Name _____ Class _____ Date _____

Inquiry Lab

DESIGN YOUR OWN

An Onion Conundrum

You recently obtained a job working for an environmental consulting firm, the Environmental Brain Trust. Your firm, famous for "brainstorming," has recently received an anxious plea for help from Oscar Frizbee, owner of Oscar's Onions. The distraught Oscar described how his onions failed to take root. He had tried everything, including the latest watering system and the finest organic fertilizer. Oscar suspected that runoff from a nearby bleach company had contaminated groundwater underneath his farm. Oscar has done the first step for you: he has observed that his onions have failed to take root. It's up to you and your coworkers to develop a hypothesis to explain the mystery of the failed crop.

OBJECTIVES

Identify the problem.

Create a hypothesis that you can test to find out the reason behind the problem.

Gather data by experimenting.

Analyze and contrast your data to identify differences.

MATERIALS

- beaker
- bleach
- graduated cylinder
- graph paper
- knife
- notebook
- organic fertilizer (bone meal or fish meal)
- pen or pencil
- ruler, metric
- stirring rod
- test-tube rack
- test tubes, large
- water, distilled
- wax pencil
- white onion bulbs between 1.5 and 2.0 cm in diameter (unsprouted, mold-free, and of approximately the same size)

Procedure

PART I—MAKE A HYPOTHESIS

1. Get together with your team, and discuss the mystery of the failed crop. Decide what scientific problem you need to solve, and write the problem below.

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2. First list all the variables that might have affected Oscar's onions, based on his description. Working with your team, pick one variable that you think is a likely cause of the problem, and develop a hypothesis. Write your hypothesis below. Remember: a hypothesis is a prediction of what the correct answer might be, based on prior knowledge and experience.

3. Share your team's hypothesis with the class. Your teacher will write the hypothesis on the board. There should be several hypotheses for each variable.

PART II—DESIGN THE EXPERIMENT

4. The next step is to test your hypothesis. You will investigate the growth of onions by growing bulbs in test tubes filled with different growing solutions. The components of the solutions depend on which variable your team is testing. With your team, decide on the amounts (concentrations) of the substances in your test solutions. Here are some other questions you need to answer before you begin:

a. What will your sample size be?

b. Is it necessary to set up a control? Why or why not?

5. Write the procedure for your team's experiment on a separate sheet of paper. Create a data collection chart to record your data. Design your chart according to the conditions of this experiment as defined in your procedure.

PART III—PERFORM THE EXPERIMENT AND COLLECT DATA

6. Fill the test tubes with the solutions that you are testing. Label each test tube, and set the test tubes in a rack. Remove the onions' outer layers, and cut off a 2 mm slice from the bottom of each onion. Insert the onion bulbs into the test tubes so that the bottom of the bulb is immersed in the solution. Set the test-tube rack in a sunny location.

7. Over a five-day period, take note each day of the root growth of the onions. Measure the growth using a metric ruler, and record your data in the chart you created.

Analysis

1. Constructing Graphs After you have collected all your data, make a line graph comparing root growth over time in the solutions you tested. Explain why a line graph is a good way to represent your data.

2. Analyzing Results Did your results support your hypothesis? Explain.

3. Recognizing Patterns Compare your team's chart with those of your classmates. Which hypotheses were supported?

Conclusions

4. **Evaluating Methods** In your experiment, what variable did you change, and what variables did you hold constant? Why is it important to make sure that only one variable is changed for your test?

5. **Interpreting Information** What conclusions can you draw from the class results?

6. **Making Predictions** Describe an experiment you could do to test the effect of another variable on onion growth.

7. **Interpreting Information** Write a report that includes your hypothesis, data, and analysis to send to your client.

Extension

1. **Research and Communications** In a cranberry bog, the water and soil pH numbers should be in the 4.5 to 5.0 range for good cranberry production. Use your school library or the Internet to research the variables faced by a cranberry grower. For example, what variables do cranberry growers face when they treat the soil the cranberries grow in? How do the growers solve these problems?