Bridgeport Public Schools
Science Department

Embedded Performance Task

Solar Cooker

Laboratory Investigation
Teacher Materials

Renewable Energy

Teacher Materials

This curriculum-embedded science performance task is related to the content standards and expected performances for Grades 9-10, as described in the Core Science Curriculum Framework, under Scientific Inquiry, Literacy and Numeracy, Strand I – Energy Transformations.

Targeted Content Standard

9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.

Targeted Scientific Inquiry, Literacy and Numeracy Standards

D INQ. 1 Identify questions that can be answered through scientific investigation.

D INQ. 3 Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

D INQ. 4 Design and conduct appropriate types of scientific investigations to answer different questions.

D INQ. 5 Identify independent and dependent variables, including those that are kept constant and those used as controls.

D INQ. 6 Use appropriate tools and techniques to make observations and gather data.

D INQ. 7 Assess the reliability of the data that was generated in the investigation.

D INQ. 9 Articulate conclusions and explanations based on research data, and assess results based on the design of an investigation.

Learning objective:

Students will be able to use solar energy to heat water and understand the design factors that influence the effectiveness of capturing solar energy in this context.

Listed below are the suggested materials for the laboratory exercise. You may use additional materials if they are available.

Materials:

- heat lamps or sunlight
- cardboard
- aluminum foil
- containers for water
- safety goggles
- tape
- thermometer
- water
- colored paper or paint

Considerations:

Teams of two students are ideal for laboratory work, but circumstances may necessitate teams of three students. Students will need a minimum of 90 minutes to complete this laboratory exercise if you expect their lab reports to be written during class time. You should allow at least 60 minutes of instructional time for the students to design and conduct their experiment and a minimum of 30 minutes for the students to write about their results. As an alternative, the students can write their lab report for homework. These time frames are merely suggestions. Additional time is appropriate if the circumstances and schedule at your school call for it. A sample scoring rubric is provided for your convenience or you may design one of your own.

If the weather is unfavorable and the laboratory exercise must take place indoors, heat lamps can be used as an alternative to sunlight. If your students are unfamiliar with solar cookers, various designs and photographs of solar cookers may be found at these and many other sites:

http://solarcooking.org
http://pbskids.org/zoom/activities/sci/solarcookers.html

The curriculum-embedded task can be integrated into a unit on energy sources and used in any high school physical or Earth science course. The curriculum-embedded task is intended to be used as a formative assessment during the appropriate instructional unit. The Connecticut Academic Performance Test – Generation III will include some open-ended items that will assess scientific inquiry and communication skills in the same context as this task.

Curriculum-Embedded Laboratory Investigation
Scoring Rubric

Statement of Problem and Hypothesis

3 The problem and hypothesis are stated clearly and completely. Clear identification of independent and dependent variables.

2 The problem and hypothesis are stated adequately. Adequate identification of independent and dependent variables.

1 The problem and/or hypothesis are poorly stated. Poor identification of independent and dependent variable.

0 The statement of the problem and/or hypothesis is very limited or missing altogether. No identification of independent and dependent variables.

Experimental Design

3 The experimental design matches the stated problem. Variables are held constant. The procedures are clear, complete and replicable. A control is included when appropriate.

2 The experimental design generally matches the stated problem. Attempt at holding variables constant is made. Procedures are generally complete. Minor modifications or clarifications may be needed.

1 The experimental design matches the stated problem to some extent. Little attempt to hold variables constant. Procedures are incomplete. Major modifications or clarifications may be needed.

0 The experimental design does not match the stated problem, is very incomplete or missing. There is no attempt to hold variables constant.

Data Presentation

3 Data are well organized and presented in an appropriate manner.

2 Data are organized and presented in an appropriate manner. Minor errors or omissions may be present.

1 Data are poorly organized or presented in an inappropriate manner. Major omissions or errors may be present.

0 Data are very poorly organized or presented in an inappropriate manner or missing altogether.

Conclusions

3 Conclusions are fully supported by data and address the hypothesis. Reliability of data and validity of conclusions are thoroughly discussed.

2 Conclusions are generally supported by data and address the hypothesis. Minor errors in interpretation of results may be present. Discussion of reliability of data and validity of conclusions is limited.

1 Conclusions are supported by data and address the hypothesis to a limited extent. Major errors in interpretation of results may be present. There is little discussion of the reliability of the data or validity of conclusions.

0 Conclusions are not supported by data, do not address the hypothesis or are missing. There is no discussion of the reliability of data or validity of conclusions.

Excellent performance	10-12 points
Proficient performance	7-9 points
Marginal performance	4-6 points
Unsatisfactory performance	0-3 points