

# TEACHER'S GUIDE FOR SIXTH GRADE INQUIRY IN THE GARDEN - STAGE 3

## Transpiration



Desert Botanical Garden website

### ACTIVITY OVERVIEW

The purpose of this activity is to move students through the completion of an investigation using the scientific process. Having previously made observations, asked questions, developed hypotheses, and made and tested predictions, students now analyze their results and draw conclusions about ways desert plants are uniquely adapted for transpiration in the desert. After reviewing their experiences from their field trip to the Desert Botanical Garden, students complete a *Study Guide* and develop creative displays to share their results with others. Students are also encouraged to post their work online at the Desert Botanical Garden website.

### MATERIALS

- *Transpiration – Data Collection Journal* (from the DBG fieldtrip)
- *Student Study Guide – Transpiration Adaptations – Results and Conclusion*
- *Student Worksheet – Transpiration Adaptations Table* (from the Inquiry Stage 1 – Introductory Activity)

### PROCEDURES

1. Review and discuss the students' experiences during their trip to the Desert Botanical Garden. Go over the data collected in the *Transpiration - Data Collection Journal* and use the Organize and Analyze section to review student findings.
2. Review how roots collect water. Review the term **osmosis** and call on students to describe the activity they did at the Botanical Garden to demonstrate how water moves from an area of high concentration to an area of low concentration (students moved into less empty circles of rope when the circle of rope in which they were standing became full of students).
3. Review and discuss the special adaptations of a saguaro cactus stem. Ask students why saguaros have this adaptation. (Saguaros and other cacti live in an arid environment and conserve water by storing it in their stems.) What evidence did students see to show that saguaro stems hold water? Call on students to describe how cacti store water (special cells in the stem absorb water and the cactus expands – in a saguaro, the “ribs” allow the stem to expand).

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*Palo Verde*

4. For the third plant part of the transpiration process – leaves – explain that students will now continue to follow the scientific method and make conclusions about that investigation. Specifically, students should consider the Leaf – Transpiration investigation they conducted in which they compared water use by a little-leaf plant and a big-leaf plant. Students will need to refer to their *Transpiration - Data Collection Journals* from their field trip.
5. Hand out the *Student Study Guide – Transpiration Adaptations – Results and Conclusion*, one to each student. Review the *Study Guide* and explain that they should copy their data from the *Data Collection Journal* onto their *Study Guide*, taking time to clarify their writing. They should then consider their results and articulate their conclusions. Finally, they should answer the “*Questions for Discussion*.”
6. Explain to students that an important part of the scientific process is sharing your findings with others. Discuss the value of sharing scientific information (so that others may learn from the work and to expand everyone’s understanding of the subject). Scientists typically publish their work in scientific journals. As described in their *Study Guides*, students will prepare a final presentation of their investigation to share with others, both in class and by submitting online on the *DBG Journal of Student Findings*.
7. Give students time to prepare a final presentation display of their investigation. Using the information from their *Study Guide*, they may choose to create a poster, draw pictures, and/or include photographs taken during their field trip or acquired from the internet. Encourage student creativity in the display of their work. (*Note: For more ideas on art projects that tie into Garden themes, go to the Additional Resources section of the Digital Learning website.*)
8. Have students share their displays and compare their investigations with the rest of the class. Since students worked in different groups at the Botanical Garden, be sure to compare the results from the different groups. Conclude the activity with a discussion of the investigation using the “*Questions for Discussion*” from the *Student Study Guide* as a guide.

### **POST YOUR FINDINGS ON THE INTERNET!**

The final step of the Inquiry Process is to share your findings. Students may share their findings by visiting the *DBG Journal of Student Findings* at <http://www.dbg.org/index.php/digital/students/journal>. Here, students can submit investigation findings or original art inspired by their Inquiry in the Garden.

# STUDENT STUDY GUIDE - TRANSPIRATION ADAPTATIONS - RESULTS AND CONCLUSION

Student Name \_\_\_\_\_ Teacher \_\_\_\_\_  
Team \_\_\_\_\_

## Instructions:

Use the information from your Student Worksheet – Transpiration Adaptations Table and from the Transpiration Data Collection Journal (from your field trip) to answer the questions below. When finished with this Study Guide, prepare a display of your investigation. Be creative! You could make a poster, draw pictures, generate graphs, and/or include photos from your trip or from the internet. Then, think of a fun way to share your display. You could do a team presentation, poster displays, "science fair" displays, mock interviews, 3-D models, etc. Following your teacher's instructions, you may also post your work online on the DBG Journal of Student Findings.

Name of your investigation: \_\_\_\_\_

1. Question. What question was generated by your original observations of desert plant leaves?

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2. Hypothesis. What was your hypothesis?

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3. Prediction: What prediction did you make about desert leaves' adaptations for transpiration?

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4. Experiment. How did you test your hypothesis?

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5. Results. In the space below, copy the results you recorded in your *Data Collection Journal*.

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6. Conclusions: In your own words, what do you conclude about your hypothesis based on your test results? Is your hypothesis supported by your results?

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# STUDENT STUDY GUIDE - TRANSPIRATION ADAPTATIONS - RESULTS AND CONCLUSION

Student Name \_\_\_\_\_ Teacher \_\_\_\_\_  
Team \_\_\_\_\_

1. What is the main challenge desert plants must deal with during the process of transpiration?

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2. Would you consider your investigation a valid (or reasonable) way to test your hypothesis? Are you satisfied with your results? Why or why not?

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3. How did your data and results compare with other students' who worked in different groups at the Botanical Garden? What were the similarities / differences? What might have caused differing results?

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4. How might you revise your experiment to yield better results? Which variables would you change? Describe.

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5. Based on your findings, what are some other questions that arise that might lead to new investigations?

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### RELATED ADE STANDARDS:

#### WRITING STRAND 1: WRITING PROCESS

CONCEPT	PERFORMANCE OBJECTIVE
C1: Prewriting	PO 1: Generate ideas through a variety of activities (e.g., prior knowledge, discussion with others, printed material or other sources).
C3: Revising	PO 4: Rearrange words, sentences, and paragraphs to clarify the meaning or to enhance the writing style.
C5: Publishing	PO 3: Use graphics (e.g., drawings, charts, graphs), when applicable, to enhance the final product.

#### WRITING STRAND 3: WRITING APPLICATIONS

CONCEPT	PERFORMANCE OBJECTIVE
C2: Expository	PO 1: Record information (e.g., observations, notes, lists, charts, map labels and legends) related to the topic.

#### LANGUAGE ARTS STANDARD 4: VIEWING AND PRESENTING

STANDARD	PERFORMANCE OBJECTIVE
Students use a variety of visual media and resources to gather, evaluate and synthesize information and to communicate with others.	VP-E2: Plan, develop and produce a visual presentation, using a variety of media such as videos, films, newspapers, magazines and computer images.

#### SCIENCE STRAND 1: INQUIRY PROCESS

CONCEPT	PERFORMANCE OBJECTIVE
C3: Analysis and Conclusions	PO 1: Analyze data obtained in a scientific investigation to identify trends. PO 3: Evaluate the observations and data reported by others. PO 5: Analyze the results from previous and/or similar investigations to verify the results of the current investigation. PO 6: Formulate new questions based on the results of a completed investigation.
C4: Communication	PO 2: Display data collected from a controlled investigation. PO 5: Communicate the results and conclusion of the investigation.

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### SCIENCE STRAND 4: LIFE SCIENCE

CONCEPT	PERFORMANCE OBJECTIVE
C1: Structure and Function in Living Systems	<p>PO 1: Explain the importance of water to organisms.</p> <p>PO 6: Relate the following structures of living organisms to their functions:  transpiration – roots  absorption – roots</p> <p>PO 7: Describe how the various systems of living organisms work together to perform a vital function</p>

### EDUCATIONAL TECHNOLOGY STRAND 2: COMMUNICATION AND COLLABORATION

CONCEPT	PERFORMANCE OBJECTIVE
C1: Effective Communications and Digital Interactions	PO 1: Communicate digitally with others by selecting and using a variety of appropriate communication tools.
C2: Digital Solutions	PO1: Communicate and collaborate for the purpose of producing original works or solving problems.

### WORKPLACE SKILLS STANDARD 1: STUDENTS USE PRINCIPLES OF EFFECTIVE ORAL, WRITTEN AND LISTENING COMMUNICATION SKILLS TO MAKE DECISIONS AND SOLVE WORKPLACE PROBLEMS.

STANDARD	PERFORMANCE OBJECTIVE
IWP-E4: Respond to oral and written presentations by formulating relevant feedback, expressing opinions, discerning the main idea and distinguishing fact from opinion.	<p>PO 3: Formulate related questions in a presentation</p> <p>PO 4: Express opinions relating to the main idea in a presentation</p>
IWP-E6: Speak in a content area (e.g., science, social studies, literature), using vocabulary of the subject accurately; locate and interpret information in documents such as manuals, graphs, and schedules.	<p>PO 1: Deliver a factual presentation using appropriate terminology.</p> <p>PO 2: Use a variety of formats such as data, graphs and technical manuals to support a presentation</p>