

Title of Lesson: Algal Shapes and Sinking

Target Grades: High School Physical Science or Physical World Concepts, 8th Grade Science

Time Required: 1 45-minute periods

Alignment to Standards:

8.PS2.3. Create a demonstration of an object in motion and describe the position, force, and direction of the object.

8.PS2.4. Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

PSCI.PS2.1. Use mathematical representation to show how various factors affect one-dimensional kinematics parameters. Determine graphically the relationship among those one-dimensional kinematics parameters.

PWC.PS2.1. Investigate, measure, calculate, and analyze the relationship among position, displacement, velocity, acceleration, and time.

Materials Needed:

Play dough measured out in 5 gram pieces

Large graduate cylinder, or other tall container (a pitcher or vase)

Corn Syrup

Stopwatch

Meter Stick

Background Information:

Algae can be used in the production of bioenergy. Because algae are photosynthetic, they depend on the sun to produce food. In order to produce food, algae must remain in the photic zone where sunlight is able to penetrate the water. Because algae are very limited in motility, they depend on their shape to produce enough drag in the water to slow down their sinking. This activity will investigate how different shapes affect the sinking rate in water. Students will have the opportunity to design their own algae shape and test the sinking rate.

Lesson Objectives:

Students will be able to calculate velocity from experimental data.

Students will be able to explain the relationship among position, speed, and acceleration.

Students will be able to explain the forces that act on an object as it sinks in water.

Instructional Process:

Introduce Problem to Students

Algae are small single-celled photosynthetic organisms that live in water. If you go out and take a sample of pond water and look at it under a microscope, as you may have done in Biology class, you can see all kinds of algae in just one drop of water. Scientists are looking at different ways that we can use these algae to produce biofuels as an alternative to petroleum based fuels. Algae are very interesting organisms because they are microscopic plants that live in water. Like the plants that grown on land, they are not able to move on their own – but because they are photosynthetic, they must stay relatively near the surface of the water where they can get sunlight. How do they stay at the top of the pond or lake without just sinking to the bottom where they were essentially starve to death? Today you will get to try to design algae that will sink at a slow rate when submerged in water.

Student Activity:

1. Working in groups of 3-4 students, each student will use 5 grams of play dough to construct an algae cell. Your shape can not rely on trapping air and must be fully submerged in water for the trial.
2. Each group will also have a “control” algae made from play dough that is rolled into a ball.
3. Set up your tank with the meter stick aligned with the side to provide measurements. Fill the tank with corn syrup. Designate one group member to be the timer and operate the stopwatch.
4. For each algae shape (the control and each student’s design) hold the algae just under the surface of the corn syrup. Record the corresponding measurement on the meter stick as the “start” point. When the student releases the algae, start the stopwatch and record the total time it takes to sink. Record the measurement on the meter stick that corresponds with the bottom of the tank as the “end” point.
5. Repeat your trial 3 times for each algae and average your time for the trials.

Name: _____ Date: _____ Period: _____

Algae Sinking

Materials

- Play dough measured out in 5 gram pieces
- Large graduated cylinder filled with corn syrup
- Stopwatch
- Meter Stick

Procedure

1. Working in groups of 3-4 students, each student will use 5 grams of play dough to construct an algae cell. Your shape can not rely on trapping air and must be fully submerged for the trial.
2. Each group will also have a "control" algae made from play dough that is rolled into a ball.
3. Set up your graduated cylinder with the meter stick aligned with the side to provide measurements. Designate one group member to be the timer and operate the stopwatch.
4. For each algae shape (the control and each student's design) hold the algae just under the surface of the water. Record the corresponding measurement on the meter stick as the "start" point. When the student releases the algae, start the stopwatch and record the total time it takes to sink. Record the measurement on the meter stick that corresponds with the bottom of the cylinder as the "end" point.
5. Repeat your trial 3 times for each algae and average your time for the trials.

Data Table

Algae	Start Point	End Point	Trial 1	Trial 2	Trial 3	Average
CONTROL						
DESIGN 1						
DESIGN 2						
DESIGN 3						
DESIGN 4						

Questions

1. What were some of the unique design aspects of your algae? Why did you choose this?
2. Which algae sank slowest? Why do you think this happened?
3. Why was it important to do more than one trial for each algae shape?
4. Sketch a position-time graph and a velocity-time graph for your algae.