11. Transpiration

When Water Leaves

Driving Question

What happens to a living plant throughout the day and night?

Materials and Equipment

For each student or group:

- ☐ Data collection system
- ☐ Weather sensor
- ☐ Sensor extension cable
- ☐ Gallon size self-sealing bag, 1 or 2 depending on
- ☐ plant size
- ☐ Small potted plant
- ☐ Aluminum foil
- ☐ Water, tap (for moistening plant soil)
- ☐ Tape

Safety

Add this important safety precaution to your normal laboratory procedures:

- ■ Students should wear an apron to protect clothing.

Thinking about the Question

How are plants like every other living thing?

_____

What measurement can we use to determine if the plant is undergoing transpiration?

_____

_____

Will there be a difference in how much a plant transpires during the day and how much it transpires at night?

_____

_____

Sequencing Challenge

☐ **The steps below are part of the Procedure for this lab activity. They are not in the right order. Determine the proper order and write numbers in the circles that put the steps in the correct sequence.**

◯	◯	◯	◯	◯
Cover the pot and the soil entirely with a sheet of aluminum foil to prevent loss of soil moisture.	Make sure each lab group member is aware of the safety rules and procedures for this activity.	Obtain a small potted plant and water it so its soil is moist.	Use tape to seal the bag around the weather sensor extension cable.	Place the potted plant and a weather sensor into a plastic sealable bag.

Investigating the Question

☐ **Note:** When you see the symbol "**❖**" with a superscripted number following a step, refer to the numbered Tech Tips listed in the Tech Tips appendix that corresponds to your PASCO data collection system. There you will find detailed technical instructions for performing that step. Your teacher will provide you with a copy of the instructions for these operations.

Part 1– Making predictions

1. ☐ What do you think will happen to the relative humidity around a plant during a period of light? Record your prediction:

_____

_____

_____

2. ☐ What do you believe will happen to the relative humidity around a plant during a period of dark? Record your prediction:

_____

_____

_____

Part 2 – Temperature and humidity in light and dark conditions

3. ☐ Start a new experiment on the data collection system. (1.2)

4. ☐ Connect a weather sensor to the data collection system. (2.1)

5. Display both Relative humidity and Temperature on the y-axis of a graph with Time on the x-axis. (7.1.10) What is relative humidity and why are we measuring it in this activity?

_____

_____

_____

6. ☐ Change the sampling rate to take a relative humidity measurement once every two minutes. (5.1)

7. ☐ Acquire a small plant from your teacher.

8. ☐ Wrap aluminum foil around the base of the plant so that all of the soil is covered. Why do you need to wrap the base of the plant?

_____

_____

9. ☐ Place the wrapped plant into the gallon size self-sealing bag.

10. ☐ Put the weather sensor in the bag with the plant. Seal the bag and tape around the opening, as necessary.

    ☐ **Note**: If the plant is larger than one bag, place a second one over the top of the plant.

11. ☐ Place the plant in a sunny location.

12. ☐ Start data recording. (6.2)

13. ☐ Record data for at least one 24 hour period.

14. ☐ Stop data recording at the end of the 24 hours. (6.2)

15. ☐ Save your experiment according to your teacher's instructions. (11.1)

Answering the Question

Analysis

1. Review your data. You may need to adjust the scale of your graph to see all of the data. (7.1.2) did the plant undergo transpiration more during the day or during the night? Suggest reasons for this observation.

_____

_____

2. How did your prediction compare to the actual rate of transpiration during the day?

_____

_____

3. How did your prediction compare to the actual rate of transpiration during the night?

_____

_____

4. How do the plants avoid losing too much water through transpiration?

_____

_____

5. What environmental conditions control water loss in plants?

_____

_____

6. Would the transpiration rate in a conifer leaf (needle) be higher or lower than a deciduous (regular) leaf? Explain.

_____

_____

Multiple Choice

☐ **Circle the best answer or completion to each of the question or incomplete statements below.**

1. The cuticles on leaves that are in the sun will be _____ compared to the cuticles on leaves that are in the shade.

   A. Thinner
   B. Thicker
   C. The same
   D. Cannot determine

2. Which of the following describes the fate of most of the water taken up by a plant?

   A. It is used as a solvent.
   B. It is used as a hydrogen source in photosynthesis.
   C. It is lost during transpiration.
   D. It makes cell elongation possible.

3. Where in a plant does transpiration take place?

   A. All parts of the plant
   B. Leaves
   C. Stem
   D. Only the aerial parts

4. Most of transpiration takes place through:

   A. Stomata
   B. Epidermis
   C. Stem
   D. Cuticle

5. All of the following can affect transpiration except:

   A. Humidity
   B. Temperature
   C. Air Movement
   D. Leaf Color

6. Most stomata are located in the lower epidermis. This is to:

   A. Increase photosynthesis
   B. Reduce respiration
   C. Reduce water loss
   D. Increase transpiration

True or False

☐ **Enter a "T" if the statement is true or an "F" if it is false.**

_____ 1. Transpiration is the exchange of oxygen for carbon dioxide gas by a plant.

_____ 2. All organisms must be able to maintain stable internal conditions while living in a constantly changing external environment.

_____ 3. Plants can transpire from cells in their roots.

_____ 4. Plants are able to regulate the amount of water they lose to the environment.

_____ 5. A plant may transpire more on a calm day than on a windy day.

_____ 6. Water is taken in from the soil through the root hairs, moves into the xylem, up the stem and out through the leaves.

_____ 7. The processes of photosynthesis and transpiration both occur in a plant's leaves.