

## **Lesson 1-Does the increased use of fertilizers effect biodiversity?**

### **Objectives:**

Students will be able to:

determine if the introduction of fertilizers can effect the biodiversity of an aquatic ecosystem.

evaluate how the introduction of fertilizers can change an aquatic ecosystem in a simulated system.

**Note:** Safety goggles and aprons should be worn at all times during this lab activity.

### **Materials:**

Water sample from a local stream or pond

1000 milliliter beaker or large container

3 500 milliliter beakers or jars to set up miniature water ecosystems

Dissecting microscope and hand lenses

10% fertilizer solution in dropper bottles

20% fertilizer solution in dropper bottles

Graduated cylinder

Nitrate test kit (Chemical) or Nitrate test strips

Phosphate test kit (Chemical) or Phosphate test strips

Petri dishes

Pipettes

### **Procedure:**

#### **Working with a partner:**

1. Working with a partner, take an approximate 1000 ml sample of the water sample from a local stream or pond.

2. Pour a portion of the sample into a petri dish and examine it under low power on the microscope or with a hand lens.
3. Provide a detailed description of the water sample. What types of organisms are found? Is there an abundance of algae and plant life?
4. Test the nitrate and phosphate levels of the water sample.

Initial nitrate reading:

Initial phosphate reading:

5. Separate the water sample into the three beakers or jars and label as follows:

Beaker 1-Control-no additions  
Beaker 2-10% fertilizer solution  
Beaker 3-20% fertilizer solution

6. To beaker 1, the control, do not add any additional materials.
7. To beaker 2, 10% fertilizer, add 2 milliliters of 10% fertilizer solution. Stir after the addition of the fertilizer solution.
8. To beaker 3, 20% fertilizer, add 2 milliliters of 20% fertilizer solution. Stir after the addition of the fertilizer solution.
9. Place the 3 beakers in an area where they will be undisturbed for a 24 hour period.
10. Based on the levels of fertilizer solution in each container, hypothesize how the biodiversity of each water sample will change over the 24 hour period. Will the organisms increase or decrease?  
Will the plant material and algae increase or decrease?

### **Hypothesis:**

11. After the 24 hour period, place a portion of each of the water samples from beakers 1, 2 and 3 in a petri dish and examine it under low and high power on a dissecting microscope. Provide a detailed description of each sample. Record your description in the appropriate column in the data table.
12. Test the nitrate and phosphate level of each sample and record the number in the appropriate column in the data table.

**Data Table:**

<b>Beaker</b>	<b>Nitrate Level</b>	<b>Phosphate Level</b>	<b>Observations</b>
<b>1 Control No Additions</b>			
<b>2 10% Fertilizer Solution</b>			
<b>3 20% Fertilizer Solution</b>			

**Conclusions:**

1. Does the data collected support your hypothesis? Why or why not?
2. Based on your observations, how does the increase of nitrates and phosphates due to the overuse of fertilizers effect biodiversity?
3. How would an increase in fertilizers around an aquatic ecosystem such as a pond or a stream, effect the plant and animal life?
4. Research how fertilizers are used and how a determination is made on the levels and the amounts to apply to farmland. Describe other sources of nitrates and explain how they end up in aquatic ecosystems and the effects they have when found in excess.

## **Lesson 2-Does an increase in nitrate and phosphate levels effect the growth of algae?**

### **Objectives:**

Students will be able to:

determine if an increase in nitrate and phosphate levels will effect the growth of Chlorella, an algae.

evaluate the nitrate and phosphate levels at which an increase in algal growth occurs in a closed system.

**Note:** Safety goggles and aprons should be worn at all times during this lab activity.

### **Materials:**

3 test tubes with screw caps

distilled water

graduated cylinder

10% nitrate/phosphate solution

20% nitrate/phosphate solution

Chlorella culture

light source

After reading through the activity, develop a hypothesis which states which of the solutions, distilled water, 10% nitrate/phosphate solution or 20% nitrate/phosphate solution, will contain the largest amount of Chlorella after a five day period.

### **Hypothesis:**

**Procedure:****Working with a partner:**

1. Write your name and your lab partner's name on each test tube.
2. Label the first test tube distilled water and fill in three quarters full with distilled water. This is the control.
3. Label the second test tube 10% nitrate/phosphate solution and the third test tube 20% nitrate/phosphate solution. Fill both test tubes three quarters full with the appropriate solution.
4. Gently mix the Chlorella culture. Using the dropper, place 10 drops of the Chlorella culture into each tube. Shake each tube gently to mix the contents.
5. Place the caps on the test tubes tightly and lay them on their sides in a well lit area where they will be undisturbed for the five day period.

**Note: A light source may be used to provide a well lit area.**

6. Check the test tubes every day for the next five days. Record the observations on the data table. Growth of Chlorella can be determined by an increase in the density of the algae as well as an increase in the darkness of the green color in the tubes. Record your results on the data table each day.

**Data Table:**

<b>Day</b>	<b>Control Distilled Water</b>	<b>10% nitrate/phosphate Solution</b>	<b>20% nitrate/phosphate Solution</b>
<b>1</b>			
<b>2</b>			
<b>3</b>			
<b>4</b>			
<b>5</b>			

**Conclusions:**

1. Does the data collected support your hypothesis? Why or why not?
2. Were there any changes in the distilled water tube? Explain.
3. At what level of nitrate, 10% or 20%, did the most growth occur? Why?

4. Based on your observations, what would you conclude about the effects of excessive nitrates and phosphates on the growth of algae?
  
5. How could the increased use of nitrates and phosphates (fertilizers), adversely effect an aquatic ecosystem?

### **Lesson 3-Does the use of increased amounts of fertilizer accelerate seed germination?**

#### **Objectives:**

Students will be able to:

determine the optimal amount of fertilizer to use to accelerate seed germination.

**Note:** Safety goggles and aprons should be worn at all times during this lab activity.

#### **Materials:**

3 petri dishes with lids

Distilled Water

10% Fertilizer solution

20% Fertilizer solution

Radish seeds, Bean seeds or mustard seeds

Filter paper

#### **Procedure:**

##### **Working with a partner:**

1. Label three petri dishes as follows:

Petri dish 1-Distilled water -this is the control

Petri dish 2-10% fertilizer solution

Petri dish 3-20% fertilizer solution

2. Cut 2 pieces of filter paper to fit inside each petri dish. Place five seeds in a row on top the filter paper in each petri dish.

3. Moisten the seeds in petri dish 1 with distilled water only. This is the control. Cover the moisten seeds with the second piece of filter paper and moisten it with distilled water.

4. Moisten the seeds in petri dish 2 with 10% fertilizer solution. Cover the moistened seeds with the second piece of filter paper and moisten it with 10% fertilizer solution
5. Moisten the seeds in petri dish 3 with 20% fertilizer solution. Cover the moistened seeds with the second piece of filter paper and moisten it with 20% fertilizer solution.
6. Place all three petri dishes in a warm area where they will remain undisturbed for a five day period.
7. Check the seeds for the next five days and determine the number germinated in each petri dish. Moisten the seeds each day with the appropriate solution. Record your observations in the data table.

Develop a hypothesis which states which of the solutions, distilled water, 10% fertilizer solution or 20% fertilizer solution, will accelerate seed germination.

**Hypothesis:**

**Data Table:**

<b>Day</b>	<b>Control Distilled Water # of seeds germinated</b>	<b>10% Fertilizer Solution # of seeds germinated</b>	<b>20% Fertilizer Solution # of seeds germinated</b>
1			
2			
3			
4			
5			

**After the observations are complete, answer the following questions.**

**Conclusions:**

1. Does the data collected support your hypothesis? Why or why not?
2. Describe the similarities and differences of the germination process in each of the three petri dishes.
3. Based on your observations, do increased strengths of fertilizers accelerate seed germination?