

**Alternate Field Investigation** 



Desert Botanical Garden website

#### **ACTIVITY OVERVIEW**

In this investigation, students venture outside for a teacher-led, plant investigations walk in their own schoolyard. They then use what they've learned about identifying specific plant characteristics to discover the scientific name, common name, and plant family of the eleven plants they looked at in *Inquiry in the Garden-Stage 1*. This activity is offered as an alternative field investigation for classes unable to visit the Desert Botanical Garden. The purpose of this activity is to get students outside and involved in real, hands-on field investigations about plants and for them to complete the investigation they began in Stage 1. Although that introductory activity is primarily for classes visiting the Desert Botanical Garden, it provides foundational concepts and activities which are further explored in this investigation.

#### **TEACHER PREPARATION**

The purpose of the plant investigations walk is for students to experience observing plant characteristics and using selected characteristics to use a dichotomous key to identify plants. To prepare for this activity, it is suggested that teachers first scout the school grounds before taking the students outside. Decide on a route that would offer students the best overview of the various plants on the school grounds. The route should include a diversity of trees, shrubs, and cacti (if possible). Select stops along the route to convey specific teaching points. Students will be better prepared for this investigation if the class first has the opportunity to practice making and using dichotomous keys as described in *Steps to Making a Dichotomous Key* from Stage 1.

#### **MATERIALS**

- Optional depending on selected activities: pencils, paper, hand lens, field guide to plants (of your area), guide to landscape plants (used in your area), digital camera
- Leaf Characteristics
- Steps to Making a Dichotomous Key (from Key to Desert Plants Inquiry in the Garden-Stage 1)
- Pictures of eleven plants from Stage 1
- Student Investigation Journal
- Student Study Guide- Key to Desert Plants- Results and Conclusion



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#### GENERAL PROCEDURES

Guide students on an outdoor plant investigation walk following your preplanned route. During your walk and at pre-planned stops, conduct inquiry discussions using the *Plant Characteristics Discussion Questions* to convey the Teaching Points presented. Following your discussions, conduct one or more of the *Suggested Activities*. After students have studied and discussed plant characteristics and conducted several of the associated activities, review the *Key to Desert Plants Teaching Points* and conduct the associated *Suggested Activities*. Wrap up the lesson by discussing students' discoveries, reviewing the *General Teaching Points*, and giving students the opportunity to post their findings online at the DBG website.

#### PLANT INVESTIGATION— GENERAL TEACHING POINTS

- Different plant species have particular characteristics that help identify the species.
- Some plant characteristics develop as adaptations in response to environmental conditions.
- Organisms may adapt to similar environmental conditions by evolving similar characteristics. This is called convergent evolution.
- Characteristics such as spines, succulence, hairy leaves, photosynthetic branches, and compound leaves are adaptations to a desert environment in which a limiting factor is water.
- A dichotomous key is used to identify organisms by observing their characteristics.
- Field guides are useful for identifying plants in a particular area.

#### PLANT CHARACTERISTICS WALK

#### Description

The plant characteristics walk should cover a large part of the schoolyard in order for students to see the greatest variety of plants. If possible, the walk should include views of trees, shrubs, small bushes, cacti, small forbs, and grasses. Several stops (identified in advance) may be incorporated into the walk where specific teaching points are best addressed. The final stop should offer the opportunity to view some specific plant characteristics up close and to conduct the suggested activities.



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#### PLANT CHARACTERISTICS TEACHING POINTS

- Plants come in a variety of sizes, shapes, and species.
- Observing the growth form of plants (e.g., tree, shrub, bush, vine, cactus, forb, etc.) can help us narrow down the plant's identity.
- Plants have specific characteristics that can be used as an aid in their identification.
- Leaf characteristics include variations in shape, texture, size, growth pattern (e.g., compound or simple), and color.
- Stem characteristics include variations in branching patterns, texture (including presence or absence of spines or hairs), color, succulence, height, and width.
- Characteristics such as spines, succulence, hairy leaves, photosynthetic branches, and compound leaves are adaptations to a desert environment in which a limiting factor is water.
- Flower characteristics vary greatly and are ultimately the primary identifying feature of most plants.
- Some characteristics are actually adaptations which help the plant survive specific environmental conditions.
- Organisms may adapt to similar environmental conditions by evolving similar characteristics. This is called convergent evolution.

#### **DISCUSSION QUESTIONS AND ACTIVITY SUGGESTIONS**

Along your walk and at your pre-planned stops, conduct inquiry discussions using the teaching points as your guide. Questions to help students arrive at the key points for this stop could include the following:

What are some of the different kinds of plants we're seeing on our walk?

What are some of the different growth forms of plants we're seeing?

What are some of the different plant characteristics we see?

Which of the characteristics we're seeing will change as the plant grows and which are inherent and unchanging?

Which characteristics could be used to help identify plants?

How many different plant characteristics do you see?

Are any of the plant characteristics we're seeing possibly adaptations to our environment?

3. continued



#### **Alternate Field Investigation**

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Do you see any examples of convergent evolution (plants from different ancestries develop similar characteristics to adapt to similar environmental conditions)?

Who can describe the environmental conditions to which plants must survive here in our area?

Who can describe some plant characteristics which help them survive our particular environment?

Who can describe some plant characteristics which help plants survive other environments?

After students have had a chance to observe and discuss plant characteristics, choose and conduct one or more of the following suggested activities. Student should record in their *Student Investigation Journals*.

#### Have students...

- List the different plant characteristics they noticed during their walk and at the stops.
- Sit quietly, observe, and draw plant characteristics they see.
- Use a hand lens to observe different plant characteristics up close.
- Find and describe different leaf characteristics. See who can find the most.
- Refer to the *Leaf Characteristics* handout and see if they can find an example of each.
- Play a game similar to "I Spy" in which a student describes a plant by its characteristics and other students have to guess the plant.
- Compare and contrast plant characteristics that will change with those that won't.
- Find two different plants that have one or more of the same characteristics.
- List and describe characteristics that are likely adaptations to your particular environment.

#### **KEY TO DESERT PLANTS**

#### Description

These activities should be conducted after students have studied and discussed plant characteristics and conducted several of the associated activities. Students should also have practiced making and using dichotomous keys as

4. continued



#### **Alternate Field Investigation**

#### continued

described in *Key to Desert Plants Inquiry in the Garden-Stage 1* and *Steps to Making a Dichotomous Key.* Students will need to use the picture sets from Stage 1 so this activity may work best back in the classroom. Students will identify each of the eleven plants by scientific name, common name, and plant family. Students will understand the differences and similarities between Cactus Family plants and Euphorbia Family plants.

#### **TEACHING POINTS**

- A dichotomous key is a tool used to identify something (such as plants, insects, rocks) by going through a series of choices that ultimately lead to the identity of the object.
- A dichotomous key uses the characteristics of plants as identifying features to establish their identity.
- In addition to a dichotomous key, photos of plant characteristics can help in their identification.
- Organisms may adapt to similar environmental conditions by evolving similar characteristics. This is called convergent evolution.
- An areole is a structure that is unique to plants in the Cactus Family.

#### **ACTIVITY SUGGESTIONS**

After students have had a chance to study and discuss plant characteristics and are familiar with using dichotomous keys, conduct one or more of the following suggested activities.

#### Have students...

- Use the Dichotomous Key from *Student Investigation Journals* and the pictures from *Inquiry in the Garden Stage 1* to learn the identity and family of the eleven plants from Stage 1.
- Have a discussion about the differences and similarities between plants in the Cactus Family and plants in the Euphorbia Family, focusing on areoles.
- Use provided images of cactus areoles and euphorbia spines to discuss the differences and similarities.



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#### CONCLUDING ACTIVITY

#### **Procedures**

- 1. In order for students to complete their investigation of plant families, students should complete the provided *Student Study Guide Key to Desert Plants Results and Conclusions*, which replaces Stage 3 of Inquiry in the Garden.
- 2. 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. Students will prepare a final presentation of their investigation to share with others, both in class and by posting online on the *DBG Journal of Student Findings*.
- 3. Give students time to prepare a final presentation display of their investigation. Using the information from their journals, they may choose to create a poster, create graphs or tables for their data, draw pictures, and/or include photographs taken during their investigation 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.)
- 4. Have students share their displays and compare their investigations with the rest of the class.

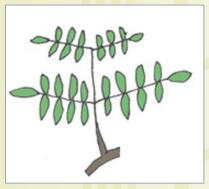
#### **POST YOUR FINDINGS ON THE INTERNET!**

As part of the Inquiry Process students may share their work with others by visiting the *DBG Journal of Student Findings* at http://www.dbg.org/index.php/digital/students/journal. Here, students can submit their findings or creations such as field guides, dichotomous keys, poems, or original art inspired by their Inquiry in the Garden. For more ideas on art projects that tie into Garden themes, go to the *Additional Resources* section of the Digital Learning website.

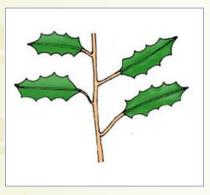


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#### LEAF CHARACTERISTICS



compound (pinnate)



Alternate arrangement



compound (palmate)



Opposite arrangement



lobed



simple



# STUDENT INVESTIGATION JOURNAL

Student Name\_\_\_\_

-	
	Record your observations and findings during the investigation.
75	PLANT CHARACTERISTICS
-	1. Sketch some of the plant characteristics you saw.
	1. Sketch some of the plant characteristics you saw.
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	2. List characteristics that are likely adaptations to your particular environment.
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	3. Find, draw, and identify (if you can) two different plants that have one or more of the same
	characteristics.
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- 3	
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	4. What are some similarities and differences between cactus areoles and euphorbia spines?
	what are some similarities and differences between cactus arcoles and cupitorbia spilles:
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# STUDENT INVESTIGATION JOURNAL

Student Name\_\_\_\_

- 10	
	DICHOTOMOUS KEY FOR DESERT PLANTS
-	1a) Stem succulent3
- 13	1b) Stem not succulent2
	2a) Stem herbaceous with light green leaves Encelia farinose, Brittlebush; Asteraceae Family
	2b) Stem woody8
	3a) Single main stem from ground4
	3b) Multiple stems or mounds of stems from ground 6
	<del> </del>
	4a) Stems branched only 5
	4b) Stems jointed and branched, raised upwards with silver to golden colored spines: <i>Opuntia</i>
-	bigelovii, Teddy Bear Cholla; Cactus Family
3	5a) Stems branched with spines and areoles Myrtillocactus geometrizans, Whortleberry; Cactus Family
	5b) Stems branched with spines and no areoles <i>Euphorbia coerulescens</i> , Sweet Noor; Euphorbia Family
	6a) Spiny clustered stems less than one meter in height with areoles <i>Echinocereous englemanii</i> , Hedgehog; Cactus Family
	6b) Spiny clustered stems less than one meter in height with no areoles 7
	7a) Stems silver green with multiple pleats and sparse spines along rib: <i>Euphorbia polygona</i> ,  Snowflake; Euphorbia Family
	7b) Stems lime-green, few pleats creating a square stem, paired spines along rib: <i>Euphorbia resinifera</i> , Moroccan Mound; Euphorbia Family
	8a) Plant has multiple or clustered grey stems from ground level <i>Larrea tridentate</i> , Creosote; Caltop Family
3	8b) Plant has single, dominant stem from ground level or may split into more stems at 20 cm from ground level 9
70	9a) Stem has spines and areoles <i>Pereskia sachrona</i> , Pereskia; Cactus Family
-3	9b) Stem has no spines 10
	10a) Main trunk green in color <i>Parkinsonia microphylla</i> , Littleleaf/ Foothills Palo Verde; Legume Family
	10b) Main trunk brown in color Mesquite spp., Mesquite; Legume Family
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# STUDENT INVESTIGATION JOURNAL

Student Name\_\_\_\_\_

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### STUDENT STUDY GUIDE-KEY TO DESERT PLANTS-RESULTS AND CONCLUSION

Student Name Teacher
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Instructions: Use the information from your Student Study Guide – Key to Desert Plants and from the Student Investigation Journal to answer the questions below. Following your teacher's instructions, you may also post your work online on the DBG Journal of Student Findings

work online on the DBG Journal of Student Findings	, , , , , , , , , , , , , , , , , , , ,
Part A. Characteristics of Desert Plants	
1. What was your class hypothesis regarding this question: What are the distinguishing characteristics of plants in the Cactus Family?	
2. What additional observations did you make during your investigation that further led you to that hypothesis?	
The singular marter lea year to mar hypomesis:	
3. What question does your hypothesis attempt to answer?	
4. What was your prediction about how to identify cacti?	
5. How did you test your prediction? Describe the investigation you conducted.	
6. Analyze your results. What did you find out about the identifying characteristics of cacti and euphorbias as you keyed them out?	



### STUDENT STUDY GUIDE-KEY TO DESERT PLANTS-RESULTS AND CONCLUSION

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

	77.			
. Why is it OK to have	your hypothesis be fal	se (not supported t	oy your results)?	
. Write a new, refined	l hypothesis bas <mark>e</mark> d on t	ne resu <mark>lts from you</mark>	r investigation:	
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### STUDENT STUDY GUIDE-KEY TO DESERT PLANTS-RESULTS AND CONCLUSION

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

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cacti and euphorbias. onstruct a more creative t materials, natural obje	onstruct a Venn Diagran After you have complet e Venn Diagr <mark>am</mark> using ac ects, etc. Consider down 3-D models to represen	ed <mark>your Venn Diag</mark> dd <mark>ition</mark> al materials Ilo <mark>ad</mark> ing pictures fro	ram below and if ti such as construction om the internet, mo	me permits, In paper, Iking
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**Alternate Field Investigation** 

#### RELATED ADE STANDARDS:

#### READING STRAND 1: READING PROCESS

CONCEPT	PERFORMANCE OBJECTIVE
C6: Comprehension Strategies	PO 4: Use graphic organizers in order to clarify the meaning of the text.
	PO 5: Connect information and events in text to experience and to related text and sources.
	PO 6: Apply knowledge of the organizational structures (e.g., chronological order, compare and contrast, cause and effect relationships, logical order) of text to aid comprehension.
	PO 7: Use reading strategies (e.g., drawing conclusions, determining cause and effect, making inferences, sequencing) to interpret text.

#### READING STRAND 3: COMPREHENDING INFORMATIONAL TEXT

CONCEPT	PERFORMANCE OBJECTIVE	
C1: Expository Text	PO 5: Locate specific information by using organizational features (e.g., key/guide words) in expository text.	
	PO 8: Interpret graphic features (e.g., charts, maps, diagrams, illustrations, tables, timelines, graphs) of expository text.	
	PO 9: Apply knowledge of organizational structures (e.g., chronological order, comparison and contrast, cause and effect relationships, logical order) of expository text to aid comprehension.	
	PO 10: Make relevant inferences about expository text, supported by text evidence.	
C2: Functional Text	PO 1: Use information from text and text features to determine the sequence of activities needed to carry out a procedure.	
	PO 2: Determine what information (e.g., steps in directions, legend, supplies needed, illustrations, diagram, sequence) is missing in functional text.	
	PO 3: Interpret details from a variety of functional text (e.g., warranties, product information, technical manuals, instructional manuals, consumer safety publications) for a specific purpose (e.g., to follow directions, to solve problems, to perform procedures, to answer questions.	

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

STANDARD 4: VIEWING AND PRESENTING	PERFORMANCE OBJECTIVE
resources to gather, evaluate and synthesize information and to communicate with	VP-E1: Analyze visual media for language, subject matter and visual techniques used to influence opinions, decision making and cultural perceptions  VP-E2: Plan, develop and produce a visual presentation, using a variety of media such as videos, films, newspapers, magazines and computer images



### **Alternate Field Investigation**

#### **SCIENCE STRAND 1: INQUIRY PROCESS**

CONCEPT	Performance Objective
C2: Scientific Testing	PO1: Demonstrate safe behavior and appropriate procedures in all science inquiry.
	PO5: Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.
C3: Analysis and Conclusions	PO1: Analyze data obtained in a scientific investigation to identify trends.
	PO3: Analyze results of data collections in order to accept or reject the hypothesis.
	PO5: Formulate a conclusion based on data analysis.
	PO6: Refine hypotheses based on results of investigations.
C4: Communication	PO 3: Communicate the results of an investigation with appropriate use of qualitative and quantitative information.
	PO 5: Communicate the results and conclusion of the investigation.

#### SCIENCE STRAND 4: LIFE SCIENCE

CONCEPT 3: POPULATIONS OF ORGANISMS IN AN ECOSYSTEM	PERFORMANCE OBJECTIVE
Analyze the relationships among various organisms and their environment.	PO 3: Analyze the interactions of living organisms with their ecosystems:  • limiting factors

#### **EDUCATIONAL TECHNOLOGY STRAND 1: CREATIVITY AND INNOVATION**

CONCEPT	PERFORMANCE OBJECTIVE
C4: Original Works	PO 1: Create innovative products or projects using digital tools to express original ideas.
	PO 2: Use digital collaborative tools to synthesize information, produce original works, and express ideas.

#### **EDUCATIONAL TECHNOLOGY STRAND 2: COMMUNICATION AND COLLABORATION**

CONCEPT	PERFORMANCE OBJECTIVE
C1: Effective Communications and Digital Interactions	PO 1: Collaborate and communicate with peers, experts, or others employing a variety of digital tools to share findings and/or publish.
C2: Digital Solutions	PO 1: Communicate and collaborate for the purpose of producing original works or solving problems.
C3: Global Connections	PO1: Independently locate and interact with teacher approved global communities.

#### **EDUCATIONAL TECHNOLOGY STRAND 6: TECHNOLOGY OPERATIONS AND CONCEPTS**

CONCEPT	PERFORMANCE OBJECTIVE
C2: Applications	PO 7: Identify and use network protocols for moving files and secure web access.



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

STANDARD 1	PERFORMANCE OBJECTIVE
1WP-E7: Identify the relevant details and facts of written materials	PO 2: Identify relevant facts contained in selected written material
1WP-E8: Write formal communications that have a definite audience and clear purpose; contain no gaps, omissions or assumptions which impede comprehension; and follow the proper form whether it be a personal or business letter, message, memo, manual directions or applications	PO 1: Write a formal communication in an appropriate format for a specific audience and purpose PO 2: Organize ideas in a meaningful sequence using transitional words or phrases PO 3: Write ideas that are clear and directly related to the topic