1. **Lesson Plan Title:**
   Biotic and Abiotic Factors In A Freshwater Ecosystem

2. **Subject Area:**
   Living Environment

3. **Topic(s):**
   abiotic, biotic, ecosystem, photosynthesis, heterotrophs, decomposers

4. **Suggested Grade Level:**
   11th

5. **Standards Used and Source:**
   Source:: NYS Living Environment Core Curriculum
   Standard(s) Used:: 6.1a, 6.1b, 6.1c, 6.1d, 6.1e, 6.1f, 6.1g

6. **Size of class:**
   24-28

7. **Please List Supplies Used and the number of each (1 per line):**
   1. “half pint” bottles of Poland Spring Water or Deer Park’s “Chugs” (depending on your class size, one “pint” per group of four students
   2. small freshwater snails Carolina Biological Supplies
   3. sprigs of Elodea which may be ordered from Carolina Biological Supplies.
   4. permanent markers
   5. 200ml beakers to gather materials
   6. tweezers

8. **Do any of these supplies need to be ordered in advance?**
   Yes

9. **Which ones? (1 per line)**
   1. “half pint” bottles of Poland Spring Water or Deer Park’s “Chugs” (depending on your class size, one “pint” per group of four students
   2. small freshwater snails from Carolina Biological Supplies
   3. sprigs of Elodea which may be ordered from Carolina Biological Supplies.
   4. permanent markers
   5. 200ml beakers to gather materials
   6. tweezers
10. Post the lesson text or link here, or upload the lesson or extra materials in the next section:


Instructional Objectives:

a. Students will define ecosystems and describe the components of an ecosystem.

b. Students will identify and describe biotic and abiotic factors of a freshwater ecosystem.

c. Students will describe the types of relationships that exist in an ecosystem between biotic and abiotic factors.

[9-12 Content Standard C- Interdependence of organisms]

d. Students will collect specified data from their ecosystems and show how specific factors affected the data.

e. Students will show a degree of knowledge on utilizing computer programming to interpret their gathered data.

Teacher's Instructions :

a. Students are to be assigned the necessary vocabulary words:

1. ecology
2. ecosystem
3. biotic
4. abiotic
5. photosynthesis
6. decomposers
7. heterotrophic
8. autotrophic

and reading from their textbooks.

b. Materials to be purchased/ordered prior to lesson(s)

1. “half pint” bottles of Poland Spring Water or Deer Park’s “Chugs” (depending on your class size, one “pint” per group of 4 students.

2. small freshwater snails from Carolina Biological Supplies

3. sprigs of Elodea which may be ordered from Carolina Biological Supplies.

4. permanent markers

5. 200ml beakers to gather materials

6. tweezers [Teaching Standard D- Make accessible science materials]

b. Instructions on how to construct a freshwater ecosystem are to be placed on an overhead transparency for students to copy and discuss.
Students' Instructions:

1. Students will gather into groups of 4.
2. Within each group, students will be assigned specific roles:
   a. group recorder
   b. ecosystem engineer
   c. materials gatherers (2)
   d. all are assigned the title “observer” [Teaching Standard E- Nurture collaboration among students]
3. The following activities must take place:
   a. The materials gatherers will acquire the necessary materials from the teacher’s desk: a sprig of Elodea, 2-3 small snails, a bottle of spring water, marker, and beaker.
   b. The recorder will write down the types and quantity of materials gathered. The recorder will also label the group’s bottle of spring water.
   c. The ecosystem engineer will uncap and pour out about 20 ml of the spring water from the bottle into the beaker. The ecosystem engineer will place the snails and Elodea into the bottle of spring water. The cap will be replaced on the newly constructed ecosystem.
   d. The observers will use the following questions to observe and analyze their ecosystems for the next few days.

Questions/Observations:

Day 1: [Teaching Standard B- Orchestrate scientific discourse]
1. If bios means life, define biotic.
2. Which components of your ecosystem are biotic?
3. How can you prove that your chosen components are biotic?
4. If the letter a in the front of the word makes the word opposite of what it means, define abiotic.
5. Which components of your ecosystem are abiotic?
6. Why did the ecosystem engineer pour out some of the water from your bottle? What did it create in your bottle?
7. Why do you need to keep your bottle by the window?
8. How do the biotic and abiotic factors relate to one another in your ecosystem?

Day 2: [9-12 Content Standard A- Questions/concepts that guide inquiry]
1. Why was Elodea placed in the ecosystem?
2. Why were snails placed in the ecosystem?
3. Based on the types of nutrition you have learned classify your biotic factors.

4. How does Elodea rely on abiotic factors such as oxygen, carbon dioxide, water, pH, temperature and light?

5. Why is the snail important for the Elodea’s survival?

6. How does the snail rely on the Elodea?

7. How does the snail provide fertilizer for the Elodea?

Day 3:

Different environmental conditions will be created to see the affects on the specific ecosystems.

[Content Standard Unifying Concepts- Change, constancy, and measurement]

Condition #1: Addition of salt. This is to recreate how salt used for de-icing affects nearby organisms and in upstate New York, our reservoirs.

Condition #2: Addition of motor oil. This is to recreate how oil spills/ illegal dumping in our sewer systems affect aquatic organisms.

Condition #3: Removal of light by adding sediments to the ecosystem. This is to recreate how soil erosion leads to the clouding of nearby streams, lakes, and rivers.

Condition #4: Addition of fertilizer. This is to recreate how fertilizers leach into ponds and lakes and increase algae blooms.

Students will observe and record the changes that develop in their ecosystem. The groups will discuss the changes and possibly explain them. Each group will present their results and relate to current environmental problems that humans have introduced. [9-12 Content Standard F- Natural and human induced hazards]

11. Upload the file(s) here (gif,jpg,doc,xls,ppt)

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12. Contact Information

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