Humanities and the Sunshine State
What Sustains Us?
Florida Ecosystems in an Era of Rapid Change
University of Florida 20-24 June, 2016

# ACTION PLAN TEMPLATE

Teacher(s): Muriel Martin-Dupre

Grade(s): 11-12

Subject(s): AP Environmental Science

Title of Lesson:

Is There a Measurable Difference in Dissolved Oxygen Level Between Day and Night?

Learning Objectives:

1. Students will review and use scientific method.
2. Students will be able to set up an experiment to test the difference in dissolved oxygen (DO) levels between day and night in algae containing fresh water.
3. Students will be able to collect, analyze, and graph data
4. Students will be able to use Vernier probe ware

Standards Addressed:

MAFS.912.N-Q.1.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MAFS.912.N-Q.1.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MAFS.K12.MP.5.1 Use appropriate tools strategically.

MAFS.K12.MP.6.1 Attend to precision.

MAFS.K12.MP.2.1 Reason abstractly and quantitatively.

SC.912.L.17.13 Discuss the need for adequate monitoring of environmental parameters when making policy decisions

SC.912.L.17.2 Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.

SC.912.L.17.20 Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

SC.912.L.17.4 Describe changes in ecosystems resulting from seasonal variations, climate change and succession.

SC.912.L.17.8 Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.

SC.912.L.18.7 Identify the reactants, products, and basic functions of photosynthesis.

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SC.912.L.18.8 Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.

SC.912.L.18.9 Explain the interrelated nature of photosynthesis and cellular respiration.
SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Pose questions about the natural world, (Articulate the purpose of the investigation and identify the relevant scientific concepts). Conduct systematic observations, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations conduct and record measurements at appropriate levels of precision. Follow safety guidelines). Examine books and other sources of information to see what is already known, Review what is known in light of empirical evidence, (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models). Plan investigations, (Design and evaluate a scientific investigation). Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage). Pose answers, explanations, or descriptions of events, Generate explanations that explicate or describe natural phenomena (inferences), Use appropriate evidence and reasoning to justify these explanations to others, Communicate results of scientific investigations, and Evaluate the merits of the explanations produced by others.

SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented

Lesson Outline:

1. Teacher collects water sample from a canal, lake, creek or any other fresh water source that contains algal growth.
2. Students will postulate a hypothesis based on their knowledge of photosynthesis, cellular respiration, eutrophication.
3. In the morning students will obtain 4 (500 ml) beakers and in 3 of them place 250 ml of the canal water, and the fourth one place 250 ml of tap water.
4. Students will measure the dissolved oxygen (DO) level in the four beakers using the Vernier DO probe and record the results in their Data Table. This will be their baseline.
5. Students will place their four beakers under the grow lights or on a window sill.
6. In the afternoon, at the end of the day the student s will again measure the DO and record it.
7. Students will then turn off the grow lights and cover the beakers with a cardboard box.
8. In the morning, the students will take the reading of DO again, turn the grow lights on and leave them until the end of the day when they will take the reading of DO again.
9. Continue this process for a period of a week, recording the data on the Data Table.
10. Students will create a graph, graph the data, and analyze the data.
11. Students will draw conclusions based on the results of the experiment. Was the hypothesis supported or not by the results, why or why not?
12. Students will complete a lab report and answer the Analysis questions.

Systems thinking connection (learning habits and/or tools used):

Is there a correlation between dissolved oxygen and viability of organisms in this environment, what factors are affecting or causing this change in dissolved oxygen (DO). Could there be other factors such as pollutants, bacteria, temperature, organisms, etc., affecting these results? What relationships exist between the various factors and the levels of dissolved oxygen in water?

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Learning Strategies:

Pre-lab lectures
classroom discussion on dissolved oxygen (DO), biological oxygen demand (BOD)
review of use of lab equipment
lab safety
probe ware use
Individual group discussion as to possible hypothesis.

Science Concept(s):
Scientific method, eutrophication, Dissolved Oxygen, Biological Oxygen Demand, bacterial action, limiting factors, Photosynthesis, cellular respiration, nitrogen cycle, oxygen cycle.

Humanities Concept(s):

Is man adding chemicals to the environment that may be directly or indirectly affecting the DO levels in streams?
Is man's unsustainable harvesting of aquatic resources, both biotic and abiotic, affecting the quality of the water resources?
Is food security being compromised by these actions?

Student Assessment Strategies:

Pre-lab quiz, writing of a proper hypothesis, carrying out an experiment, responding to oral and written questions., post-lab quiz.
Students will be able to complete a concept map or systems diagram.

Benefit to my students:

Students will practice scientific method, will better understand the effect of photosynthesis on levels of DO in bodies of water, will be able to make connections to water pollution, eutrophication and its effects on living organisms. They will understand the interconnectedness of the organisms and their environment, as well as the role that man plays and his effect on the environment, and the possible consequences of his actions.

Resources and Materials (supplies needed for activities):

500 ml beakers
Light source
Water from a fresh water source that contains algal growth
DO Probe
Cardboard boxes or covers to simulate darkness
Paper and pen to record data, draw graphs, and complete lab report

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