Energy Alive!

Activity

Part I: The Challenge

Design and construct a scaled prototype of an algae growth chamber that accelerates the production of green algae.

Part II: Criteria and Constraints

- The prototype must be constructed from the given materials. Other materials may be approved by the teacher as needed.

Possible Materials for Building Prototypes:
Plastic bottles (1 liter)
Plastic containers with lids (24 oz.)
Freezer baggies
Foil pie pans
Straws
Balloons
Craft sticks
Aquarium gravel
Chenille sticks
Plant food, such as Miracle-Grow
Active dry yeast
Antacid, such as Alka-Seltzer
Plastic, flexible tubing
Tape
Algae (5g per group)*

* Live algae can be collected from area ponds or purchased from science supply outlets such as Carolina Biological or Fisher Scientific.

- The prototype must allow the algae to be observed during the testing period.
- The prototype must mimic the conditions needed for maximum algae growth.

Part III: Procedures

- In groups, you will research and explore the problem. You may use the Student Reference Sheet as a starting place.

- Review the design challenge and criteria.

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Activity, continued

Part III: Procedure, continued

- Explore the materials you may use in constructing and maintaining your prototype. If you need additional materials, discuss what you need and why. Get approval to obtain the appropriate materials.
- Now brainstorm and design your prototype.
- Build, test, and analyze the solution.
- Monitor the algae growth in their prototypes for 1–2 weeks.
- Improve or redesign and retest the solution.
- Each group will present its algae growing prototype and discuss how well the prototype meets the challenge and the criteria. Before you present your prototypes be able to answer the following questions:

    1. What is needed in order for photosynthesis to occur?
    2. What is needed in order for cellular respiration to occur?
    3. What are the main reactants and products in photosynthesis?
    4. What are the main reactants and products in cellular respiration?
    5. What is the relationship between the reactants and products of photosynthesis and cellular respiration?
    6. What are the benefits of using biomass from algae to produce fuel?
    7. What conditions are needed for effective algae growth?

- Allow other students to ask relevant questions and make positive critiques.

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Activity, continued

Rubric for an Engineering Design Challenge

Points Awarded	Expert (4)	Competent (3)	Beginner (2)	Novice (1)
Identification of Problem and Constraints	Clearly defines the problem in a real-world context and identifies the constraints for a viable solution.	Defines the problem and the constraints within the context presented.	Identifies the problem and does not address the constraints.	Problem is not clearly identified, and/or few constraints are addressed.
Solution, Prototype, or Plan	The solution to the problem is well outlined and clearly addresses each of the constraints listed. The solution is viable within a real-world context. Alternative solutions are also offered.	The solution to the problem is outlined with some areas not clearly addressed. Some constraints are not addressed. The solution is limited to the context of the problem.	The solution to the problem is outlined with some key pieces missing. Some constraints are not addressed.	The solution is not probable and/or many of the constraints are not addressed.

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Activity, continued

Rubric for an Engineering Design Challenge, continued

Points Awarded	Expert (4)	Competent (3)	Beginner (2)	Novice (1)
21st Century Skill: Collaboration	Steps in to help the team when another member is absent. Encourages others to share ideas, helps to make them clear, and connects them to the team's work. Notices if a team member does not understand something and takes action to help.	Helps the team solve problems, manage conflicts, and stay focused and organized. Shares ideas that help the team improve its work. Gives useful feedback (specific and supportive) to others so they can improve their work. Offers to help others do their work if they need it.	Cooperates with the team but does not actively help. Makes some effort to share ideas with the team. Sometimes gives useful feedback to others. Sometimes offers to help others.	Does not help the team solve problems; may cause problems. Does not share ideas with other team members. Does not give useful feedback to others. Does not offer to help others.
Scientific Content and Scientific and Engineering Design Practices	The solution uses accurate scientific reasoning. The information given is research based and cites resources. The proposed solution uses the EDP or is based on a fair test.	The solution uses scientific reasoning. Some of the information given is research based, and some resources are cited. The proposed solution is based on a fair test or the EDP.	The solution is based on scientific knowledge. Some resources are cited.	The solution is not based on scientific principles, and/ or no resources are used.

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