

Cellular Energy Performance Task

10th grade Biology

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Performance Tasks

Create Product



Demonstrate
Skill

Positive Attributes of Performance Task Assessment:

- Higher order thinking and deeper understanding.
- Students are active and engaged in the learning process.
- Less stress than traditional tests.

Brookhart, 2014

Performance Task Standard


Next Generation Science Standard

HS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics.

“Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere (NGSS, n.d.)”

Effective teaching and learning happens when standards are deconstructed into understandable learning targets.

Learning Targets:

- Need to be easily understood by the student. 
- Should be high quality learning targets.
- Both student and teacher will have a clear understanding of expected outcomes.

Task Purpose

The purpose of this performance task is for 10th grade biology students to demonstrate their understanding of how plants and animals cycle carbon among the biosphere and relate this understanding to photosynthesis and cellular respiration processes.



Learning Targets

Knowledge/Understanding:

- Students can define photosynthesis, cellular respiration, autotrophs, heterotrophs.
- Students explain how the carbon in carbon dioxide is used in the carbon cycle.
- Students can describe how plants and animals use the processes of photosynthesis and cellular respiration to produce energy

Reasoning:

- Students can explain how the reactants and products of photosynthesis are interconnected.
- Students can interpret the carbon cycle to explain how human activities contribute to atmospheric carbon dioxide.



Learning Targets

Performance Skill

- Conduct an experiment to collect data to provide evidence that the reactants and products of photosynthesis are related.

Product Targets:

- Create a diagram or model to trace the path of carbon dioxide in the atmosphere.
- Create a 3-fold poster to illustrate experimental results and communicate findings through presentation



Cell Energy- Student Guide

Student's Goal	<ul style="list-style-type: none">➤ I can define photosynthesis and cell respiration.➤ I can identify how carbon dioxide travels to producers and consumers.	Progress evaluation
Student's Role	<ul style="list-style-type: none">➤ I can work with my partner to collect data.➤ I can work with my lab partner to complete the lab poster presentation	Progress evaluation
Student's Audience	<ul style="list-style-type: none">➤ I can work collaboratively to present our final results to classmates and teacher.	Progress evaluation




Cell Energy- Student Guide


Student's Procedure	<ul style="list-style-type: none">➤ Plan and conduct the lab experiment comparing photosynthesis and cellular respiration.➤ Conduct research needed.	Progress evaluation
Student's Product	<ul style="list-style-type: none">➤ Create a lab poster report from data collected.➤ Create a model or diagram of the carbon cycle.	Progress evaluation



Cell Energy Rubric

Score	Criteria	5 Points Advanced	3 Points Proficient	1 Points Needs Improvement
	Research and Task Completion:	Extensive and Complete research on photosynthesis and cell respiration used in experiment. 	Research on processes is complete.	Did not complete the research
	Understanding Scientific Content:	Includes Exemplary use of research information to describe experiment and provide background.	Includes Exemplary use of research information to describe experiment and provide background.	Research is incomplete or missing. Background is incomplete and does not provide enough information to
	Critical Thinking and Scientific processing Skills: Experimental procedure	Procedure is clear, detailed, and complete. Procedure is clearly repeatable and identifies control and controlled variables.	Procedure, generally complete. Minor errors/omissions Control and variables not identified	Procedure difficult to follow. Major omissions or errors.

Cell Energy Rubric- continued

Score	Criteria	5 pts Advanced	3 Pts. Proficient	1 Pt. Need Improvement
	<p>Analysis and problem solving skills:</p> <p>Conclusion</p> <p>Discussion and Error Analysis</p>	<p>Conclusion relates to stated problem. Clearly supported by at least three pieces of evidence.</p> 	<p>Conclusion attempts to address stated problem. Supported by at least one piece of evidence.</p>	<p>Conclusion incomplete and does not address the problem.</p>
	<p>Effective Communication:</p> <p>Lab. Poster Presentation.</p>	<p>Highly prepared and show understanding of material. Clearly presented and engaging. Presentation includes more than two appropriate graphics</p>	<p>Well prepared and shows some understanding of material. Minor omissions. At least one appropriate graphic used</p>	<p>Well prepared and shows some understanding of material. Minor omissions. At least one appropriate graphic used</p>

Assessment Critique

Key 1: Assessment serves a clear and appropriate purpose. Rating 5

In key 1 of the quality assessment critique, the focus is on ensuring that the purpose of the assessment is clear to the teacher and the students. Teachers need to evaluate whether the assessment is supported by instruction and fits the needs of the student (Chappuis et al, 2012). The purpose of this assessment is for 10th grade biology students to understand the processes of photosynthesis and cellular respiration. This concept is critical to understanding cellular energy and is an overarching concept in Biology. Students can relate this information to their everyday life as it relates to everyday metabolic processes in living things. Students can relate this information to how human bodies use energy, nutrients, vitamins and minerals to function.

Key 2: Assessment reflects valued achievement targets. Rating 5

Key 2 of the quality assessment critique relates to the deconstructing of the standards. The learning targets need to be clear to teachers as well as to the students. The learning targets need to be the focus of the assessment and need to align with the learning outcomes and what students need to achieve (Chappuis et al, 2012).

The learning targets of this assessment are the focus of instruction. For example, students will need to identify and explain how the carbon in carbon dioxide is used by plants to convert light energy into chemical energy in the process of photosynthesis. The instruction that will focus on this target will be student research, direct instruction, group discussions, culminating in the development of a model or diagram of the carbon cycle.



Assessment Critique

Key 3: Design. Rating 5

The 3rd key to quality assessment critique is concerned with evaluating whether the assessment method is appropriate for the target and ensuring that there is no misleading results (Chappuis et. al., 2012).

The selection of methods for this performance task make sense given the goals and purposes. In order for students to understand and explain the abstract processes related to cellular energy, engaging students in active lessons such as performing an experiment to collect data as evidence of these processes is appropriate for the instructional targets. Any misleading results related to the methods could be addressed using the student friendly template to review progress and clarify misconceptions.

Key 4: Communication. Personal Rating = 5

- In this key to quality assessment, focus is placed on evaluating effective communication regarding student achievement. How can communication be given to provide students with effective feedback (Chappuis, 2012)?
- A student friendly rubric is provided to students before the assessment. Providing students with a rubric that understandable can help students identify what they could improve on. Teachers can use the rubric to communicate effective feedback to improve student learning.



Assessment Critique

Key 5: Student Involvement. Rating = 5

In Key 5 of the quality assessment critique, the focus is on checking the assessment for student involvement. Students should be involved in the learning process and have the opportunity to track their own learning and evaluate their progress and success (Chappuis et. al., 2012).

In this performance assessment, students have the opportunity to work in small groups and evaluate progress along the way. Students can learn from one another while working in groups. Students are active in the learning process while performing experiments, collecting data, and researching information. They can check on their learning while engaged in the learning process. In addition, students will have the opportunity to complete the student friendly template to evaluate progress before the assessment is complete. The performance assessment rubric will also provide students with the opportunity to check their own learning.



Reflection on Learning

- Learning targets drive effective teaching and provide students with a clear understanding of the learning outcomes (Moss & Brookhart, 2012).
- Teachers need to modify the standard into clear language that could translate into a unit plan as well as daily instructional objectives (Badgett & Christmann, 2009).
- Rubrics provide students with a learner-centered environment. Rubrics could be used as teaching tool and not just a grading tool.



References:

- Badgett, J. L., & Christmann, E. P. (2009). *Designing middle and high school instruction and assessment: Using the cognitive domain*. Thousand Oaks, CA: Corwin Press.
- Brookhart, S. M. (2014). *How to design questions and tasks to assess student thinking*. Alexandria, VA: ASCD.
- Chappuis, S., Chappuis, J., & Stiggins, R. (2009). The quest for quality. *Educational Leadership* 67(3), 14-19.
- Chappuis, S., Stiggins, R., Arter, J., & Chappuis, J. (2012). *Classroom Assessment for Student learning: Doing it Right-Using It Well*. (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- Moss, C. M., & Brookhart, S. M. (2012). *Learning Targets: Helping students aim for understanding in today's lesson*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Next Generation Science Standards, (n.p.) Retrieved from <http://www.nextgenscience.org/>