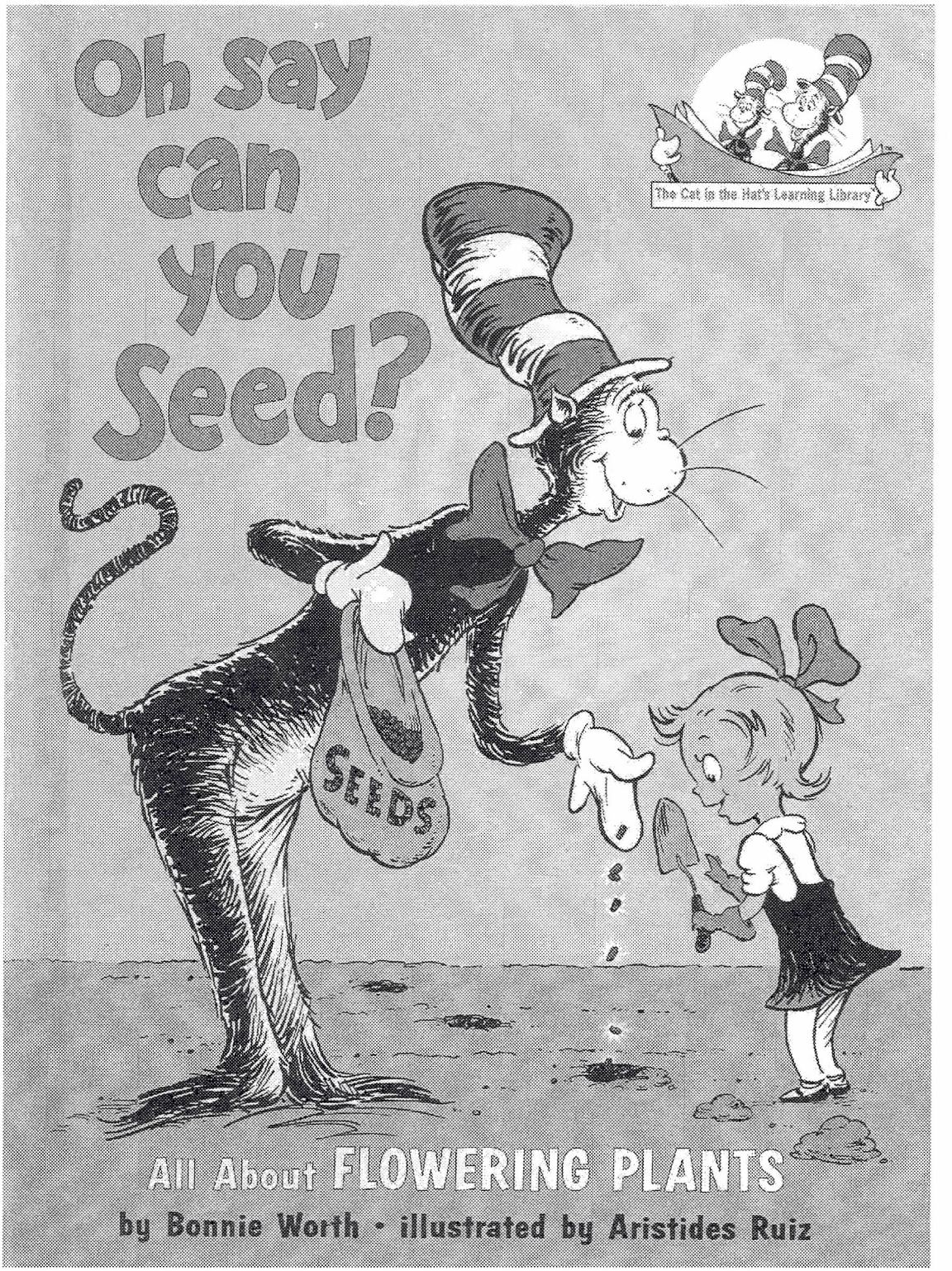
Classroom Activities



Thanks to:

North Carolina Ag in the Classroom

Florida Ag in the Classroom

Photosynthesis Promenade

Greetings from North Carolina Ag in the Classroom! Ag in the Classroom is happy to share *Photosynthesis Promenade* with you and your students. It is hoped that using the activities in this manual and the Promenade kit will help your young scientists understand and appreciate one of the most miraculous processes in all of nature.

Ag in the Classroom is an educational program provided by the North Carolina Farm Bureau Federation to help teachers enrich instruction as outlined by the Standard Course of Study while helping students to develop an appreciation for agricultures as the source of all our food and fiber. A document outlining the components of NC Ag in the Classroom is contained in this manual. We invite all North Carolina educators to become familiar with all that Ag in the Classroom has to offer and to take advantage of the opportunities available through the program.

Photosynthesis Promenade is actually the culminating activity of a set of lesson designs focusing on plant science. There are lessons related to seed parts, germination, plant parts, and pollination. The final lesson focuses on Photosynthesis and its importance to the function of all living things. All of these lessons are included in this teacher's manual.

As an anchor component of the plant science study, a book entitled *Oh Say Can You Seed*, by Bonnie Worth has been selected. The text is written in the fashion of Dr. Seuss and features The Cat in the Hat, Thing One, and Thing Two. The lessons included in this manual go along with *Oh Say Can You Seed*. The lessons can be taught effectively without the use of the text. A copy of the book is included in the kit.

In keeping with the goals and ideals of Ag in the Classroom, *Photosynthesis Promenade* gives due reference to the farmer and the role that photosynthesis plays in the agricultural industry. It helps students to see that people are all dependent on a number of factors they tend to take for granted.

Ag in the Classroom hopes that you and your students find these lessons appealing and helpful in your efforts and that you have great fun as you Dance with the Plants!

Bean Dissection

Traditional Lesson Design

Preparation:

Purchase a bag of large lima beans at the supermarket.

Count out approximately 2 beans for each student who will participate in the Bean Dissection activity.

Place counted beans in a bowl and cover with water.

Soak beans overnight.

Teacher Information:

Introduce the book *Oh Say Can You Seed*, by Bonnie Worth to the class. Read orally pages 6-15 and discuss.

Distribute 2 beans to each student. Place beans on dry paper towels.

Discuss seed parts with students as they investigate the beans,

Ask students to take beans apart and identify the seed coat, cotyledon(s), and embryo.

- You may ask students to observe and record findings as they locate seed parts.
- You may ask students to sketch the seed parts as they locate and identify them.

- Provide "Ag in the Classroom Bean Book" kits for students to construct as a reference tool for future use. To obtain Bean Book plans, visit http://www.agintheclassroom.org/060605/Teachers/Make%20&%20Takes/Bean%20Book.pdf.

BEAN SEED DISSECTION

5E Lesson Design

Engagement Activity

Bring a bowl of large lima beans, which have been soaked in water overnight to class. Invite students to work individually or in pairs and to take two beans from the bowl and place them on paper towels in their work space.

Instruct students to take one of the objects and observe.

Ask attention focusing questions such as:

- Describe what you see.
- What clues does this lima bean give you about its growth?

Exploration Activity

Instruct students to investigate one of the beans they have placed on the paper towel. They may use their hands or other simple instruments you may provide. (tweezers, toothpicks, files, etc.)

Encourage the use of process skills by asking students to observe size, shape, number of parts, textures, etc. Ask students to record observations in appropriate ways. Ask students to draw a diagram of the parts of a seed and label it. (See picture of the seed.)

Explanation Activity

Tell students that the bean they have investigated is a part of a plant. Every flowering plant has six parts and their bean is one of them.

Ask students to hypothesize which plant part they think the bean might be and explain why. (It is the seed)

Instruct students to discuss the three different parts they found when dissecting the bean and hypothesize their purpose. (The seed coat protects the seed, cotyledons provide food prior to germination and photosynthesis, and the embryo is a tiny plant) Ask students how they might test hypotheses.

Instruct students to hypothesize as to the needs of the seed in order to germinate/sprout. (water, soil or other medium to hold moisture, warm temperature) Ask students how they might test their hypotheses.

Would the same be true for all seeds?

Elaboration Activity

Allow students to set up and conduct experiments to test hypotheses formed during the Explanation Activity. Have them gather needed resources (books to verify guesses, materials to test needs of seeds) and follow through with experimental activities.

Require students to journal findings of all experiments stating whether hypotheses were proven or disproved.

Evaluation/Extension Activity

Draw, label, and write explanations of the purposes of each part of the seed.

Provide "Ag in the Classroom Bean Book" kits for students to construct as a reference tool for future use. To obtain Bean Book plans, visit
http://www.agintheclassroom.org/060605/Teachers/Make%20&%20Takes/Bean%20Book.pdf.

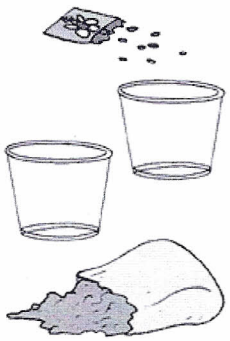
BUILD A GREENHOUSE

Traditional Lesson Design

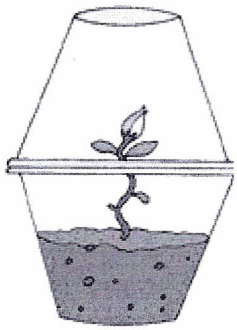
Materials Needed: potting soil, two clear plastic cups, 1 bean seed, 1 corn sees, 1 pea seed, water, transparent tape, permanent pen

With these supplies you can build the greenhouse below.

Directions:



- Place some soil in one of the cups, filling it about halfway up.
- Plant each of the three seeds equidistant next to the "wall" of the plastic cup so you can observe the germination and growth of your plants.
- Add a 10 ml of water and then place the other cup on top. Tape the cups together.
- Label seed type above each planting (on top cup). Bean, corn, pea.
- Once you've completed your mini-greenhouse, observe it over time. Experiment by placing your greenhouse in different locations. If it doesn't grow in one spot, try another. Place your greenhouse in indirect sunlight.
- Most likely, your plant will quickly outgrow its container. When the plants touch the top of the upper cup, remove the tape and begin watering.
- Your plants will need to be transplanted to a larger container or into outside soil shortly thereafter.



Pointers for making a successful greenhouse using this Ag in the Classroom plan:

- Seeds should be planted next to the "wall" of the cup so children can see them as they begin to germinate. To get the seeds where they can be seen, put the potting soil into the bottom cup, then use a plastic knife or popsicle stick to push the seeds down into the soil right up next to the "wall" of the cup. Make sure that each seed is visible through the wall of the cup.
- It is suggested that by planting 3 different seeds children can observe differences in germination and growth. Plant them equidistant around the cup.
- Have children write name and date on top (or bottom) cup with a permanent marker.
- Do not put too much water – basically, get the soil moist throughout. Place greenhouses in indirect sunlight. Placing them in direct sunlight will cause them to become too hot and prevent germination and/or proper growth.

BUILD A GREENHOUSE

5E Lesson Design

Engagement Activity

Prepare several greenhouses using printed directions (see traditional lesson). Display one greenhouse for students to investigate.

Ask attention focusing questions such as:

- What is this? What is it called?
- Have you seen anything like it before?
- What do you think will happen inside and why?
- Where should it be kept?

Exploration Activity

Provide additional greenhouses for students to observe in small groups. Instruct students to deconstruct the greenhouses to investigate the contents. Allow students to observe contents of the greenhouse and record their findings in their science notebook.

Ask explorative questions such as:

- What are the contents of the greenhouse?
- Why do you think each item was placed in the greenhouse? What is its purpose?
- What changes do you think have taken place since the time that the greenhouse was assembled?
- If the greenhouse is reassembled, what do you think will happen?

Explanation Activity

Provide materials and directions for students to make their own greenhouses. Allow them to do so. Instruct students to journal their activities and continue to note changes in the greenhouse over a period of several weeks.

Ask explorative, measuring, and how/why questions such as:

- What seeds did you plant?
- What happens if you plant the seeds deeper or shallower?
- What happens if you add more or less water.
- What will this environment cause the seeds to do?
- What factors are present in the greenhouse which will enable the seeds to germinate and grow?
- Why will you not need to water the seeds and young plants?
- Which seed do you predict will germinate first, second, last?

Elaboration Activity

Provide reference materials for students to view. Challenge them to find text that describes the processes taking place inside their greenhouses. Have them record their findings and cite sources.

Ask clarifying questions such as:

- What term did you find that describes the sprouting of a seed? (germinate/germination)
- What are the names of the three parts of a seed? (seed coat, cotyledon, embryo)
- What is the function of each seed part? (the seed coat protects the seed, the cotyledon provides food for the baby plant, the embryo is the baby plant that will grow)
- What does a seed need in order to germinate? (water, soil or other growing medium, warm temperature)
- Once a seed has germinated, what does the young plant need in order to grow? (water, soil or other growing medium, appropriate temperature, sunlight)
- Why did you not need to water the seeds and seedlings inside the greenhouse? (the greenhouse was able to sustain its own water cycle)
- What are the stages of the water cycle (evaporation, condensation, precipitation)

Evaluation/Extension Activity

Allow students to continue to care for, observe, and journal the activities associated with their greenhouses. They should remove the tops when the first leaf touches the top of the upper cup. Students may condition the plants to be transplanted outdoors by placing the greenhouses outdoors briefly, adding a few minutes each day.

Read orally and discuss pages 16-17 from the text, Oh Say Can You Seed, by Bonnie Worth.

Plant Parts
Traditional Lesson Design

Read orally pages 18-25 of *Oh Say Can You Seed* and discuss.

Distribute copies of "Roots, Stems, Leaves."

Divide students into six groups. Assign each group a verse of the song to pantomime. Allow time for groups to develop their activities and rehearse them.

Play the song using CD, tape, or live accompaniment. Students should sing along and present their "skit" during each verse as appropriate. Tapes and CDs are available for purchase at www.bananaslugstringband.com.

Note: This activity could be used as an educational presentation at a parent night or school assembly program.

Plant Parts

5E Lesson Design

Engagement Activity

Bring a number of whole plants representing agricultural commodities from your area and place them on tables for students to see. One plant should be placed on each table. Allow students to form small groups and to gather at tables by groups. Ask students to take a look at the plants and share observations. Possible plants for use include: soybeans, greenhouse/nursery plants, cotton, peanuts, sweetpotatoes, corn, cucumber, or any other vegetable plant.

Ask attention focusing questions such as:

- What type of plant do you think your group has?
- How many plant parts does your plant have?
- Can you identify the parts of your plant?
- What time of year do you think your plant was planted?
- How do you suppose your plant is harvested?

Exploration Activity

Each group should dissect their plant into specific parts. Challenge students to label the parts and the function of each. Instruct students to journal their activities making sketches and providing written descriptions of each plant part they identify.

Ask explorative questions such as:

- Where on the plant are the parts located? (top, middle, or bottom)
- Do you see any ways in which the plant is designed to protect itself from predators?
- What are the colors of the different plant parts?
- How many different plant parts can you identify?
- Do you think that the plant you are investigating had more parts than you are able to identify? (ex. A fruit that has been harvested….A flower that has fallen off?)

Explanation Activity

Provide resource materials for students to research the plants they are investigating. Challenge them to locate information that confirms or disproves their hypotheses about the plants and their parts.

Ask students to prepare a presentation about their plant to share with classmates. Presentations should contain information about the parts of the plant and the function of each part.

Challenge students to base presentations on information they gathered from their hands-on investigation as well as from resource materials.

Ask explanatory questions such as:

- How do you know the function of each part you have identified?
- What do you know about the growing conditions needed for the plant you have investigated?
- What do you know about how to care for your plant?

Elaboration Activity

Allow student groups to present information about the plants to others in the class.

Challenge audience members to question presenters about their plant and its parts.

Allow students to list all possible commonalities among plants being investigated. Lead them to the realization that all these plants represent important agricultural commodities produced in North Carolina.

Ask elaborative questions such as:

- What do you know about the uses of your plant?
- How/where is your plant transported, processed, marketed, and sold?
- How is your plant beneficial to people and/or animals?

Evaluation/Extension Activity

Read orally and discuss pages 18-25 of *Oh Say Can You Seed* by Bonnie Worth.

Sing and pantomime the song, "Roots, Stems, Leaves" by The Banana Slug String Band. Available for purchase in audio or video format at www.bananaslugstringband.com .

Name _____

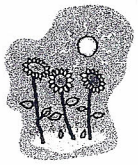
"Oh Say Can You Seed?"
By Bonnie Worth
Pre/Post Test

Directions: See how many of these questions you can answer ***before*** hearing the story and then see how much you have learned ***after*** hearing the story! Circle the "T" if you think the answer is true and circle the "F" if you think the answer is false. Don't change your "Before Hearing Story" answers, but be sure and answer the "After Hearing Story" answers correctly!

	Before Hearing Story		After Hearing Story	
1. Every flowering plant starts out as a seed.	T	F	T	F
2. Bean seeds have 2 parts.	T	F	T	F
3. The baby plant inside of a seed is called the embryo.	T	F	T	F
4. The cotyledon is where food is stored in the bean seed.	T	F	T	F
5. The part of the plant growing above the ground is called the root system.	T	F	T	F
6. Food making is done in the roots of the plants.	T	F	T	F
7. Photosynthesis is the food-making process done by plants.	T	F	T	F
8. Plants give off carbon dioxide.	T	F	T	F
9. Bees help carry pollen from plant to plant.	T	F	T	F
10. Nuts are fruits.	T	F	T	F
11. Bur seeds are "hitchhikers".	T	F	T	F
12. Plants are the only living things on Earth that make their own food.	T	F	T	F

Florida Agriculture in the Classroom, Inc.
For more "Oh Say Can You Seed?" activities go to www.agtag.org

Name _____



Glossary for "*Oh Say Can You Seed?*"
(pp. 43-43 of text)

1. Carbon dioxide: The gas humans and animals breathe out, and green plants use to make food.
2. Cotyledon: The first leaf or pair of leaves within the embryo. A part of the seed that stores food.
3. Edible: Fit to eat
4. Embryo: The part of a seed that develops into a new plant, including the stem, leaves and roots.
5. Fertilization: Male (or sperm) cells contained in pollen reach the female (or egg) cells in the ovules and the combination grows into seeds.
6. Minerals: Materials that is neither animal nor vegetable. Found in rocks and soil, they help animals and plants to grow.
7. Nectar: The sweet liquid secreted by a flower to attract pollinators like bees, butterflies and hummingbirds.
8. Numero: The Spanish word for "number".
9. Ovule: The part of the plant in the ovary that contains egg cells and becomes a seed after fertilization.
10. Oxygen: The gas humans and animals breathe in order to stay alive, and green plants produce when making food.
11. Photosynthesis: The process in which green plants, powered by the energy of the sun, combine carbon dioxide and water to produce sugar inside their leaves and release oxygen into the air.
12. Pistil: The ovule-bearing, female reproductive part of a flowering plant that includes the stigma, style and ovary.
13. Plantain: A kind of banana that is best eaten when cooked.
14. Pollen: The minute grains that are produced in the anthers of a flower and contain male sex cells.
15. Stamen: The male reproductive part of a flowering plant that includes the anthers and the filaments that support the anthers.

Language Ideas:
Use these vocabulary words to have students illustrate the meanings, make a plant dictionary, put in alphabetical order, use in sentences, make a plant booklet, etc.

Lesson Extension:
On a separate page, draw a diagram of a plant. Be sure to include the roots, stem, leaves and flowers. **Label each part**.

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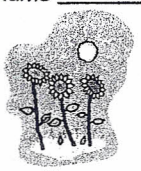
Name _____



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For more "Oh Say Can You Seed?" activities go to www.agtag.org

Name _____

*Use the phrases about plant parts on the next page to fill in the following table. Write the sentences under the correct headings. One has been done for you.

"Oh Say Can You Seed?"

Roots	Stem	Leaves	Flowers
Grow underground			

Use the phrases below to fill in the table about plant parts.

grows underground

acts like a pipe to carry water up the plant

photosynthesis occurs

pollen is found

food-making for the plant is done here

absorbs minerals from the ground

look twisty and hairy

is where the leaves are attached

anchors the plant

gives the plant support

petals

oxygen is released

have different "edges"

stamen

stoma is found

nectar is found

"Oh Say Can You Seed?" (Answer Sheet)

"Oh Say Can You Seed?"

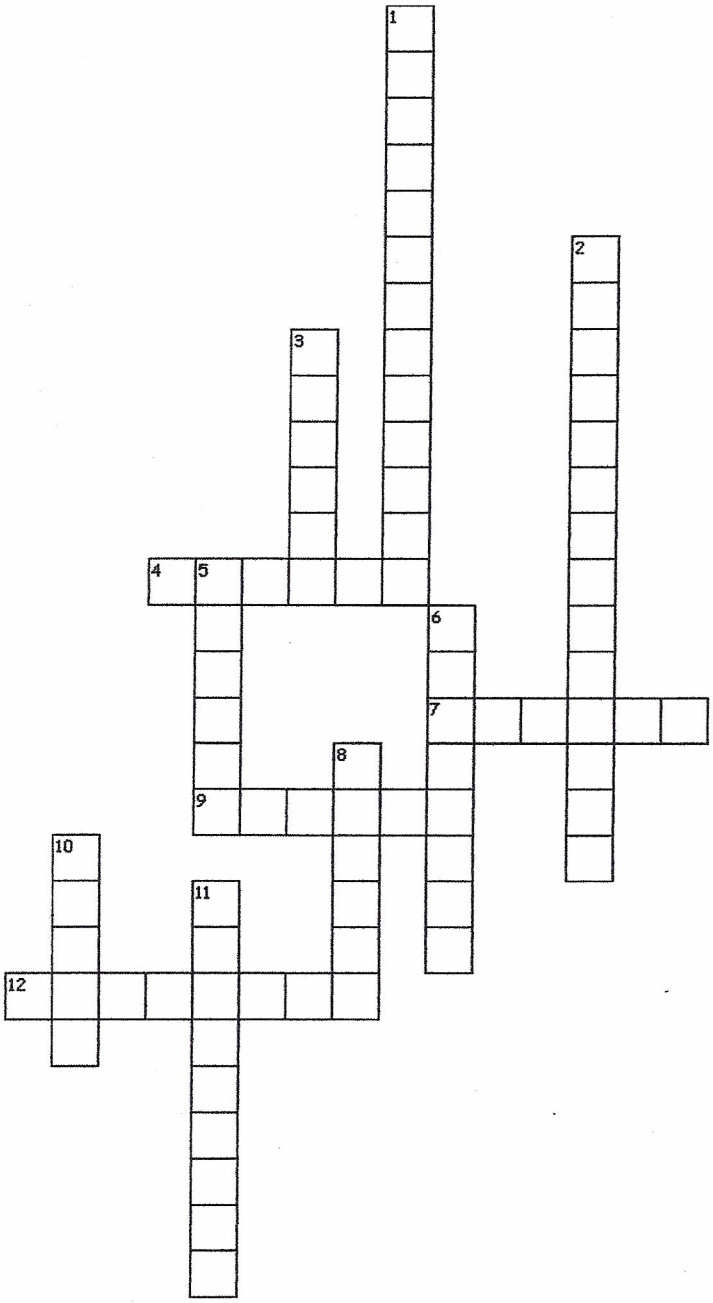
Teacher's Answers to Pre/Post Test
(page numbers where found in text provided!)

1. T p. 7
2. F p. 13 (seeds have 3 parts)
3. T p. 14
4. T p. 15
5. F p. 19 (shoot system)
6. F p. 28 (leaves)
7. T p. 25
8. F p. 29 (oxygen)
9. T p. 31
10. T p. 35
11. T p. 36
12. T p. 26

Completed Chart:

Roots	Stem	Leaves	Flowers
Grows underground	Acts like a pipe to carry water up the plant	Photosynthesis occurs	Pollen is found
Anchors the plant	Is where leaves are attached	Food-making is done here	Nectar is found
Look twisty and hairy	Gives the plant support	Stoma is found	Petals
Absorbs minerals from the ground		Oxygen is released	Stamen
		Have different "edges"	

Oh Say Can You Seed? Puzzle #2



Crossword Puzzle Clues for
Oh Say Can You Seed?

Across
4. The minute grains that are produced in the anthers of a flower and contain male sex cells.
7. Spanish word for "number".
9. The sweet liquid secreted by a flower to attract pollinators like bees, butterflies, and hummingbirds.
12. A kind of banana that is best eaten when cooked.

Down
1. When the male cells contained in pollen reach the female cells in the ovules and cause them to grow into seeds.
2. The process by which green plants, powered by the energy of sunlight, combine carbon dioxide and water to produce sugar inside their leaves and release oxygen into the air.
3. The ovule-bearing, female reproductive part of a flowering plant that includes the stigma, style, and ovary.
5. The gas humans and animals must breathe in order to stay alive and which green plants produce when making food.
6. Materials that are neither animal nor vegetable, found in rocks and soil and help animals and plants to grow.
8. The male reproductive part of a flowering plant that includes the anthers and the filaments that support the anthers.
10. The part of the plant in the ovary that contains egg cells and becomes a seed after fertilization.
11. The first leaf or pair of leaves within the embryo that stores food.

Student's Name _____

Oh Say Can You Seed? Puzzle #1

E T M O P T S C V W O E G N Q
I V I S O R P U E L Z V L U H
C Q N M L Y P R N V K H U H A
P C E W L L Z J A L Q L A L G
X S R F E V Y R U T I D L T E
I Z A U N Q U Q T P C G O N N
Q E L D X L V H P E V E H O K
L Z S N E G Y X O T P F N T F
N O F E R T I L I Z A T I O N
T C O T Y L E D O N F M F M U
G C D V B P I S T I L X T S S
P H O T O S Y N T H E S I S W
L V W E W U Z N R D L W A Z R
C S A V S T A M E N Q C Z C Q
P J I I B F E M B R Y O P P A

Cotyledon
Embryo
Fertilization
Food
Leaf
Minerals
Nectar
Ovule
Oxygen
Photosynthesis
Pistil
Pollen
Stamen
Sunlight