Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for science provides criteria by which to measure the alignment and overall quality of lessons and units with respect to the Next Generation Science Standards (NGSS). The purposes of the rubric and review process are to: (1) review existing lessons and units to determine what revisions are needed; (2) provide constructive criterion-based feedback and suggestions for improvement to developers; (3) identify exemplars/models for teachers’ use within and across states; and (4) to inform the development of new lessons and units.

To effectively apply this rubric, an understanding of the National Research Council’s A Framework for K–12 Science Education and the Next Generation Science Standards, including the NGSS shifts (Appendix A of the NGSS), is needed. Unlike in the EQuIP Rubrics for mathematics and ELA, there is not a category in the science rubric for shifts. Over the course of the rubric development, writers and reviewers noted that the shifts fit naturally into the other three categories. For example, the blending of the three-dimensions, or three-dimensional learning, is addressed in each of the three categories; coherence is addressed in the first two categories; connections to the Common Core State Standards is addressed in the first category; etc. Each category includes criteria by which to evaluate the integration of engineering, when included in a lesson or unit, through practices or disciplinary core ideas. Another difference between the EQuIP Rubrics from mathematics and ELA is in the name of the categories; the rubric for science refers to them simply as categories, whereas the math and ELA rubrics refer to the categories as dimensions. This distinction was made because the Next Generation Science Standards already uses the term dimensions to refer to practices, disciplinary core ideas, and crosscutting concepts.

The architecture of the NGSS is significantly different from other sets of standards. The three dimensions, crafted into performance expectations, describe what is to be assessed following instruction and therefore are the measure of proficiency. A lesson or unit may provide opportunities for students to demonstrate performance of practices connected with their understanding of core ideas and crosscutting concepts as foundational pieces. This three-dimensional learning leads toward eventual mastery of performance expectations. In this scenario, quality materials should clearly describe or show how the lesson or unit works coherently with previous and following lessons or units to help build toward eventual mastery of performance expectations. The term element is used in the rubric to represent the relevant, bulleted practices, disciplinary core ideas, and crosscutting concepts that are articulated in the foundation boxes of the standards and in K–12 grade-banded progressions and the NGSS Appendices. Given the understanding that lessons and units should integrate the practices, disciplinary core ideas, and crosscutting concepts in ways that make sense instructionally and not replicate the exact integration in the performance expectations, the new term elements is needed to describe these smaller units of the three dimensions. Although it is unlikely that a single lesson would provide adequate opportunities for a student to demonstrate proficiency on an entire performance expectation, high-quality units are more likely to provide these opportunities to demonstrate proficiency on one or more performances expectations.

There is a recognition among educators that curriculum and instruction will need to shift with the adoption of the NGSS, but it is currently difficult to find instructional materials designed for the NGSS. The power of the rubric is in the feedback and suggestions for improvement it provides curriculum developers and the productive conversations in which educators engage while evaluating materials using the quality review process. For curriculum developers, the rubric and review process provide evidence of the quality and the degree to which the lesson or unit is designed for the NGSS. Additionally, the rubric and review process generate suggestions for improvement on how materials can be further improved and better designed to match up with the vision of the Framework and the NGSS.
### I. NGSS 3D Design

The lesson/unit is designed so students make sense of phenomena and/or design solutions to problems by engaging in student performances that integrate the three dimensions of the NGSS.

- **A. Explaining Phenomena/Designing Solutions**: Making sense of phenomena and/or designing solutions to a problem drive student learning.
  - i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem solving.
  - ii. The focus of the lesson is to support students in making sense of phenomena and/or designing solutions to problems.
  - iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical, life, and/or earth and space sciences.

- **B. Three Dimensions**: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions.
  - i. Provides opportunities to develop and use specific elements of the SEP(s).
  - ii. Provides opportunities to develop and use specific elements of the DCI(s).
  - iii. Provides opportunities to develop and use specific elements of the CCC(s).

- **C. Integrating the Three Dimensions**: Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

### II. NGSS Instructional Supports

The lesson/unit supports three-dimensional teaching and learning for ALL students by placing the lesson in a sequence of learning for all three dimensions and providing support for teachers to engage all students.

- **A. Relevance and Authenticity**: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.
  - i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations).
  - ii. Includes suggestions for how to connect instruction to the students’ home, neighborhood, community and/or culture as appropriate.
  - iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

- **B. Student Ideas**: Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and to respond to peer and teacher feedback orally and/or in written form as appropriate.

- **C. Building Progressions**: Identifies and builds on students’ prior learning in all three dimensions, including providing the following support to teachers:
  - i. Explicitly identifying prior student learning expected for all three dimensions
  - ii. Clearly explaining how the prior learning will be built upon

- **D. Scientific Accuracy**: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students’ three-dimensional learning.

- **E. Differentiated Instruction**: Provides guidance for teachers to support differentiated instruction by including:
  - i. Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English language learners, have special needs, or read well below the grade level.
  - ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.
  - iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

### III. Monitoring NGSS Student Progress

The lesson/unit supports monitoring student progress in all three dimensions of the NGSS as students make sense of phenomena and/or design solutions to problems.

- **A. Monitoring 3D student performances**: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.

- **B. Formative**: Embeds formative assessment processes throughout that evaluate student learning to inform instruction.

- **C. Scoring guidance**: Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

- **D. Unbiased tasks/items**: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.
### EQuIP Rubric for Lessons & Units: Science

Units designed for the NGSS will also include clear and compelling evidence of the following additional criteria:

<table>
<thead>
<tr>
<th>I. NGSS 3D Design</th>
<th>II. NGSS Instructional Supports</th>
<th>III. Monitoring NGSS Student Progress</th>
</tr>
</thead>
</table>
| **D. Unit Coherence**: Lessons fit together to target a set of performance expectations.  
  i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.  
  ii. The lessons help students develop toward proficiency in a targeted set of performance expectations. |
| **E. Multiple Science Domains**: When appropriate, links are made across the science domains of life science, physical science and Earth and space science.  
  i. Disciplinary core ideas from different disciplines are used together to explain phenomena.  
  ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted. |
| **F. Math and ELA**: Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects. |
| **F. Teacher Support for Unit Coherence**: Supports teachers in facilitating coherent student learning experiences over time by:  
  i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).  
  ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions. |
| **G. Scaffolded differentiation over time**: Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems. |
| **E. Coherent Assessment system**: Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning. |
| **F. Opportunity to learn**: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback. |
Using the EQuIP Rubric for Lessons & Units: Science

The first step in the review process is to become familiar with the rubric, the lesson or unit, and the practices, disciplinary core ideas, and crosscutting concepts targeted in the lesson or unit. The three categories in the rubric are: NGSS 3D Design, NGSS Instructional Supports, and Monitoring NGSS Student Progress. Each criterion within each category should be considered separately as part of the complete review process and are used to provide sufficient information for determination of overall quality of the lesson or unit.

For the purposes of using the rubric, a lesson is defined as: a set of instructional activities and assessments that may extend over several class periods or days; it is more than a single activity. A unit is defined as: a set of lessons that extend over a longer period of time. If you are reviewing a lesson, you will use only the first section of the rubric (page 2). If you are reviewing an instructional unit, you apply all of the criteria of the rubric (pages 2 and 3) across the unit. You’ll notice that the definition of a “unit” is intentionally broad here. If you are reviewing instructional materials that cover more than a few days of instruction, use the full unit list of criteria.

Also important to the review process is feedback and suggestions for improvement to the developer of the resource. For this purpose, a set of response forms is included so that the reviewer can effectively provide criterion-based feedback and suggestions for improvement for each category. The response forms correspond to the criteria of the rubric. Evidence for each criterion must be identified and documented and criterion-based feedback and suggestions for improvement should be given to help improve the lesson or unit.

While it is possible for the rubric to be applied by an individual, the quality review process works best with a team of reviewers, as a collaborative process, with the individuals recording their thoughts and then discussing with other team members before finalizing their feedback and suggestions for improvement. Discussions should focus on understanding all reviewers’ interpretations of the criteria and the evidence they have found. With professional learning support for the group, this process will provide higher quality feedback about the lessons and also calibrate responses across reviewers in a way that moves them toward agreement about quality with respect to the NGSS. Commentary needs to be constructive, with all lessons or units considered “works in progress.” Reviewers must be respectful of team members and the resource contributor. Contributors should see the review process as an opportunity to gather feedback and suggestions for improvement rather than to advocate for their work. All feedback and suggestions for improvement should be criterion-based and have supporting evidence from the lesson or unit cited.

In order to apply the rubric with reliability and with fidelity to its intent, it is recommended that those applying the rubric to lessons and units be supported to attend EQuIP professional learning based on the EQuIP Facilitator’s Guide. There is guidance within the rubric below and in the Facilitator’s Guide, but application of the rubric is much more successful with the support of professional learning. It is difficult to develop proficiency at using the rubric without at least two days of high quality professional learning that engages participants in evaluating lessons and units.

**Step 1 – Review Materials**

The first step in the review process is to become familiar with the rubric and the lesson or unit that is being evaluated.

- Review the rubric and record the grade and title of the lesson or unit on the response form.
- Scan the lesson/unit to see what it’s about; identify what practices, disciplinary core ideas, and crosscutting concepts are targeted; and determine how it is organized.
- Read key materials related to instruction, assessment, and teacher guidance.
- Read the definitions of “lesson” and “unit” near the top of this page and decide as a group whether you will be using the shorter list of criteria for a lesson, or the longer list of criteria that apply to a unit.

**Step 2 – Apply Criteria in Category I: NGSS 3D Design**

Evaluate the lesson or unit using the criteria in the first category, first individually and then as a team.

- Closely examine the lesson or unit through the “lens” of each criterion in the first category.
- For each criterion, record where you find it in the lesson/unit (the evidence) and why/how this evidence is an indicator the criterion is being met (the reasoning).
- As individuals, check the box for each criterion on the response form that indicates the degree to which evidence could be identified.
- Identify and record input on specific improvements that might be made to meet criteria or strengthen alignment.
Look across the criteria of the category (A–C for a lesson and A–F for a unit), evaluate the degree to which they are met, and enter your 0–3 rating for Category I: NGSS 3D Design (see scale description below).

As a team, discuss criteria for which clear and substantial evidence is found, as well as criterion-based suggestions for specific improvements that might be needed to meet criteria. As a team, enter your 0–3 rating for Dimension I: NGSS 3D Design.

If the rubric is being used to approve or vet resources and the lesson or unit does not score at least a “2” in Category I: NGSS 3D Designed, the review should stop and feedback should be provided to the lesson developer(s) to guide revisions. If the rubric is being used locally for revising and building lessons, professional judgment should guide whether to continue reviewing the lesson. Categories II and III may be time consuming to evaluate if Category I has not been met and the feedback may not be useful if significant revisions are needed in Category I, but evaluating these criteria in a group may support deeper and more common understanding of the criteria in these categories and more complete feedback to the lesson developer (if they are not in the room) so that Categories II and III are more likely to be met with fewer cycles of revision.

Step 3 – Apply Criteria in Categories II and III: Instructional Supports and Monitoring Student Progress

The third step is to evaluate the lesson or unit using the criteria in the second and third categories, first individually and then as a group.

Closely examine the lesson or unit through the “lens” of each criterion in the second and third categories of the response form.

For each criterion, record where you find it in the lesson/unit (the evidence) and why/how this evidence is an indicator the criterion is being met (the reasoning).

Individually check the box for each criterion on the response form that indicates the degree to which evidence could be identified.

Record any suggestions for improvement and then rate each category using the 0–3 rating scale in the forms below.

When working in a group, teams may choose to compare ratings after each category or delay conversation until each person has rated and recorded input for both Categories II and III. Complete consensus among team members is not required but discussion is a key component of the review process that moves the group to a better understanding of the criteria.

Step 4 – Apply an Overall Rating and Provide Summary Comments

Review ratings for Categories I–III, adding/clarifying comments as needed.

Write summary comments for your overall rating on your recording sheet.

Total category ratings, reflect on the overall quality of the lesson or unit, and record the overall rating of E, E/I, R, or N.

If working in a group, individuals should record their overall rating prior to conversation.

Step 5 – Compare Overall Ratings and Recommend Next Steps

Note the evidence cited to arrive at final ratings, summary comments and similarities and differences among raters. Recommend next steps for the lesson/unit and provide recommendations for improvement and/or ratings to developers/teachers.

Rating Scales

Rating for Category I: NGSS 3D Designed is non-negotiable and requires a rating of 2 or 3. If rating is 0 or 1 then a review for resource approval does not continue.

Rating Scale for Categories I, II, & III:
Rating scales are different for each category and can be found after each category in the rubric.

Descriptors for Categories I, II, & III:
3: Exemplifies NGSS Quality—meets the standard described by criteria in the category, as explained in criterion-based observations.
2: Approaching NGSS Quality—meets many criteria but will benefit from revision in others, as suggested in criterion-based observations.
1: Developing toward NGSS Quality—meets significant revision, as suggested in criterion-based observations.
0: Not representing NGSS Quality—does not address the criteria in the category.

Overall Rating for the Lesson/Unit:
E: Example of high quality NGSS design—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)
E/I: Example of high quality NGSS design if improved—Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)
R: Revision needed—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)
N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0–2)
Reviewer Name or ID: PASCO Education  Grade: Chemistry  Lesson/Unit Title: Chapter 4: Temperature and Heat

Category I: NGSS 3D Design (lessons and units): The lesson/unit is designed so students make sense of phenomena and/or design solutions to problems by engaging in student performances that integrate the three dimensions of the NGSS.

<table>
<thead>
<tr>
<th>Lesson and Unit Criteria</th>
<th>Specific evidence from materials (what happened/where did it happen) and reviewer’s reasoning (how/why is this evidence)</th>
<th>Evidence of Quality?</th>
<th>Suggestions for improvement</th>
</tr>
</thead>
</table>
| A. Explaining Phenomena/Designing Solutions: Making sense of phenomena and/or designing solutions to a problem drive student learning. | i: How does energy move from one object to another? Chapter 4  
i: How are Celsius and Fahrenheit temperature related? Section 4.1  
i: How is the motion of particles related to temperature? Section 4.1  
i: How does a Thermos keep your food both hot and cold? Section 4.2  
i: How does perspiration cool you down? Section 4.3  
i: How do thermometers measure temperature? Section 4.1  
i: Interactive Simulation: How do the movements of microscopic particles affect a traced particle? Section 4.1  
i: How are the Calories in food measured? Section 4.2  
i: What makes a material a good insulator or conductor? Section 4.2  
i: Why do some materials heat up faster than others? Section 4.2  
i: Project: Design an insulator that will keep a solution from losing 2°C for 2 minutes. Project Lab 4.D  
i: Specific Heat. Will equal masses of different substances produce the same result? PS3.B Lab 4.B  
i: Project: Design an insulator that will keep a solution from losing 2°C for 2 minutes. The student incorporates mathematics to do a cost analysis and calculate the energy of the system. PS3.A The student will also minimize heat transfer during a design and redesign process. PS3.B, PS3.D, ETS1.A, ETS1.B and ETS1.C. Project Lab 4.D | ☐ None  ☐ Inadequate  ☒ Adequate  ☒ Extensive |
<p>| B. Three Dimensions: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions. | Document evidence and reasoning, and evaluate whether or not there is sufficient evidence of quality for each dimension separately. | ☐ None  ☐ Inadequate  ☒ Adequate  ☒ Extensive |</p>
<table>
<thead>
<tr>
<th>i. Provides opportunities to <strong>develop and use</strong> specific elements of the SEP(s).</th>
</tr>
</thead>
</table>
| i. i: Asking questions (for science) and defining problems (for engineering): Are temperature and thermal energy the same thing?  
**Lab 4.A**  
i. i: Developing and using models: Use the Kinetic Molecular theory to describe the overall behavior of sand and milk.  
**Section 4.1**  
i. i: Planning and carrying out investigations: Students will demonstrate and observe the effects of several insulating materials and their efficiency in preventing heat transfer. Upon completion of their observations, students will design an insulated container that will keep a solution from losing less than 2 °C for 2 minutes.  
**Project 4.D**  
i. i: Analyzing and interpreting data: Use data collected in the lab to predict temperature changes.  
**Lab 4.A**  
i. i: Constructing explanations (for science) and designing solutions (for engineering): Students will design an insulated container that will keep a solution from losing less than 2 °C for 2 minutes.  
**Project 4.D** |
| (All 3 dimensions must be rated at least “adequate” to mark “adequate” overall) |

ii. Provides opportunities to **develop and use** specific elements of the DCI(s). |
| --- |
| ii. ii: SP1. Obtain, evaluate, and communicate information about insulator design and cost effectiveness of the design.  
**Project 4.D** |

iii. Provides opportunities to **develop and use** specific elements of the CCC(s). |
| --- |
| iii. iii: Design build and refine a device; Students will design an insulated container that will keep a solution from losing less than 2 °C for 2 minutes.  
**Project 4.D**  
iii: Plan and conduct an experiment; Using available resources (i.e. text, notes and/or internet), complete some research on insulators and their everyday uses. You will use this research to help create and complete the design of your cup.  
**Project 4.D**  
iii: Patterns; cause and effect; scale, proportion, and quantity; What is the shape of a heating curve and how are all heating curves similar?  
**Section 4.3** |
C. **Integrating the Three Dimensions**: Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

<table>
<thead>
<tr>
<th>Patterns; cause and effect; scale, proportion, and quantity, SP1 &amp; Developing and using models: Interactive: Brownian Motion. Use the model to determine the cause of Brownian Motion.</th>
<th>Section 4.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patterns; cause and effect; scale, proportion, and quantity, SP1 &amp; Planning and carrying out investigations: Using available resources (i.e. text, notes and/or internet), complete some research on insulators and their everyday uses. You will use this research to help create and complete the design of your cup.</td>
<td>Project 4.D</td>
</tr>
<tr>
<td>Patterns; cause and effect; scale, proportion, and quantity, SP1 &amp; Analyzing and interpreting data: Specific Heat. Will equal masses of different substances produce the same result?</td>
<td>Lab 4.B</td>
</tr>
</tbody>
</table>

**Rating for Category I. NGSS 3D Design—lessons**
After carefully weighing the evidence, reasoning, and suggestions for improvement, rate the degree to which there is enough evidence to support a claim that the lesson meets these criteria.

**Lesson Rating scale for Category I (Criteria A–C only):**
1: Adequate evidence to meet at least one criterion in the category, but insufficient evidence for at least one other criterion
2: Adequate evidence to meet all three criteria in the category
3: Extensive evidence to meet at least two criteria (and at least adequate evidence for the third)
0: Inadequate (or no) evidence to meet any of the criteria in the category

**Circle Rating**

<table>
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<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
</table>

**What’s next if the lesson rating is less than a 2?**
If the rubric is being used to approve or vet resources and the lesson or unit does not score at least a “2” in **Category I: NGSS 3D Designed**, the review should stop and feedback should be provided to the lesson developer(s) to guide revisions. If the rubric is being used locally for revising and building lessons, professional judgment should guide whether to continue reviewing the lesson. Categories II and III may be time consuming to evaluate if Category I has not been met and the feedback may not be useful if significant revisions are needed in Category I, but evaluating these criteria in a group may support deeper and more common understanding of the criteria in these categories and more complete feedback to the lesson developer (if they are not in the room) so that Categories II and III are more likely to be met with fewer cycles of revision.

**What’s next if the lesson rating is a 2 or 3?**
If you are evaluating a lesson that shows sufficient evidence of quality to warrant a rating of either a 2 or a 3 for Category I, proceed to Category II: **NGSS Instructional Supports**
### Category I: NGSS 3D Design (additional criteria for units only):

*If you are evaluating a lesson, it is not necessary to evaluate criteria D–F. Please enter your rating for a single lesson above (after C).*

<table>
<thead>
<tr>
<th>Unit Criteria</th>
<th>Specific evidence from materials and reviewers’ reasoning</th>
<th>Evidence of Quality?</th>
<th>Suggestions for improvement</th>
</tr>
</thead>
</table>
| **D. Unit Coherence:** Lessons fit together to target a set of performance expectations.  
   i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.  
   ii. The lessons help students develop toward proficiency in a targeted set of performance expectations. | i: The concept of temperature leads to specific heat then to the equation for energy, \( q = m \Delta T c_p \) **Chapter 4**  
   ii: Major topics are broken into smaller lessons to build and support the development of the concepts. **Chapter 4** | ☒ Extensive | ☒ Extensive |
| **E. Multiple Science Domains:** *When appropriate*, links are made across the science domains of life science, physical science and Earth and space science.  
   i. Disciplinary core ideas from different disciplines are used together to explain phenomena.  
   ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted. | i: The chemistry and physics concept of energy is used to describe the energy gained and lost in biological systems. **Section 4.2**  
   i: The Second Law of Thermodynamics is used to explain heat loss in humans. **Section 4.2**  
   i: Thermoregulation and heat flow is explained through blood vessel response in living organisms. **Section 4.2**  
   i: Specific Heat and along with heat of fusion and heat of vaporization is used to create heating curves. **Section 4.3**  
   i: Kinetic energy and energy bar diagrams are used to elucidate physical changes. **Section 4.3**  
   ii: models are used across the Lesson to build the content. Graphical patterns are utilized to help develop deeper understanding. **Chapter 4**  
   ii: scale, proportions and quantity are used to help define and relate to distances and motion over distance. **Chapter 4**  
   ii: Scale, proportions and quantity are used to quantify speed and velocity as applied to various disciplines **Chapter 4** | ☒ Extensive | ☒ Extensive |
| **F. Math and ELA:** Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects. | Mathematics:  
   i: Reinforces Quantities N.Q: MGSE9-12.N.Q.1, MGSE9-12.N.Q.2, MGSE9-12.N.Q.3 **Chapter 4**  
   i: Reinforces Seeing Structure in Expressions A.SSE: MGSE9-12.A.SSE.1 **Chapter 4**  
   i: Reinforces Reasoning with Equations and Inequalities A.REI: MGSE9-12.A.REI.1.A1-J.1 **Sections 4.2 - 4.3** | ☒ Extensive | ☒ Extensive |
ELA:
Supports Reading Literacy RL: ELAGSE9-10RL1,
Chapter 4
Supports Reading Information RI: ELAGSE9-10RI1, ELAGSE9-10RI2,
ELAGSE9-10RI3, ELAGSE9-10RI4, ELAGSE9-10RI5, ELAGSE9-10RI10
Chapter 4, Project 4.D
Supports Writing W: ELAGSE9-10W6, ELAGSE9-10W7, ELAGSE9-10W9,
Chapter 4, Project 4.D
Supports Speaking and Listening SL: ELAGSE9-10SL1, ELAGSE9-10SL4,
ELAGSE9-10SL5, Chapter 4, Project 4.D
Supports Language L: ELAGSE9-10L3 Chapter 4, Project 4.D

Strategies for Language support (L):
* Students speak using grade-level content vocabulary in context to internalize new English words. Chapter 4, Project 4.D
* Speak using grade-level content vocabulary in context to build academic language proficiency. Chapter 4, Project 4.D
* Students read linguistically supported text by relating the text in the book to the identical graphics and the stories told by fellow classmates. Chapter 4, Project 4.D
* Students are asked to present your findings to your supervisor. The presentation must include the data you collected which will justify the most cost-efficient and thermal efficient design for your insulator. Use an objective and scientific tone. What are the specific reasons why these chosen materials make good insulators? Project 4.D
* Students develop basic sight vocabulary: specific heat, heat of fusion, heat of vaporization, heating curve

| Rating for Category I. NGSS 3D Designed—units | Unit Rating Scale for Category I (Criteria A–F):
| After carefully weighing the evidence, reasoning, and suggestions for improvement, rate the degree to which the criteria are met across the unit. | 3: At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
2: At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C
1: Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
0: Inadequate (or no) evidence to meet any criteria in Category I (A–F) |

Circle Rating

If the rubric is being used to approve or vet resources and the unit does not score at least a “2” overall in Category I: NGSS 3D Design, the review should stop here and feedback should be provided to the unit developer(s) to guide revisions. If the rubric is being used locally for revising and building units, professional judgment should be used on whether or not to continue reviewing the unit. For example, a unit that is weak in one aspect of criterion A, but that the reviewers think is easy to fix, might warrant continued review to provide more complete feedback to the unit developer(s).
### Category II: NGSS Instructional Supports (lessons and units)

The lesson/unit supports three-dimensional teaching and learning for ALL students by placing the lesson in a sequence of learning for all three dimensions and providing support for teachers to engage all students.

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<tr>
<th>Lesson and Unit Criteria</th>
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</thead>
</table>
| A. Relevance and Authenticity: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.  
  i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations).  
  ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate.  
  iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience. | i: In teams, the students must design an insulator that loses less than 2 °C in 2 minutes or more that can be sold for $5. **Project 4.D**  
  i: Using available resources (i.e. text, notes and/or internet), complete some research on insulators and their everyday uses. You will use this research to help create and complete the design of your cup. **Project 4.D**  
  ii: Students are asked to present your findings to your supervisor. The presentation must include the data you collected which will justify the most cost-efficient and thermal efficient design for your insulator. Use an objective and scientific tone. What are the specific reasons why these chosen materials make good insulators? **Project 4.D**  
  ii: Chemistry uses specific meanings for words that may be used differently in conversation. You may be familiar with the following physics terms through things you learned before or from your own, everyday experiences. Below are different ways of describing each term in everyday usage. **Chapter 4**  
  iii: For an additional challenge, students can be asked to explore the following options:  
  1. Test both hot and iced water to determine the rate of temperature change using the beaker. The designed insulator should be able to reduce the overall temperature change for both the hot and cold water.  
  2. Test the hot water over a 10-15 minute time frame in order to minimize the heat lost in their design relative to the amount of heat lost in the glass beaker. **Project 4.D**  
  iii: The kinetic molecular theory is explained using milk and beach balls. **Section 4.1**  
  iii: Heat flow is explained using an analogy of a human swimming in ice water. **Section 4.2**  
  iii: Thermoregulation is explained through blood vessel contraction and blood flow. **Section 4.2**  
  iii: Specific heat is introduced using hot pizza. **Section 4.2**  
  iii: Heat and Conservation problems are introduced using hot coffee. **Section 4.2**  
  iii: Heating curves are explained using water and ice. **Section 4.3** | ☐ None  
  ☐ Inadequate  
  ☒ Adequate  
  ☒ Extensive |
iii: Ice cubes at -25.0 °C are used to cool off a glass of punch. Which absorbs more heat: warming the ice or melting ice into water? The specific heat of ice is 2.0 J/g°C  \textbf{Section 4.3}

<table>
<thead>
<tr>
<th>B. \textbf{Student Ideas:} Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present your findings to your supervisor. You may use a traditional presentation board, PowerPoint presentation and/or another multimedia presentation device such as Animoto, PowToons and/or iMovie.  \textbf{Project 4.D}</td>
</tr>
<tr>
<td>The presentation must include the data you collected which will justify the most cost-efficient and thermal efficient design for your insulator. Use an objective and scientific tone. What are the specific reasons why these chosen materials make good insulators?  \textbf{Project 4.D}</td>
</tr>
<tr>
<td>Begin by writing an outline. You will ultimately develop a 5- to 7-page paper (not including a title page and reference list) and 10-slide presentation. Review the grading rubric for the final paper as you create your outline.  \textbf{Enhancement 4.5}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. \textbf{Building Progressions:} Identifies and builds on students’ prior learning in all three dimensions, including providing the following support to teachers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Explicitly identifying prior student learning expected for all three dimensions</td>
</tr>
<tr>
<td>ii. Clearly explaining how the prior learning will be built upon.</td>
</tr>
<tr>
<td>i: Science and Engineering Practice: Planning and Carrying Out Investigations. The students design a devise using their prior knowledge of temperature, heat flow and insulators. HS-PS3-4  \textbf{Project 4.D}</td>
</tr>
<tr>
<td>i: Disciplinary Core Idea: Conservation of Energy and Energy Transfer. The students will use their newly gained knowledge to improve the design of their insulating device and slow the energy transfer process. HS-PS3-4  \textbf{Project 4.D}</td>
</tr>
<tr>
<td>i: Cross Cutting Concept: Systems and System Models. The system they design will change temperature unless a design that stabilizes the temperature is found. They will use their prior knowledge of temperature and heat flow. HS-PS3-4  \textbf{Project 4.D}</td>
</tr>
<tr>
<td>ii: The students are asked to, “...design an insulator that loses less than 2 °C in 2 minutes or more that can be sold for $5.” During the course of this project they are expected to do a cost analysis using the skills they have acquired from their study of mathematics. They will also</td>
</tr>
</tbody>
</table>

| ☐ None |
| ☐ Inadequate |
| ☐ Adequate |
| ☒ Extensive |
build a devise that will require them to use construction and artistic skills in coordination with the newly acquired knowledge of heat transfer, and insulators. At the end of the project they are expected to give a report, in which they will use linguistic and technological knowledge. **Project 4.D**

<table>
<thead>
<tr>
<th>D. <strong>Scientific Accuracy</strong>: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students’ three-dimensional learning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facts and vocabular have been checked. All resources are relevant and current <strong>Chapter 4</strong></td>
</tr>
</tbody>
</table>

- **Scientific Accuracy**: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students’ three-dimensional learning.
- **Scientific Accuracy**: Facts and vocabulary have been checked. All resources are relevant and current. **Chapter 4**

<table>
<thead>
<tr>
<th>E. <strong>Differentiated Instruction</strong>: Provides guidance for teachers to support differentiated instruction by including:</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. <strong>Differentiated Instruction</strong>: Learn new language structures used routinely in written classroom materials. In the context of physics, mathematics is a language of describing quantitative relationships. Much research shows that the language-based approach is an effective way to both learn and teach math. Throughout this course we ask students to translate back and forth between the language of symbols and English sentences with the same meaning. For those students who are not native English speakers, the language of math is the same in all languages. If they understand the meaning of an equation, its translation into English is a strong learning modality. <strong>Chapter 4</strong></td>
</tr>
<tr>
<td>ii. <strong>Differentiated Instruction</strong>: Students speak using grade-level content vocabulary in context to internalize new English words. Students are asked to &quot;Make up a 1-paragraph story around something that happened to create the energy bar diagram shown. In your story identify the system and its surroundings, explain in what direction energy moved through the system and surroundings, and be creative!&quot; <strong>Section 4.3</strong></td>
</tr>
<tr>
<td>iii. <strong>Differentiated Instruction</strong>: Students are asked, &quot;Is melting endothermic or exothermic? Explain your answer.&quot; <strong>Section 4.3</strong></td>
</tr>
<tr>
<td>i: Students are asked, &quot;Is melting endothermic or exothermic? Explain your answer.&quot; <strong>Section 4.3</strong></td>
</tr>
<tr>
<td>i: Students are asked, &quot;Heat is transferred from an object and undergoes no phase change. What data is needed to calculate the amount of heat that is lost?&quot; <strong>Chapter Review</strong></td>
</tr>
</tbody>
</table>

<p>| ☐ None |
| ☐ Inadequate |
| ☒ Adequate |
| ☒ Extensive |</p>
<table>
<thead>
<tr>
<th>i: Students are asked to, &quot;Explain why a double walled metal vacuum bottle can be used to keep your water cold even though metals are great thermal conductors.&quot; <strong>Chapter Review</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>i: Students are asked to, &quot;A hot bar of steel that weighs 25 g at 90 °C is placed on a 15 g bar of copper at 25 °C. Explain how energy will flow at the molecular level.&quot; <strong>Chapter Review</strong></td>
</tr>
<tr>
<td>i: Students are asked to, &quot;You have a 1000 g sample of water at 45 °C and a 1 g sample of water at 50 °C. Which sample would you estimate to have a higher thermal energy? Defend your choice.&quot; <strong>Chapter Review</strong></td>
</tr>
</tbody>
</table>

**Chapter Review**

i: Vocabulary words **Chapter 4**  

i: Text will be provided as verbal - auditory - reading when prompted via the reading icon **Chapter 4**  

ii: Assistance: Sample problems **Chapter 4**  

ii: In this interactive simulation, the students will see the effect of Brownian motion on a trace particle. **Section 4.1**  

iii: Extension: Test hot and iced water **Project 4.D**  

iii: Extension: Test hot water for 10 to 15 minutes **Project 4.D**  

iii: Extension: Limit design to 100g. **Project 4.D**  

iii: Extension: Limit cost to $2. **Project 4.D**  


**Rating for Category II: Instructional Supports—lessons**  
After carefully weighing the evidence, reasoning, and suggestions for improvement, rate the degree to which the lesson met this category.  

*If you are evaluating an instructional unit rather than a single lesson, continue on to evaluate criteria F–G and rate Category II overall below.*  

**Lesson Rating scale for Category II (Criteria A–E only):**  
3: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion  
2: Some evidence for all criteria in the category and adequate evidence for at least four criteria, including A  
1: Adequate evidence of quality for at least two criteria in the category  
0: Adequate evidence of quality for no more than one criterion in the category  

| Circle Rating | 0 | 1 | 2 | 3 |
### Unit Criteria
A unit or longer lesson designed for the NGSS will also include clear and compelling evidence of the following:

#### F. Teacher Support for Unit Coherence: Supports teachers in facilitating coherent student learning experiences over time by:
- Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).
- Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

##### Evidence of Quality?

- Prior lesson knowledge is emphasized in the lesson plan document.
  - Example: This lesson expands on prior teaching related to solving chemistry problems. Students should be familiar with the dimensional analysis developed in chapter 2.  
  - Chapter 4
  - Strategies to connect content provided: Example: The student is expected to: express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically.
  - Chapter 4
  - i: Prior lesson knowledge is emphasized
  - Example: This lesson expands on prior teaching related to solving chemistry problems. Students should be familiar with the dimensional analysis developed in chapter 2.  
  - Chapter 4
  - i: Strategies to connect content provided: Example: The student is expected to: express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically.
  - Chapter 4
  - i: Prior lesson knowledge is emphasized
  - Example: This lesson expands on prior teaching related to solving chemistry problems. Students should be familiar with the dimensional analysis developed in chapter 2.  
  - Chapter 4
  - i: Strategies to connect content provided: Example: The student is expected to: express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically.
  - Chapter 4
  - This is not made clear in the lesson plan. The scaffolding is part of the construction of the unit but is not clear in the presentation to students or teachers.

#### G. Scaffolded differentiation over time: Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.

##### Problem complexity develops as the unit progresses. For example, section 1 focuses on recall and comprehension (lower level Bloom’s Taxonomy). However, by section 3, students are asked to comprehend, and apply their knowledge to new situations. This is a higher level of Bloom’s. Student ability increases from low level Bloom’s to higher level Bloom’s within the Unit with additional opportunities to extend learning.

- Problem complexity develops as the unit progresses. For example, section 1 focuses on recall and comprehension (lower level Bloom’s Taxonomy). However, by section 3, students are asked to comprehend, and apply their knowledge to new situations. This is a higher level of Bloom’s. Student ability increases from low level Bloom’s to higher level Bloom’s within the Unit with additional opportunities to extend learning.

### Rating for Category II: NGSS Instructional Supports—units
After carefully weighing the evidence, reasoning, and suggestions for improvement, rate the degree to which the criteria are met

#### Unit rating scale for Category II (Criteria A-G):

- 3: At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria

### Circle Rating

0 1 2 3
<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
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</thead>
</table>
| across the unit. | 2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A  
1: Adequate evidence for at least three criteria in the category  
0: Adequate evidence for no more than two criteria in the category |
|   |   |
### Category III: Monitoring NGSS Student Progress (lessons and units)

The lesson/unit supports monitoring student progress in all three dimensions of the NGSS as students make sense of phenomena and/or design solutions to problems.

<table>
<thead>
<tr>
<th>Lesson and Unit Criteria</th>
<th>Specific evidence from materials and reviewers’ reasoning</th>
<th>Evidence of Quality?</th>
<th>Suggestions for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Monitoring 3D student performances</strong>: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.</td>
<td>Students use and demonstrate content using core concepts, engineering principles while recognizing patterns and crosscutting concepts in interactive simulations and unit investigations. For example, teachers may observe and solicit input while students are involved in: The students are asked to, “...design an insulator that loses less than 2 °C in 2 minutes or more that can be sold for $5.” During the course of this project they are expected to do a cost analysis using the skills they have acquired from their study of mathematics. They will also build a device that will require them to use construction and artistic skills in coordination with the newly acquired knowledge of heat transfer, and insulators. At the end of the project they are expected to give a report, in which they will use linguistic and technological knowledge. <strong>Project 4.D</strong> Interactive simulations allow students to work within the content, recognizing patterns, and applying engineering principles of collecting and recognizing data. For example: For example: the students will see the effect of Brownian motion on a trace particle. <strong>Section 4.1</strong> Present your findings to your supervisor. You may use a traditional presentation board, PowerPoint presentation and/or another multimedia presentation device such as Animoto, PowToons and/or iMovie. <strong>Project 4.D</strong></td>
<td>☐ None ☐ Inadequate ☒ Adequate ☒ Extensive</td>
<td></td>
</tr>
<tr>
<td><strong>B. Formative</strong>: Embeds formative assessment processes throughout that evaluate student learning to inform instruction.</td>
<td>Interactive equations, interactive simulations, Test Your Knowledge in each lesson, Lesson &quot;quiz&quot; opportunities and Unit Problems for conceptual development <strong>Chapter 4</strong> Student work opportunities provided within each lesson. <strong>Chapter 4</strong></td>
<td>☐ None ☐ Inadequate ☒ Adequate ☒ Extensive</td>
<td></td>
</tr>
</tbody>
</table>
### C. Scoring guidance:
Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

<table>
<thead>
<tr>
<th>Rating for Category III. Monitoring NGSS Student Progress—Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you are evaluating an instructional unit rather than a single lesson, continue on to evaluate criteria E–F and rate Category III overall below.</td>
</tr>
</tbody>
</table>

A rubric is provided for the student and teacher use for all investigations and enhancements

**Project 4.d**
**Enhancement 4.5**

<table>
<thead>
<tr>
<th>None</th>
<th>Inadequate</th>
<th>Adequate</th>
<th>Extensive</th>
</tr>
</thead>
</table>

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<thead>
<tr>
<th>D. Unbiased tasks/items:</th>
<th>Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive equations, interactive simulations, Test Your Knowledge in each lesson, Lesson &quot;quiz&quot; opportunities and Unit Problems for conceptual development <strong>Chapter 4</strong></td>
<td></td>
</tr>
</tbody>
</table>

Assessment evidence provided within the teacher lesson plan document. Assessment evidence provided within the teacher lesson plan document.

**Question 52.** You have a 1000 g sample of water at 45 °C and a 1 g sample of water at 50 °C. Which sample would you estimate to have a higher thermal energy? Defend your choice.

**Answer Provided.** While temperature is an average per molecule, thermal energy is the sum of all the energy in a group of molecules. Therefore, the 1000 g of water would have more thermal energy since the 1000 fold increase in mass is larger than just a 5 degree temperature increase.

**Question 57.** Explain the process of thermal equilibrium in your own words.

**Answers Provided.** A system of higher average kinetic energy transfers some of its energy to one of lower energy. This continues until both systems have the same average kinetic energy. At this point, both are transferring the same amount of energy back and forth so no net energy transfer or temperature change occurs. **Chapter Review 4**

| None | Inadequate | Adequate | Extensive |
|---|---|---|---|---|
### E. Coherent Assessment System

A unit or longer lesson designed for the NGSS will also include clear and compelling evidence of the following:

#### Pre-assessment

Each Lesson has a powerpoint presentation that provides initial pre-assessment. For example in Chapter 4, the following questions are asked at the start of the lesson:  

**Chapter 4 PPT Presentation**  
1. What is the difference between temperature and heat?  
2. Why do some materials take less energy to heat than others?  
3. How is temperature defined?  
4. How hot can liquid water get at sea level?  
5. Why does perspiration help you thermoregulate?  

**Chapter 4 PPT Presentation**

#### Formative Assessment:

Each Lesson has a powerpoint presentation that provides initial pre-assessment. For example in Chapter 4, the following questions are asked at the start of the lesson:  

**Chapter 4 PPT Presentation**

**Assessment evidence provided within the teacher lesson plan document.**  

- **Question 52.** You have a 1000 g sample of water at 45 °C and a 1 g sample of water at 50 °C. Which sample would you estimate to have a higher thermal energy? Defend your choice.  
  - **Answer Provided.** While temperature is an average per molecule, thermal energy is the sum of all the energy in a group of molecules. Therefore, the 1000 g of water would have more thermal energy since the 1000 fold increase in mass is larger than just a 5 degree temperature increase.  

- **Question 57.** Explain the process of thermal equilibrium in your own words.  
  - **Answers Provided.** A system of higher average kinetic energy transfers some of its energy to one of lower energy. This continues until both systems have the same average kinetic energy. At this point, both are transferring the same amount of energy back and forth so no net energy transfer or temperature change occurs.  

<table>
<thead>
<tr>
<th>Evidence of Quality?</th>
<th>Suggestions for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ None</td>
<td>☐ Inadequate</td>
</tr>
<tr>
<td>☐ Inadequate</td>
<td>☒ Adequate</td>
</tr>
<tr>
<td>☒ Adequate</td>
<td>☒ Extensive</td>
</tr>
</tbody>
</table>
Imbedded opportunities within each Chapter. For example, within section 4.3, What amount of heat is required to completely boil 25.0 g of liquid water at 100 °C? Chapter 4

**Summative:**
Assessment opportunities are provided at the end of each section. For example: Section 4.2: When you feel “hot,” is energy moving from your body to your surroundings, or is it moving from your surroundings to your body? Explain your answer.

**Section 4.2**
Test-bank allows for the development of additional questions to assess student learning Chapter 4

**Self Assessment:**
Students may self assess in interactive simulations that allow students to work within the content, recognizing patterns, and applying engineering principles of collecting and recognizing data. For example: In this interactive simulation, you will adjust the initial position $x_i$ and velocity $v$ of a cart so that a position vs. time graph of its motion matches graphical targets. Chapter 4

Review Problems and Questions at the end of every section. For example, The table shows heats of fusion and vaporization for several substances. Find the energy required to melt 75.00 g of silver. Section 4.3

<table>
<thead>
<tr>
<th>F. Opportunity to learn: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students demonstrate performance in interactive simulations that allow students to work within the content, recognizing patterns, and applying engineering principles of collecting and recognizing data. Chapter 4</td>
</tr>
<tr>
<td>Students demonstrate performance in Interactive equations, interactive simulations, Test Your Knowledge in each lesson, Lesson &quot;quiz&quot; opportunities and Unit Problems for conceptual development Chapter 4</td>
</tr>
<tr>
<td>Students demonstrate performance in Student work opportunities provided within each lesson. Chapter 4</td>
</tr>
<tr>
<td>Students demonstrate performance in lesson investigations Chapter 4</td>
</tr>
</tbody>
</table>

**Rating for Category III: Monitoring NGSS Student Progress—units**
After carefully weighing the evidence, reasoning, and suggestions for improvement, rate the degree to which the criteria are met across the

<table>
<thead>
<tr>
<th>Unit Rating scale for Category III (Criteria A–F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>3: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion</td>
</tr>
<tr>
<td>2: Some evidence for all criteria in the category and adequate evidence for at least</td>
</tr>
</tbody>
</table>

**Circle Rating**

0 1 2 3
<table>
<thead>
<tr>
<th>unit.</th>
<th>five criteria, including A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:</td>
<td>Adequate evidence for at least three criteria in the category</td>
</tr>
<tr>
<td>0:</td>
<td>Adequate evidence for no more than two criteria in the category</td>
</tr>
</tbody>
</table>
## Category Ratings:
Transfer your team’s ratings from each category to the following chart and add the scores together for the overall score:

<table>
<thead>
<tr>
<th>Category I: NGSS 3D Design</th>
<th>Category II: NGSS Instructional Supports</th>
<th>Category III: Monitoring NGSS Student Progress</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### Overall ratings:
The score total is an approximate guide for the rating. Reviewers should use the evidence of quality across categories to guide the final rating. In other words, the rating could differ from the total score recommendations if the reviewer has evidence to support this variation.

- **E: Example of high quality NGSS design**—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)

- **E/I: Example of high quality NGSS design if Improved**—Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)

- **R: Revision needed**—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)

- **N: Not ready to review**—Not designed for the NGSS; does not meet criteria (total 0–2)

### Circle the overall rating below:

| E | E/I | R | N |

## Overall Summary Comments: