15. Weather in a Terrarium

Driving Questions

Terrariums are excellent closed systems for environmental studies, allowing the investigator to change one variable at a time, control other variables, and monitor multiple variables in an easily maintained system.

♦ How can you create a test system using a terrarium that will help you explore the effects of environmental factors on weather parameters?

Background

Environmental studies require investigations both in the field and in the laboratory. Because the earth's environment is complex, an investigator in the field must collect a wide variety of data and look for patterns and correlations. When patterns or correlations are discovered, these can be further investigated in controlled laboratory environments. Terrariums are excellent closed systems for environmental studies, allowing the investigator to change one variable at a time, control other variables, and monitor multiple variables in an easily maintained system.

Student-designed investigations are important components of Advanced Environmental Science courses, and long-term projects are appropriate. During this activity, students become familiar with a test system, pose a hypothesis, and then design investigations to test the hypothesis. This activity provides some ideas for investigation and a structure to get students started with their inquiries. It also includes methods for reporting results, and you can choose which is appropriate for the classroom situation.

The test system for this activity is a closed system for examining factors that affect weather. The terrarium functions as a model for the earth and its troposphere. The dependent variables are temperature, barometric pressure, relative humidity, absolute humidity, and dew point. Some topics that could be investigated include the effect on the dependent variables of the following: light intensity, vegetation, water bodies, and land materials. No doubt your students will have many more creative ideas for what they would like to test.

Materials and Equipment

For each student or group:

♦ Weather sensor

♦ Light sensor

♦ Fast-growing, small, potted plant

♦ EcoChamber

♦ Full-spectrum light source (incandescent preferable)

Safety

Follow all standard laboratory procedures.

Procedure

After you complete a step (or answer a question), place a check mark in the box (□) next to that step.

Set Up

1. □ Arrange the weather and light sensors so they can detect changes inside the terrarium.

2. □ Seal the terrarium so it is airtight.

3. □ Start a new experiment on the data collection system.

4. □ Connect the sensors to the data collection system using the sensor extension cables.

5. □ Set up appropriate displays to view the data while it is being collected.

6. □ Set up a strong light source near the terrarium to shine directly at it. *Do not turn it on yet.*

7. □ What is the light source a model for? What is the terrarium a model for?

_____
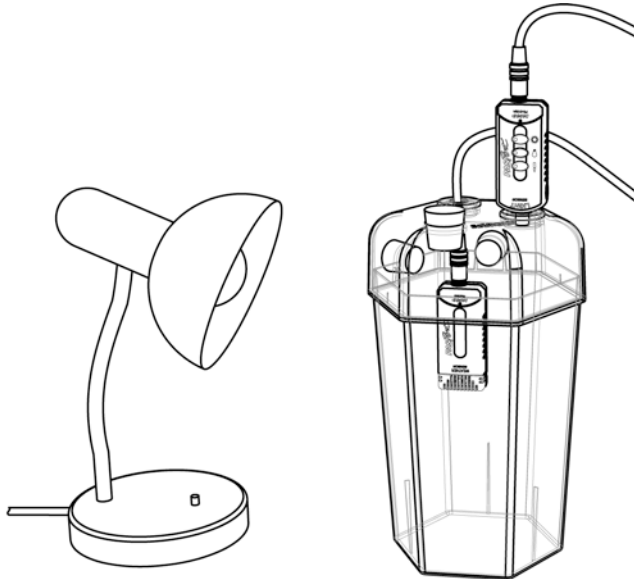
Collect Data

8. □ Start recording data.

9. □ Continue to record data with the light off for 5 minutes. *Do not stop recording data.*

10. □ Turn the light on and continue recording data for 5 minutes. *Do not stop recording data.*

11. □ Open the terrarium and add a potted plant. Close the terrarium. Continue recording data for 5 minutes.

12. □ Stop recording data.

13. □ Turn off the light.

14. □ Save your experiment and clean up according to your teacher's instructions.

Data Analysis

1. ☐ Display your data as graphs, and adjust the graphs to fill the screen vertically.

2. ☐ Sketch the graphs of light intensity, temperature, barometric pressure, relative humidity, absolute humidity, and dew point. Label the graphs and the axes, including the units and scales, use both y-axis.

3. ☐ Indicate on the graph where you turned on the bright light and where you added the plant.

4. ☐ Label the areas you think are interesting on the graphs with numbers or letters.
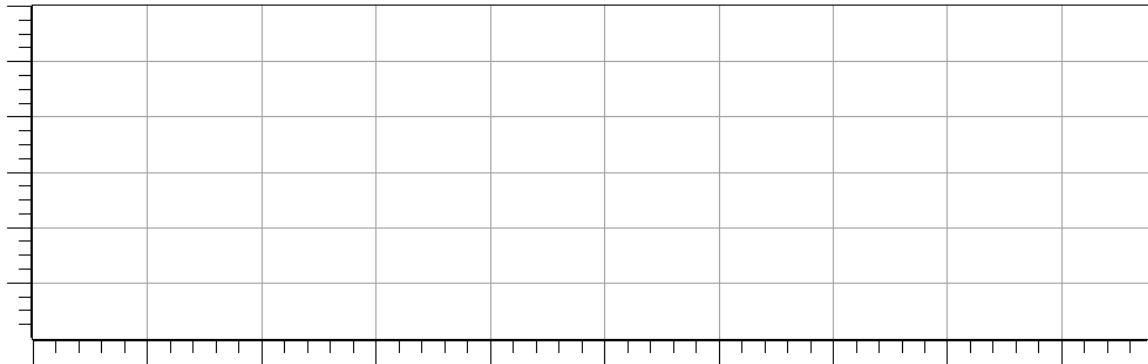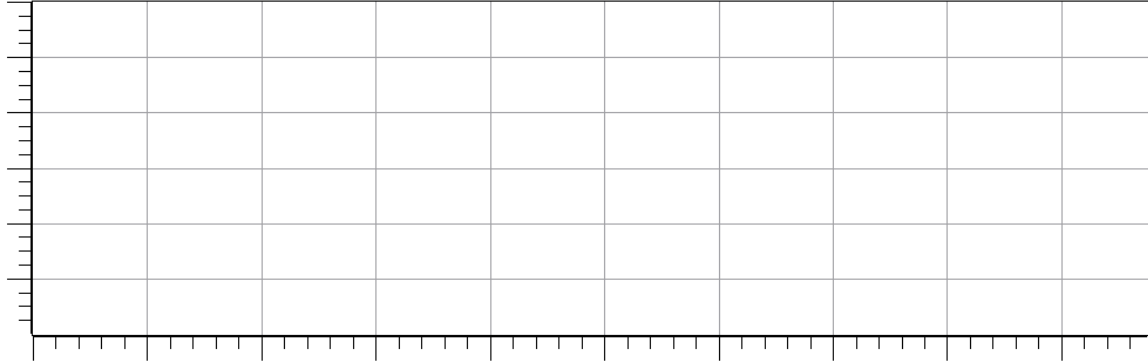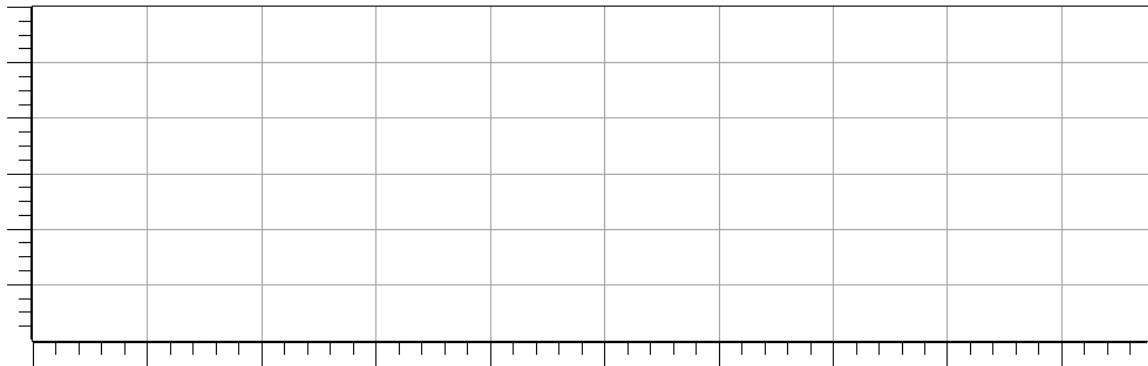
Analysis Questions

1. **Discuss the different patterns on the graphs. What do you think are explanations for the patterns?**

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2. **What were the independent variables in this activity?**

_____

3. **What were the dependent variables in this activity?**

_____

4. **What factors did you try to hold constant during this activity?**

_____

Synthesis Questions

Use available resources to help you answer the following questions.

Begin designing an experiment that investigates an aspect of the weather, using this test system. These questions will assist you to develop a proposal.

1. **How could you use the data you collected in this activity in additional investigations?**

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2. **What question would you like to investigate using this system?**

_____

_____

3. **What independent variables will you test to investigate the question? Why?**

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_____

4. What will be a hypothesis for a test of this issue using this system?

_____

_____

_____

5. How will you design the investigation to test your hypothesis?

_____

_____

_____

6. How will you analyze the results of your experiment?

_____

_____

_____

7. What materials and equipment will you need to conduct your investigation?

_____

_____

Multiple Choice Questions

Select the best answer or completion to each of the questions or incomplete statements below.

1. The design of a research study must include:

    A. A hypothesis to test

    B. A defined test system that controls variables

    C. A controllable independent variable

    D. A measurable dependent variable

E. Control or baseline measurements

F. All of the above

2. **In a scientific experiment, an independent variable is:**

    A. A variable that has nothing to do with other variables

    B. Something that changes in response to another variable

    C. Something that you change to affect another variable

    D. Something that you try to keep constant

3. **In a scientific experiment, a dependent variable is:**

    A. A variable that has nothing to do with other variables

    B. Something that changes in response to changes in another variable

    C. Something that you change to affect another variable

    D. Something that you try to keep constant

4. **In the test system in this activity, an independent variable is:**

    A. Temperature

    B. Light energy

    C. Vegetation

    D. Humidity level

    E. Either B or C

5. **In the test system in this activity, a dependent variable is:**

    A. Temperature

    B. Light energy

    C. Vegetation

    D. Humidity level

    E. Either A or D

    F. Either B or C