KIDS ENVIRONMENTAL LESSON PLANS

This lesson plan developed by:

SEA Semester®

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Sinking Races

Overview:
Plankton have adaptations that help them float in the water column. Students will create plankton with craft materials and race them in a large container of water. Slowest plankton wins!

Ocean Literacy Principles:

4. The ocean made the Earth habitable
5. The ocean supports a great diversity of life and ecosystems
7. The ocean is largely unexplored

Key Concepts:

- Plankton are a diverse group of organisms that live in the water column and cannot swim against the current
- Plankton are at the bottom of the food web and are a critical source of food for a variety of marine creatures, such as fish and whales
- Plankton have adaptations to float in the water column to either be close to sunlight or their food source

Materials:

- Pictures of phytoplankton and zooplankton
- Standard size marbles
- Assortment of materials for constructing plankton models (straws, buttons, toothpicks, clay, tape, yarn, ribbon, pipe cleaners, etc.)
- Dish pans or similar tubs for testing models
- 5 or 10 gallon aquarium for sinking races
- Stopwatches or digital watches which read in seconds

- Small, inexpensive prizes (optional)

Duration:
1 to 2 hours

Physical Activity:
Moderate

Background:
Ocean's plankton, tiny animals and plants, are the basis of marine food chains. The word "plankton" comes from the Greek word planktos meaning "drifting". Plankton cannot swim against a current. Planktonic plants are called phytoplankton. These plants, like plants on land, have the ability to photosynthesize. Using chlorophyll, they capture the energy of the sun to make food, releasing oxygen in the process. Virtually all aquatic life depends upon these microscopic single-celled organisms for food. Phytoplankton are the main source of food for zooplankton. Phytoplankton also contributes a significant portion of the oxygen we breathe.

Planktonic animals are referred to as zooplankton ("oo" is pronounced as in toe). Many zooplankton are able to move up and down in a water column, pursuing food and escaping predators. However, their small size prevents them from moving against the currents.

Phytoplankton must remain in the photic (light) zone in order to receive enough sunlight energy to carry on photosynthesis. However, if they are too close to the surface, photosynthesis is less efficient. Phytoplankton are found in a fantastic array of shapes, incorporating adaptations which help keep them from sinking. For example, phytoplankton usually have a large surface area relative to body size. They can be round and flat, have long spines or bristles, or join single-celled units in long chains. Many zooplankton need to stay in the same zone because the phytoplankton are their food source. Zooplankton are often wide and flat, and many have long spines and bristles, but they have an advantage over phytoplankton - they can swim. Tiny movements of their appendages can propel them and keep them in the food-filled zone of the ocean. Some zooplankton rely on accumulating tiny amounts of oils, which help floatation.

Activity:
1. Start with observations of zooplankton and phytoplankton. Use pictures, photos, and samples to allow students to observe their shapes, projections, and behaviors.
2. Next ask students what phytoplankton and zooplankton need to survive (light for phytoplankton; water, food, space, protection).
3. Most plankton are heavier than water and tend to sink. Ask the students how they might stay up in the water.
4. Make a list of the students' observations. Encourage connections to what they know about density.
5. Some of the students should notice that many plankton have long projections or antennae or hairs. Have them speculate on how these would affect movement through water. Could the students run through water faster with their own arms spread out or

folded up?

6. After observing and discussing shapes, tell students they will make a model phytoplankton or zooplankton organism, which will sink slowly. Since “thrashing” or swimming is not possible in a non-mechanical model, they must concentrate on designing a plant or animal that is just barely heavier that water and that slows its rate of sinking by increasing its resistance to movement through water.
7. Have a variety of materials and clear containers of water available around the room for design and testing.
8. The creatures must meet the following criteria:
    - They must be denser than water (not float at the surface) - density can be measured as mass per unit volume, and must be higher than 1 gm/cm^3, the density of water.
    - They must be no larger than 15cm x 5cm or they will be seen and eaten!
    - Each phytoplankton must contain one standard sized marble, green if possible (representing body structures and chlorophyll).
    - Each zooplankton must contain 2 standard sized marbles (representing body structures).
    - NOTE: phytoplankton will be raced against other phytoplankton; zooplankton will be raced against other zooplankton. If students wish to race the finalists in each category, they may.
9. Have students use stopwatches to time the speed of sinking. Set a time limit for experimentation and announce a contest for the slowest sinking animal or plant at the end of that time.
10. For the contest, have the class gather around a large glass aquarium where everyone can see. You can time each trial separately, but it will be more exciting if pairs of phytoplankton or zooplankton are released to “reverse race” their way down.
11. Put both on a sheet of cardboard so they can be tipped in at the same time for a fair start. The SLOWEST from each pair goes into a second heat and so on until the last tow models winners. Then have them vote on which they think will win the grand prize for slowest overall based on their analysis. Do the final test and distribute prizes.

Discussion:

- Which adaptations work the best?
- Which adaptations were not as successful?
- Did any adaptations mimic real phytoplankton or zooplankton?

Acknowledgements:
Below pictures courtesy of Smithsonian Environmental Research Center

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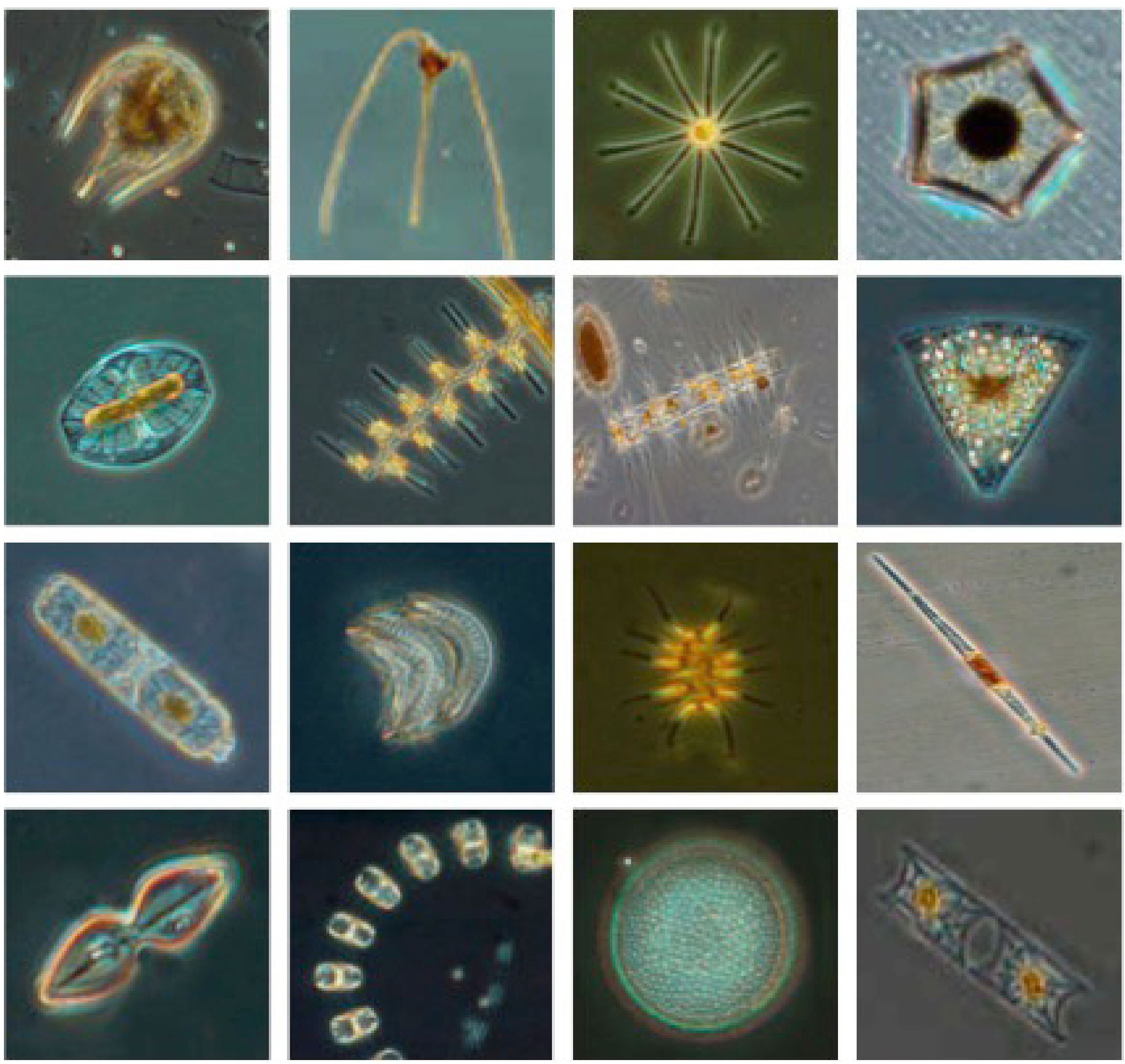
Examples of Phytoplankton



Examples of Zooplankton