

PLANTING THE SEEDS OF KNOWLEDGE

Grade Level: 5th Grade

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Length of Unit: 14 days

I. ABSTRACT

This unit presents a program of basic studies focusing on green plant structures and processes as found in the Fifth Grade section of the *Core Knowledge Sequence*. The study will include hands-on experience and observations based on the scientific method. Students will develop a basic knowledge of vascular and non-vascular plants, the basic need for photosynthesis, and the importance of reproduction and germination.

II. OVERVIEW

A. Concept Objective for this unit:

1. Students will develop an awareness of plant structures and life processes.

B. Content from the *Core Knowledge Sequence*

1. Structure: Non-vascular and vascular plants- Non-vascular plants (for example, algae), Vascular plants- Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant; Parts and functions of vascular plants: roots, stems and buds, leaves – pg. 127
2. Photosynthesis – Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis= putting together). Unlike animals, plants make their own food, through the process of photosynthesis, Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)-pg. 127
3. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127

C. Skill Objectives:

1. Students will analyze and conduct investigations based on the living processes in the life of a green plant.
2. Students will compare and contrast vascular and non-vascular plants.
3. Students will observe and identify the patterns and structures of a plant in its environment using the scientific method.
4. Students will describe the process by which green plants manufacture food and light energy is changed to chemical energy and contrast that change to respiration.
5. Students will demonstrate the transpiration and water movement that occurs in plant leaves.

6. Students will analyze asexual reproduction using algae and vegetative reproduction, and sexual reproduction of spore-bearing plants, non-flowering seed plants, and flowering plants.
7. Students will identify and describe the parts of a flower and their functions in relation to development of seeds.
8. Students will describe pollination as the transfer of pollen from an anther to a stigma and fertilization as the uniting of a sperm with an egg.
9. Students will use experimentation to compare the different parts of a dicot and monocot seed and the location of the food for the plant.

III. BACKGROUND KNOWLEDGE

- A. For Teachers:
 1. Hirsch, Jr., E.D. *What Your Fifth Grader Needs to Know*. New York, New York: Doubleday, 1993, ISBN 0-385-31464-7
 2. Ortleb, Edward P. and Richard Cadice. *Plants*. St. Louis, Missouri: Milliken Publishing Company, 1986, ISBN1-55863-094-5
 3. *The Visual Dictionary of Plants*. New York, New York: Dorling Kindersley, Inc., 1992, ISBN 1-56458-016-4
- B. For Students:
 1. Review what plants need to grow
 2. Review the basic parts of a plant
 3. Review how plants make their own food
 4. Review the two types of plants (deciduous, evergreen)
 5. {Optional} Review computer publishing program (for newsletter)

IV. RESOURCES

- A. *Core Knowledge Sequence*. Charlottesville, Virginia: Core Knowledge Foundation, 1999, ISBN 1-890517-20-8
- B. Hirsch, Jr., E.D. *What Your Fifth Grader Needs to Know*. New York, New York: Doubleday, 1993, ISBN 0-385-31464-7
- C. Hoover, E., Larimer, H., Mercier, S., & Walsh, M. *Aims: The Budding Botanist*. Fresno, California: Aims Education Foundation, 1993, ISBN 1-88-1431-40-1
- D. Ortleb, Edward P. and Richard Cadice. *Plants*. St. Louis, Missouri: Milliken Publishing Company, 1986, ISBN1-55863-094-5

V. LESSONS

Lesson One: Introduction to Plants

- A. *Daily Objectives*
 1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
 2. Lesson Content
 - a. Structure: Non-vascular and vascular plants- Non-vascular plants (for example, algae), Vascular plants- Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant; Parts and functions of vascular plants: roots, stems and buds, leaves-pg. 127
 - b. Photosynthesis – Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis= putting together). Unlike animals, plants make their own food, through the process of photosynthesis, Role in photosynthesis of: energy from

sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)-pg. 127

3. Skill Objective:
 - a. Students will analyze and conduct investigations based on the living processes in the life of a green plant.
 - b. Students will compare and contrast vascular and non-vascular plants.

B. *Materials*

1. Pen/pencil
2. Crayons/Map pencils
3. Overhead projector
4. My Garden Journal – pgs. A-1,5,7,10-12
5. Appendices A-2-4 made into transparencies
6. Various seeds that will be different (fruits, vegetables, flower, herb, other)
7. Milk Carton (cut in half)
8. Soil

C. *Key Vocabulary*

1. Bud - to put forth or produce buds; to begin to grow
2. Leaf - the main food producing part of a plant
3. Petals – leaf-like structures that attract bees and other insects
4. Roots – the part of a plant that absorbs water and nutrients and anchors the plant in the soil
5. Shoot – a young branch or growth; sprout
6. Stem – the plant part that supports the leaves and flowers of a plant and transports water, minerals, and food

D. *Procedures/Activities*

1. Pre-lesson activity: Students need to color Appendix A (My Garden Journal Cover).
2. Teacher will laminate and bind together pages:
 - Page 1 – “Why Plants Are Important” (A-1)
 - Page 2 – “Vascular & Non-Vascular Plants” Graphic Organizer (A-4)
 - Page 3 – “Seed Plants” Graphic Organizer (A-5)
 - Page 4 - “Reproduction” Graphic Organizer (A-6)
 - Page 5 – Vocabulary (A-7)
 - Page 6 - Vocabulary (A-8)
 - Page 7 – Vocabulary (A-9)
 - Page 8 – “Planting Seeds” (A-10)
 - Page 9 – “Observing My Plant” drawings (A-11)
 - Page 10 – “Observing My Plant” question/answer (A-12)
 - Page 11 – “Transpiration” (A-13)
 - Page 12 – “Photosynthesis and Respiration” (A-14)
 - Page 13 – “Parts Of A Flower” (A-15)
 - Page 14 - “Seed Facts” *Aims: The Budding Botanist* pg. 5
 - Page 15 – “Examples of Seeds” (A-16)
 - Page 16 – “Labeling Monocots & Dicots” (A-17)Teacher needs to add 5-10 sheets of notebook paper at end of journal for note taking activities.
3. Go over Appendix A-1 (Why Plants are Important) aloud and highlight important facts together
4. Go over Appendix A-2 (Vascular & Non-Vascular Plants) aloud and have students fill in missing information on Appendix A-5

5. Discuss key vocabulary and have students fill in on Appendix A- 7
 6. Fill milk cartons ½ full with soil
 7. Add seed to soil
 8. Add water to milk carton
 9. Place in sunlight
 10. Students will be keeping track of the water consumption and growth of their plant using Appendices A-10-12.
- E. *Assessment/Evaluation*
1. Teacher will pick up colored cover for lamination (pre-activity)
 2. Teacher will assess completion of predictions (A-10)

Lesson Two: The Difference Between Non-Vascular and Vascular Plants

- A. *Daily Objectives*
1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
 2. Lesson Content
 - a. Structure: Non-vascular and vascular plants- Non-vascular plants (for example, algae), Vascular plants- Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant; Parts and functions of vascular plants: roots, stems and buds, leaves.
 3. Skill Objective
 - a. Students will compare and contrast vascular and non-vascular plants
- Materials*
4. Pen/pencil
 5. Overhead projector
 6. *Plants* by Milliken pg. 1 (transparency) and 1a (handout)
 7. *Plants* by Milliken pg. 7 (transparency) and 7a (handout)
 8. My Garden Journal note-taking section, A-7
- B. *Key Vocabulary*
1. Non-vascular plants - absorb water through their plant tissue and do not have roots, stems, leaves, and flowers - must live in moist habitats because of required water for fertilization.
 2. Vascular plants – contain tube-like structures in the stem (xylem and phloem) that carry water and nutrients up the tubes and sugar down the tubes to be stored
- C. *Procedures/Activities*
1. Review Appendix A-2 (Vascular & Non-Vascular Plants) with students.
 2. Discuss key vocabulary and have students fill in on Appendix A-7
 3. Go over the transparency pg. 1 “Algae” aloud with the students using background information and concepts pg ii.
 4. Students will take notes in note-taking section of Garden Journal.
 5. Students will complete handout pg. 1a independently after discussion.
 6. Go over the transparency pg. 7 “Stems” aloud with the students using background information and concepts pg iv.
 7. Students will take notes in note-taking section of Garden Journal.
 8. Students will complete handout pg. 7a independently after discussion.
 9. Students may refer to Plant Journals for needed help.
- D. *Assessment/Evaluation*
1. Teacher will assess note-taking participation.
 2. Teacher will evaluate handout pgs. 1a and 7a.

Lesson Three: Roots and Leaves

A. Daily Objectives

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
2. Lesson Content
 - a. Structure: Non-vascular and vascular plants- Non-vascular plants (for example, algae), Vascular plants- Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant; Parts and functions of vascular plants: roots, stems and buds, leaves.
 - b. Photosynthesis – Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis= putting together). Unlike animals, plants make their own food, through the process of photosynthesis, Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)-pg. 127
3. Skill Objective
 - a. Students will compare and contrast vascular and non-vascular plants.

B. Materials

1. Pen/pencil
2. Overhead projector
3. *Plants* by Milliken pg. 6 (transparency) and 6a (handout)
4. *Plants* by Milliken pg. 8 (transparency) and 8a (handout)
5. My Garden Journal note-taking section & A-11&12

C. Key Vocabulary

1. None

D. Procedures/Activities

1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12).
2. Go over the transparency pg. 6 “Roots” aloud with the students using background information and concepts pg iv.
3. Students will take notes in note-taking section of Garden Journal.
4. Students will complete handout pg. 6a independently after discussion.
5. Go over the transparency pg. 8 “Leaves” aloud with the students using background information and concepts pg iv.
6. Students will take notes in note-taking section of Garden Journal.
7. Students will complete handout pg. 8a independently after discussion..

E. Assessment/Evaluation

1. Teacher will assess note-taking participation.
2. Teacher will evaluate handout pgs. 6a and 8a.

Lesson Four: AIMS: Enviroscope

A. Daily Objectives

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
2. Lesson Content
 - a. Structure: Non-vascular and vascular plants- Non-vascular plants (for example, algae), Vascular plants- Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the

plant; Parts and functions of vascular plants: roots, stems and buds, leaves – pg. 127

3. Skill Objective
 - a. Students will analyze and conduct investigations based on the living processes in the life of a green plant
 - b. Students will observe and identify the patterns and structures of a plant in its environment using the scientific method

B. *Materials*

1. *AIMS: The Budding Botanist* pgs iii, 1-4 “Enviroscape”
2. Pen/pencil
3. 120 cm piece of string
4. Trowel or digging tool
5. Magnifying lens (per student)
6. Writing paper/drawing paper
7. My Garden Journal – *AIMS* pg. iii(teacher transparency), Appendix A-5 (Seed Plants - student)
8. Overhead projector

C. *Key Vocabulary*

1. None

D. *Procedures/Activities*

1. Go over *AIMS* pg iii introducing seed plants and their basic parts.
2. Students will complete Appendix A-5 (Graphic Organizer).
3. Divide the students into groups and hand out materials.
4. Assign each group to layout one 30cm x 30 cm area of the school playground using string to make boundaries.
5. Instruct students to carefully evaluate their areas and their environment to determine what is around them –such as, blacktop, trees, or buildings, etc.
6. Instruct students to pick a plant and dig it up keeping the roots intact.
7. Students will draw and label the different parts of their seed plant on *AIMS* pg 3.
8. Students will describe the colors, shapes, textures, and smells of their seed plant on *AIMS* pg. 4.
9. Students will measure and record the widths and lengths of the four main parts of their seed plant on *AIMS* pg. 4.

E. *Assessment/Evaluation*

1. Teacher will bring class together to share plant observations and comparisons.
2. Teacher will evaluate completed drawings and labeling on *AIMS* pg. 3.
3. Teacher will evaluate participation and completion on *AIMS* pgs. 3-4.

Lesson Five: Photosynthesis and Respiration

A. *Daily Objectives*

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
2. Lesson Content
 - a. Photosynthesis – Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis= putting together). Unlike animals, plants make their own food, through the process of photosynthesis, Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)-pg. 127

3. Skill Objective
 - a. Students will describe the process by which green plants manufacture food and light energy is changed to chemical energy and contrast that change to respiration.
- B. *Materials*
1. *AIMS: The Budding Botanist* pgs. 80-83
 2. Elodea plant/Pondweed (can be purchased at pet store)
 3. Narrow bottle or test tube
 4. Containers for water or clear plastic cups
 5. *The Visual Dictionary of Plants* pgs. 32-33 and 52-53
 6. Pen/pencil
 7. Overhead projector
 8. *Plants* by Milliken pg. 11 (transparency) and 11a-b (handout)
 9. My Garden Journal- note taking section, A-7, & A-11&12
- C. *Key Vocabulary*
1. Carbon dioxide – a heavy colorless gas absorbed from the air by plants in photosynthesis (CO₂)
 2. Chlorophyll - the green pigment in plant cells
 3. Glucose – a kind of simple sugar
 4. Phloem – the tubes that carry glucose down the stem of the plant to be stored
 5. Photosynthesis – the process by which plants use the energy from the sunlight, carbon dioxide, and water to make food
 6. Stomata – openings in the epidermis (skin) of leaves through which oxygen, carbon dioxide, and water vapor enter and leave a plant
 7. Xylem – the tubes that carry water and nutrients up the stem of a plant
- D. *Procedures/Activities*
1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12).
 2. Review photosynthesis formula on Graphic Organizers - Appendices A2-teacher, pg iii *AIMS* on overhead projector as the students follow along in their Garden Journals.
 3. Discuss key vocabulary and have students fill in on Appendix A-7
 4. Discuss pg. 32-33 and 52-53 of *The Visual Dictionary of Plants*
 5. Give students a 7-8 cm piece of elodea and place it first into a test tube or small bottle filled with water.
 6. Turn the test tube upside down in a container half filled with water.
 7. Place the container and the test tube in the sun
 8. Students will observe whether or not photosynthesis is taking place as the sunlight is absorbed by the chlorophyll of the leaves and combines with carbon dioxide and water showing small oxygen bubbles on the elodea.
 9. Students will count the number of oxygen bubbles that leave the cut end of the elodea.
 10. Students will wait 20 minutes and recognize and measure the column of oxygen bubbles at the top of the test tube.
 11. Students will draw a diagram to explain the process taking place in the test tube as photosynthesis on *AIMS* pg 83.
 12. Go over the transparency pg. 11 “Photosynthesis” aloud with the students using background information and concepts pg vii.
 13. Students will take notes in note-taking section of Garden Journal.

14. Students will complete handout pg. 11a-b independently after discussion.
- E. *Assessment/Evaluation*
1. Teacher will evaluate drawing and descriptions of photosynthesis activity pgs. 82-83.
 2. Teacher will assess note-taking participation.
 3. Teacher will evaluate handout pgs. 11a-b.

Lesson Six: AIMS: Transpiration (2 days)

A. *Daily Objectives*

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes
2. Lesson Content
 - a. Photosynthesis – Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis= putting together). Unlike animals, plants make their own food, through the process of photosynthesis, Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)-pg. 127
3. Skill Objective(s)
 - a. Students will demonstrate the transpiration and water movement that occurs in plant leaves.

B. *Materials*

1. *AIMS: The Budding Botanist* pgs. 84-86
2. Plant – philodendron, geranium, ivy
3. Magnifying lens
4. Plastic bag
5. Clear finger nail polish
6. Microscope
7. Slides
8. Rubber bands or twist ties
9. *The Visual Dictionary of Plants* pgs. 30-31
10. My Garden Journal note taking section, A-7, & A-13 (Transpiration)

C. *Key Vocabulary*

1. Transpiration – loss of water vapor through the stomata of a leaf

D. *Procedures/Activities*

DAY ONE:

1. Review key vocabulary from Lesson 4.
2. Discuss key vocabulary and have students fill in on Appendix A-7.
3. Students will examine underneath the leaves of their plant to try and locate the stomata. Students will find that the stomata cannot be seen because they are too small.
4. Students will brush underneath the leaf with 5 to 6 layers of clear finger nail polish.
5. Students will allow the polish to dry then carefully peel the polish from the leaf.
6. Students will place the leaf on a slide and examine under microscope.
7. Students will draw what they examine on *AIMS* pg. 86.
8. Students will place a plastic bag over the leaves of the plant and close with a tie or rubber band to seal the plant.

9. Students will place the bag in the sun or under a lamp and check the bag every couple of hours to see what collects on the side of the bag.
10. Let stand for 24 hours then remove plant from bag.
11. Students will record results of observations on Appendix A-13 (Transpiration).

DAY TWO:

12. Students will observe the plant after 24 hours.
13. Students will complete Appendix A-13 (if needed).
14. Teacher will call on students to draw their pictures from Appendix A-11 on the board for discussion.
15. Students will complete Appendix A-14 (Photosynthesis & Respiration)

E. *Assessment/Evaluation*

1. Teacher will evaluate Appendix A-13 and A-14.

Lesson Seven: Asexual/Sexual Reproduction

A. *Daily Objectives*

1. Concept Objective(s)
 - a. Students will develop an awareness of plant structures and life processes
2. Lesson Content
 - a. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
3. Skill Objective
 - a. Students will analyze asexual reproduction using algae and vegetative reproduction, and sexual reproduction of spore-bearing plants, non-flowering seed plants, and flowering plants.

B. *Materials*

1. Appendix A-3 (Reproduction-teacher) and A-6 (Reproduction -student)
2. Pen/pencil
3. Overhead Projector
4. *The Visual Dictionary of Plants* pgs. 48 & 49
5. Flower Bulb
6. Strawberry Plant
7. Aged Potato
8. Airplane plant
9. Ginger Root
10. My Garden Journal A-8, A-11&12

C. *Key Vocabulary*

1. Asexual reproduction – reproduction without the use of two organisms; the organism simply makes a copy of itself through cell division

2. Budding – to reproduce asexually especially by the pinching off of a small part of the parent
 3. Bulb – a resting stage of a plant that is usually formed underground and consists of a short stem base bearing one or more buds enclosed in overlapping membranous or fleshy leaves
 4. Cloning – the asexual forming of an exact replica of a species
 5. Regeneration – the restoration or replacing of a living organisms part
 6. Reproduction – the process by which plants and animals give rise to an offspring by either an asexual or sexual way
 7. Sexual reproduction – reproduction by the joining of a male and female cell
- D. *Procedures/Activities*
1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12).
 2. Discuss key vocabulary and have students fill in on Appendix A-8.
 3. Teacher will discuss Appendix A-3 (Reproduction) with students and have them fill in information on Appendix A-6 (Reproduction -Graphic Organizer).
 4. Teacher will show examples of plants that use asexual reproduction.
- E. *Assessment/Evaluation*
1. Teacher will evaluate participation of A-6 (Reproduction - Graphic Organizer) in Garden Journals.

Lesson Eight: Spore-Bearing Plants

- A. *Daily Objectives*
1. Concept Objective(s)
 - a. Students will develop an awareness of plant structures and life processes
 2. Lesson Content
 - a. Skill Objective Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
 3. Skill Objective
 - a. Students will analyze asexual reproduction using algae and vegetative reproduction, and sexual reproduction of spore-bearing plants, non-flowering seed plants, and flowering plants.
- B. *Materials*
1. *What Your 5th Grader Needs to Know* pgs. 343-345
 2. *What Your 5th Grader Needs to Know* pgs. 344a “The Life Cycle Of A Moss” transparency
 3. *What Your 5th Grader Needs to Know* pgs. 344b “The Life Cycle Of A Fern” transparency
 4. Pen/pencil

5. Overhead projector
 6. *Plants* by Milliken pg. 2 (transparency) and 2a (handout)
 7. *Plants* by Milliken pg. 3 (transparency) and 3a (handout)
 8. My Garden Journal note-taking section & A-8
- C. *Key Vocabulary*
1. Spore – a type of seed produced by a fungus
- D. *Procedures/Activities*
1. Discuss key vocabulary and have students fill in on Appendix A-8.
 2. Teacher will go over transparency “The Life Of A Moss” and explain how a moss reproduces itself (pg. 343).
 3. Go over the transparency pg. 2 “Moss” aloud with the students using background information and concepts pg ii.
 4. Students will take notes in note-taking section of Garden Journal.
 5. Students will complete handout pg. 2a independently after discussion
 6. Teacher will go over transparency “The Life Of A Fern” and explain the similarities and differences of moss and fern reproduction (pg. 343 & 345).
 7. Go over the transparency pg. 3 “Ferns” aloud with the students using background information and concepts pg ii-iii.
 8. Students will take notes in note-taking section of Garden Journal.
 9. Students will complete handout pg. 3a independently after discussion
- E. *Assessment/Evaluation*
1. Teacher will assess note-taking participation.
 2. Teacher will evaluate handout pgs. 2a and 3a.

Lesson Nine: Sexual Reproduction: Non-flowering and Flowering plants

- A. *Daily Objectives*
1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes
 2. Lesson Content
 - a. Skill Objective Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
 3. Skill Objective(s)
 - a. Students will analyze asexual reproduction using algae and vegetative reproduction, and sexual reproduction of spore-bearing plants, non-flowering seed plants, and flowering plants.
- B. *Materials*
1. Pen/pencil
 2. Overhead projector
 3. *Plants* by Milliken pg. 4 (transparency) and 4a (handout)

4. *Plants* by Milliken pg. 5 (transparency) and 5a (handout)
 5. My Garden Journal note-taking section, A-8, & A11-12
- C. *Key Vocabulary*
1. Gymnosperm – a plant whose seeds are produced in cones
 2. Angiosperm – a flowering plant that produces seeds within fruits
- D. *Procedures/Activities*
1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12).
 2. Discuss key vocabulary and have students fill in on Appendix A-8.
 3. Go over the transparency pg. 4 “Gymnosperms” aloud with the students using background information and concepts pg iii.
 4. Students will take notes in note-taking section of Garden Journal.
 5. Students will complete handout pg. 4a independently after discussion.
 6. Go over the transparency pg. 5 “Angiosperms” aloud with the students using background information and concepts pg iii-iv.
 7. Students will take notes in note-taking section of Garden Journal.
 8. Students will complete handout pg. 5a independently after discussion.
- E. *Assessment/Evaluation*
1. Teacher will assess note-taking participation.
 2. Teacher will evaluate handout pgs. 4a and 5a.

Lesson Ten: Flower Model

- A. *Daily Objectives*
1. Concept Objective(s)
 - a. Students will develop an awareness of plant structures and life processes
 2. Lesson Content
 - a. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
 3. Skill Objective(s)
 - a. Students will identify and describe the parts of a flower and their functions in relation to development of seeds.
- B. *Materials*
1. Pen/pencil
 2. My Garden Journal A-8
 3. Appendix B- Flower Model
 4. Bathroom tissue tube
 5. Seven 6-inch lengths of string
 6. Two straws
 7. One 9x12 sheet of green construction paper

8. One 8x8 sheet of construction paper –color optional
9. Two 15 inch pipe cleaners (one green, one yellow)
10. Cornmeal
11. Ruler
12. Tape
13. Scissors
14. Glue

C. *Key Vocabulary*

1. Pistil – the female part of a plant, consisting of an ovary, style, and stigma.
2. Sepals – green leaf-like structures that surround and protect a flower bud.
3. Stamen – a pollen-producing structure of a flower consisting of the filament and anther.
4. Stigma – the part of a pistil of a flowering plant that receives the pollen.
5. Style - the stem-like part of the pistil of a flower having a stigma at its top.

D. *Procedures/Activities*

1. Discuss key vocabulary and have students fill in on Appendix A-8.
2. Cut a 4 ½ x 6” piece from the green paper and tape it around the tissue tube. Label tissue tube “stem”.
3. Tape the seven pieces of string inside the tissue tube so they hang about 5 inches down from the tube. Inside the tube, label “roots” and draw an arrow pointing to the string.
4. Cut the straws the same length as the tube and label one straw (with Sharpie) “xylem” with an up arrow, and the other one “phloem” with a down arrow and tape them on the inside of the tube.
5. Fold the remaining green paper in half.
6. Cut out the sepals pattern (Appendix B) and place it on the folded green paper to trace.
7. Cut out traced sepals and label them “sepals”.
8. Fold the other construction paper into fourths.
9. Cut out the petals pattern (Appendix B) and place it on the folded paper to trace.
10. Cut our traced petals and label them “petals”.
11. Tape the sepals under the petals so the green leaves can be seen.
12. Fold the petals upward so they appear to “stand up”.
13. Cut the yellow pipe cleaner into five 3-inch pieces.
14. Cut a 3-inch piece from the green pipe cleaner.
15. Make a small hole in the center of the petals and sepals.
16. Insert the pipe cleaner pieces into the hole with the green piece surrounded by the yellow pieces.
17. Twist the bottoms of the pipe cleaners together to hold them in place under the sepals.
18. Slightly bend the yellow pipe cleaners back so they fan out.
19. Tape the sepals and petals in place on top of the tissue tube stem.
20. Leaves: Trace leaves (Appendix B) and cut out from remaining green paper. Add veins to the leaves and label “leaves” on the underside and “veins” to the top. Tape to the stem.
21. Pollen: place a dot of glue at the end of each yellow pipe cleaner (stamen). Sprinkle cornmeal to represent pollen.

E. *Assessment/Evaluation*

1. Teacher will check vocabulary in Garden Journal.

2. Teacher will check for correct labeling on model.

Lesson Eleven: AIMS: A Flower Study

A. Daily Objectives

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes
2. Lesson Content
 - a. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
3. Skill Objective(s)
 - a. Students will identify and describe the parts of a flower and their functions in relation to development of seeds.

B. Materials

1. *AIMS: The Budding Botanist* pgs. 49-52 and pg. 53 as transparency
2. Pen/pencil
3. My Garden Journal -A-9, A-15 (Parts of a Flower), note taking section, A11-12
4. Overhead projector
5. *Plants* by Milliken pg. 9 (transparency) and 9a (handout)
6. Flower
7. Knife
8. Magnifying lens
9. Small square of black paper

C. Key Vocabulary

1. Anther – the part of the stamen of a flower that bears pollen.
2. Filament –the stalk-like part of the stamen that supports the anther.
3. Receptacle – the expanded tip of a peduncle to which the various parts of a flower are attached, called a flower base.
4. Ovary – the rounded, bottom part of a pistil where ovules are located; the mature ovary develops into the fruit.
5. Ovule – the parts of a flower that contain egg cells and develop into seeds

D. Procedures/Activities

1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12).
2. Discuss key vocabulary and have students fill in on Appendix A-9.
3. Go over the transparencies pg. 9 “Flowers” and pg. 53 (AIMS) aloud with the students using background information and concepts pg vi.
4. Students will take notes in note-taking section of Garden Journal.
5. Students will label Appendix A-15.
6. Students will complete handout pg. 9a independently after discussion.

7. Students will use *AIMS* pg. 51 to observe and record observations of their flower.
 8. Students will remove the sepals from their flower and sketch, count, measure, and describe them on *AIMS* pg. 52.
 9. Students will remove the petals from their flower and sketch, count, measure, and describe them. *AIMS* pg. 52.
 10. Students will locate the stamens and remove them. Identify the anther and the filament. Sketch, count, measure, and describe each.
 11. Students will use the square of black paper to press the anthers against the paper to make a pollen print.
 12. Discuss how pollen is needed by the flowers for fertilization.
 13. Students will remove the pistil from their flower and observe the parts (stigma, style, ovary). Sketch, count, measure, and describe on *AIMS* pg. 52.
 14. Students will sketch, count, measure, and describe receptacle and stem on *AIMS* pg. 52.
 15. Gather students together and discuss what parts were easy or hard to find.
- E. *Assessment/Evaluation*
1. Teacher will assess note-taking participation.
 2. Teacher will evaluate handout pg. 9a.

Lesson Twelve: Pollination and Fertilization

A. *Daily Objectives*

1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes
2. Lesson Content
 - a. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
3. Skill Objective(s)
 - a. Students will describe pollination as the transfer of pollen from an anther to a stigma and fertilization as the uniting of a sperm with an egg.

B. *Materials*

1. Pen/pencil
2. Overhead projector
3. *Plants* by Milliken pg. 10 (transparency) and 10a (handout)
4. My Garden Journal –note taking section & A-10

C. *Key Vocabulary*

1. Fertilization – the joining of the sperm cell and the egg cell.
2. Pollen – the yellow dust-like powder produced by the male part of the flowering plant.

3. Pollinate – to transfer pollen from its site of formation to a receptive surface where it may germinate.
- D. *Procedures/Activities*
1. Discuss key vocabulary and have students fill in on Appendix A-10.
 2. Students will observe their “Flower Model” from lesson 10 and visualize the cornmeal as pollen.
 3. Go over the transparency pg. 10 “Pollination and Fertilization” aloud with the students using background information and concepts pg vi.
 4. Students will take notes in note-taking section of Garden Journal.
 5. Students will complete handout pg. 10a independently after discussion.
- E. *Assessment/Evaluation*
1. Teacher will assess note-taking participation.
 2. Teacher will evaluate handout pg. 10a.

Lesson Thirteen: AIMS: Dissect a Seed

- A. *Daily Objectives*
1. Concept Objective
 - a. Students will develop an awareness of plant structures and life processes.
 2. Lesson Content
 - a. Reproduction – Asexual reproduction, example of algae, Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems; Sexual reproduction by spore-bearing plants (for example, mosses and ferns); Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination; Sexual reproduction of flowering plants (for example, peas), Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule), Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit; Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn), and dicots (for example, beans)-pg. 127
 3. Skill Objective
 - a. Students will use experimentation to compare the different parts of a dicot and monocot seed and the location of the food for the plant.
- B. *Materials*
1. *AIMS: The Budding Botanist* pgs. 5 (Garden Journal pg. 14) and 13-16
 2. My Garden Journal – A-10, A-16-17, and 11-12
 3. Transparency Appendix C and D
 4. Magnifying Lens (or microscope)
 5. Seeds (lima, pinto, corn)
 6. Scissors
 7. Pen/pencil
 8. *Plants* by Millken pg.10b
- C. *Key Vocabulary*
1. Cotyledon – a seed leaf that usually stores food.
 2. Dicotyledon (dicot) – a group of flowering plants that have seeds with two seed leaves.
 3. Embryo – the tiny plant within a seed.
 4. Endosperm – stored food in the seeds.

5. Germinate – to begin to grow or sprout.
6. Monocotyledon (monocot) – a group of flowering plants that have seeds within one seed leaf.
7. Seed - a ripened ovule that contains a baby plant and its stored food.

D. *Procedures/Activities*

1. Students will observe and record changes taking place with their seed plant from lesson 1 (Appendices A11 & 12). Make sure pgs. A10-12 are completed at this time.
2. Discuss key vocabulary and have students fill in on Appendix A-10.
3. Go over and discuss *AIMS* pg. 5 and have students highlight important information.
4. Go over Transparency Appendix C and have students complete Appendix 16 (Examples of Seeds) in Garden Journals.
5. Go over Transparency Appendix D and have students complete Appendix 17 (Labeling Monocots & Dicots) in Garden Journals.
6. Pass out *Plants* pg. 10b and discuss go over aloud with students.
7. Teacher will have the students examine the outer wall of the dry and soaked DICOT bean seed.
8. Students will draw what they examine on their Recording Sheet *Aims* pg. 15.
9. Students will carefully remove the seed coat from the seed.
10. Teacher will discuss with the students why they feel the seed needs a coat.
11. Students will try and remove the seed coat from the dry seed and compare to the soaked seed.
12. Students will carefully split the seed into two parts and determine that it is a dicot seed.
13. Students will examine the different parts inside the seed with hand lens and look for the leaves, stem, and root stalk of the embryo.
14. Students will find the food storage area of the seed.
15. Students will draw their examinations of their recording sheet *Aims* pg. 15 and write at least 5 examinations of the dicot seed.
16. Teacher will have the students examine the outer wall of the dry and soaked MONOCOT corn seed.
17. Students will remove the outer coat of the soaked corn seed and draw their examinations on *Aims* pg. 16.
18. Students will try and split the corn seed into two parts and recognize that it won't split like the bean seed.
19. Students will record these observations on *Aims* pg. 16 *Aims* pg. 16 and cut the corn seed with scissors lengthwise.
20. Students will use their hand lenses and locate the embryo of the corn seed.
21. Students will draw their observations on *Aims* pg. 16 and write at least 5 examinations of the monocot seed.
22. Students will compare and contrast the two seeds.
23. Teacher will choose from student's sentences to list on the board for class discussion.

E. *Assessment/Evaluation*

1. Teacher will assess labeling, note-taking, and activity participation.

VI. CULMINATING ACTIVITY (Optional)

- A. The teacher can bring in different types of food such as Roots: turnips, carrots, potatoes, beets, Bulbs: onions, radishes, Leaves: cabbage, lettuce, parsley, Stems: celery, broccoli,

Buds: brussel sprouts, Seeds: peanuts, peas, corn, Fruits: strawberries, blueberries, peaches, Flowers: heads of broccoli and cauliflower, and have the students determine which part of the plant each one comes from.

- B. The students can use a publishing program to create a newsletter describing a new plant discovery.
- C. The teacher can use rubric (Appendix E) to grade completed Garden Journal.
- D. The teacher can give vocabulary and/ or unit test

VII. HANDOUTS/WORKSHEETS

Appendix A “My Garden Journal”
Appendix A-1 “Why Are Plants Important”
Appendix A-2 “Vascular & Non-Vascular Plants”
Appendix A-3 “Reproduction”
Appendix A-4 Graphic Organizer “Vascular & Non-Vascular Plants”
Appendix A-5 Graphic Organizer “Seed Plants”
Appendix A-6 Graphic Organizer “Reproduction”
Appendix A-7 “Vocabulary”
Appendix A-8 “Vocabulary”
Appendix A-9 “Vocabulary”
Appendix A-10 “Planting Seeds”
Appendix A-11 “Observing Plant” drawings
Appendix A-12 “Observing Plant” question/answer
Appendix A-13 “Transpiration”
Appendix A-14 “Photosynthesis & Transpiration”
Appendix A-15 “Parts of a Flower”
Appendix A-16 “Examples of Seeds”
Appendix A-17 “Labeling Monocots & Dicots”
Appendix B “Flower Model”
Appendix C “Examples of Seeds”
Appendix D “Parts of Seeds”
Appendix E Rubric for grading Garden Journal

VIII. BIBLIOGRAPHY

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- F. Stonehouse, Bernard. *A Closer Look At Plant Life*. New York, New York: Gloucester Press, 1978, ISBN 0531-01430-4
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Appendices

Why Plants Are Important!

My Garden Journal

Name: _____



Planting the Seeds of Knowledge, Grade 5 Appendix A

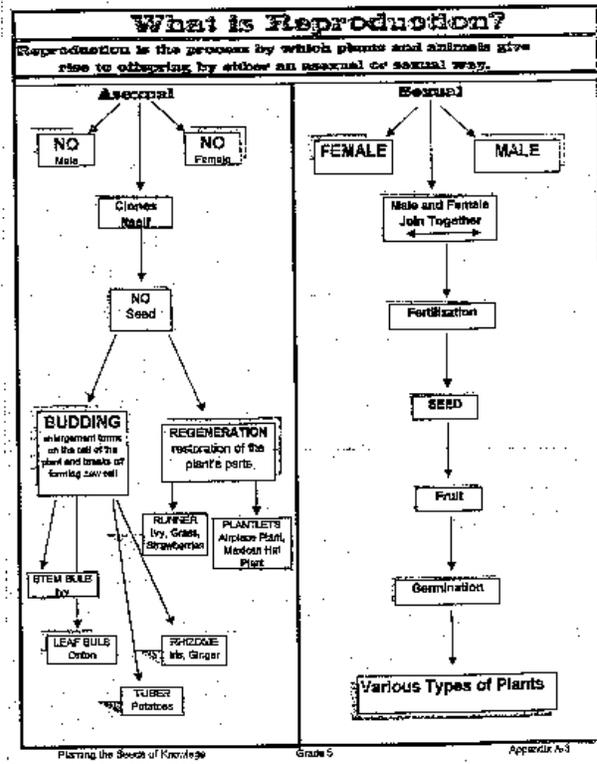
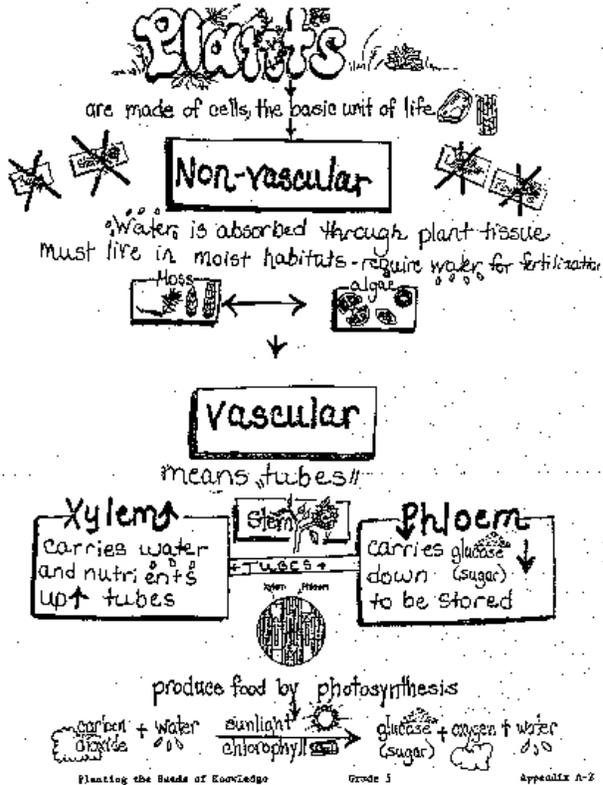
Did you know that plants are the basis of life for the entire world? Plants exist almost everywhere on earth. They can grow in the hottest places of the dry desert, very dark waters of the deep ocean, frigid cold of Polar Regions, and on the highest peaks of the tallest mountains. Plants are the determining factor of whether any animal life will inhabit a certain ecosystem.

Plants are not only pretty, but they are also interesting. They produce food for consumption and flowers for human pleasure. They appeal to all the human senses through sight, smell, touch, and taste. In the process, they are able to carry on their own life by making their own food and reproducing themselves. As we study plants in the upcoming unit, you will see they have an amazing and complex structure. They have a surprising way of adapting and surviving under very different environmental conditions.

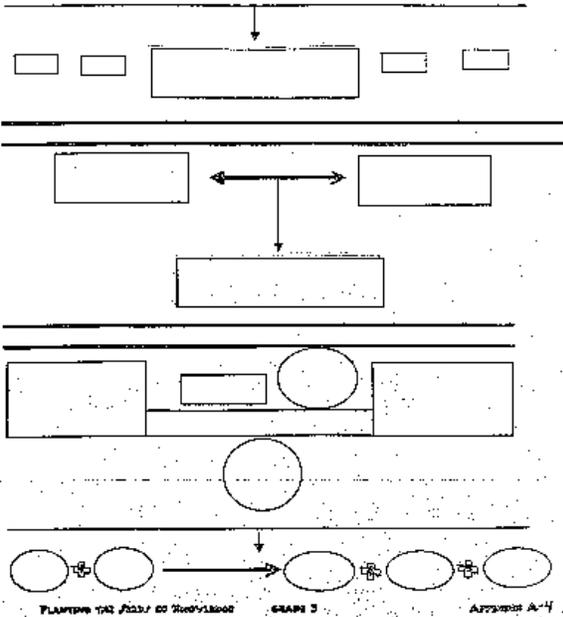
Societies have relied on plants in innumerable and most times unrecognizable ways. Humans have depended upon plants since creation. They have been surrounded by vegetation and it has been the basis of their survival. Fruits, berries, grains, and roots were the main diet for primitive man. They also use herbs, roots, bark, and berries as healing devices and medicine. Plants have provided the basic needs to humans' lives by providing food, clothing, and shelter using items like lumber, thatch, and grasses.

Every living thing, basically, depends upon plant life for their survival. Green plants are the only life form that can convert solar energy to food energy. The sun provides solar energy to earth, but this energy cannot be used directly by the human population and animals. Light energy is converted to chemical energy and is stored in the food made by green plants. This makes a chain that begins with a plant creating its own food. Animals then eat the plants, and we eat animal products as well as the green plants, themselves. All the food in the world comes from the amazingly talented green plants.

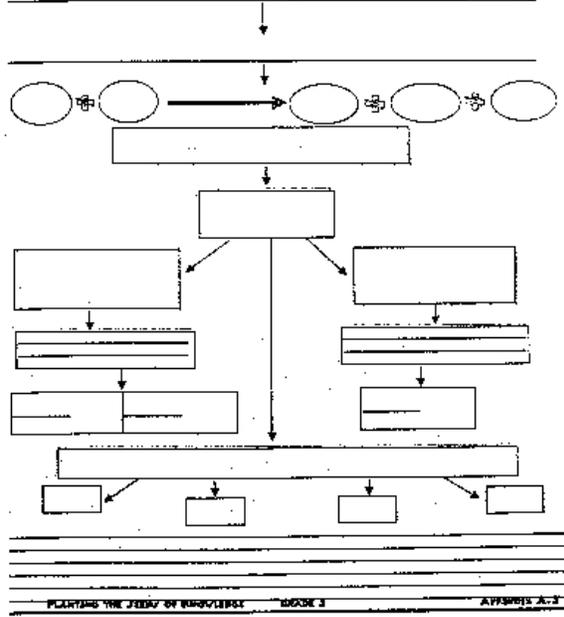
Planting the Seeds of Knowledge, Grade 5 Appendix A-1



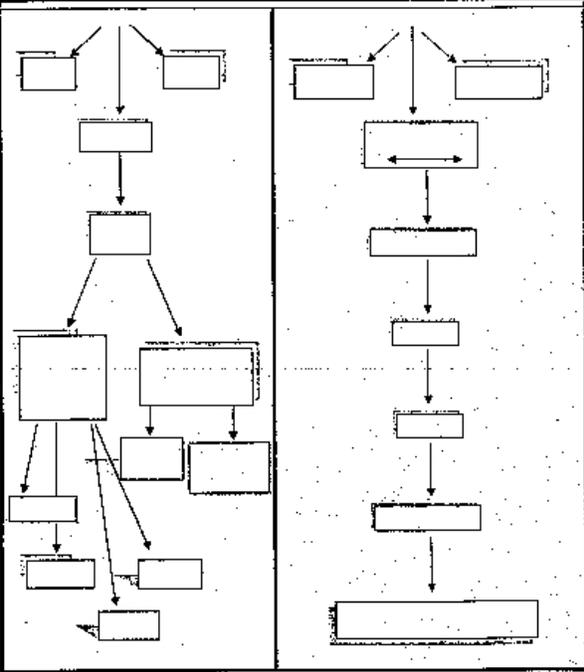
PLANTS



PLANTS



What is Reproduction?



Vocabulary

- Lesson 1:
 Bud _____
 Leaf _____
 Petals _____
 Roots _____
 Shoot _____
 Stem _____
- Lesson 2:
 Non-vascular plants _____
 Vascular plants _____
- Lesson 5:
 Carbon Dioxide _____
 Chlorophyll _____
 Glucose _____
 Phloem _____
 Photosynthesis _____
 Stomata _____
 Xylem _____
- Lesson 6:
 Transpiration _____

Lesson 7:
 Asexual Reproduction _____
 Budding _____
 Bulb _____
 Cloning _____
 Regeneration _____
 Reproduction _____
 Sexual Reproduction _____

Lesson 8:
 Spore _____

Lesson 9:
 Angiosperm _____
 Gymnosperm _____

Lesson 10:
 Pistil _____
 Sepals _____
 Stamen _____
 Stigma _____
 Style _____

Planting Seeds

I predict that I am planting this type of seed: (circle one)
 Monocot Dicot

I made this prediction because:

To be determined later:

The seed I planted was a _____ seed because

Date I planted my seeds: _____

Here are the directions to plant my seeds:

I predict my plant will be a:

- Flower Vegetable Other
 Fruit Herb

My plant was a _____ and I know this because:

Plants need water!

"Check off each day you water your plant"

My watering schedule:

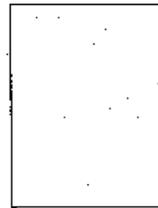
Sun	Mon	Tues	Wed	Thurs	Fri	Sat

Lesson 11:
 Anther _____
 Filament _____
 Receptacle _____
 Ovary _____
 Ovule _____

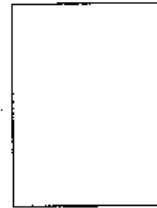
Lesson 12:
 Fertilization _____
 Pollen _____
 Pollinate _____

Lesson 13:
 Cotyledon _____
 Dicotyledon _____
 Embryo _____
 Endosperm _____
 Gamusate _____
 Monocotyledon _____
 Seed _____

Observing my Plant



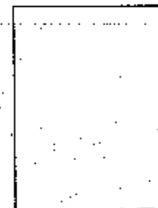
A drawing of my plant after 2 days



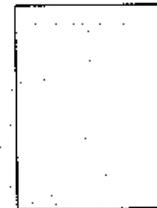
A drawing of my plant after 4 days



A drawing of my plant after 9 days



A drawing of my plant after 11 days



A drawing of my plant after 16 days



A drawing of my plant after 18 days

Observing My Plant

Date	Plant Height
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

After my plant is grown, I will:

Words that describe my plant:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Transpiration



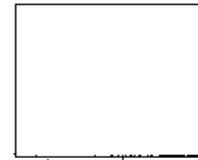
What I saw the first time I checked my plant



What I saw the second time I checked my plant



What I saw the third time I checked my plant



What I saw 24 hours after the activity

Photosynthesis Vs. Transpiration

Photosynthesis

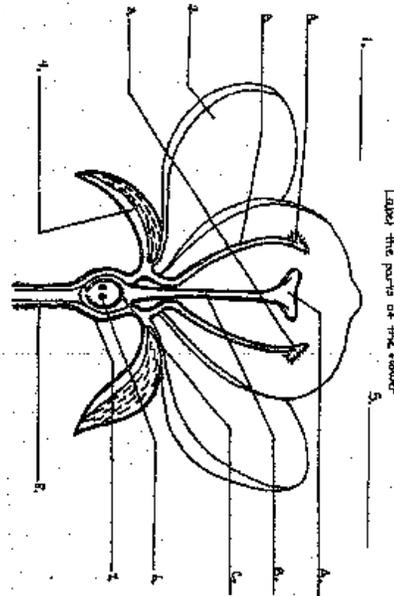
1. What is photosynthesis?
2. What is the formula for photosynthesis?
3. What took place in the photosynthesis activity? Explain.
4. How does this activity relate to photosynthesis?

Transpiration

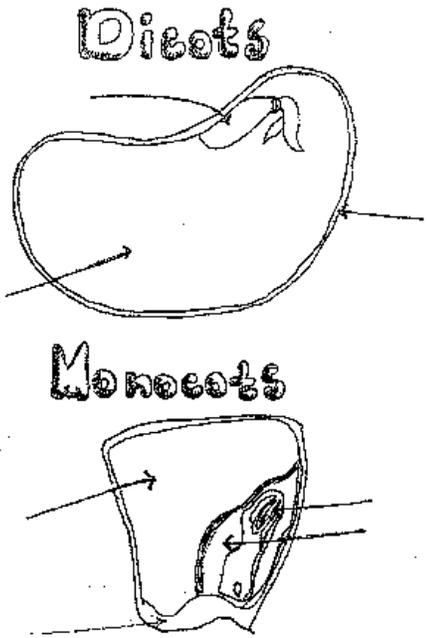
1. What is transpiration?
2. What took place in the transpiration activity? Explain.
3. How does this activity relate to transpiration?
4. Compare and contrast photosynthesis and transpiration?

Planting the Seeds of Knowledge, Grade 5

Appendix A-15



Label the parts of the flower.



Planting the Seeds of Knowledge, Grade 5

Appendix A-17



EXAMPLES OF SEEDS



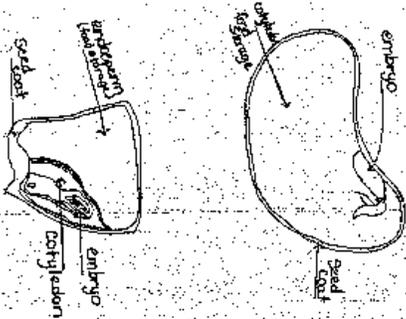
EXAMPLES OF DICOTS

EXAMPLES OF MONOCOTS

Planting the Seeds of Knowledge

Grade 5

Appendix A-18



EXAMPLES OF SEEDS



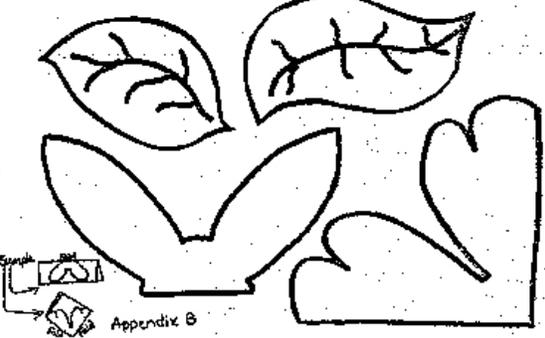
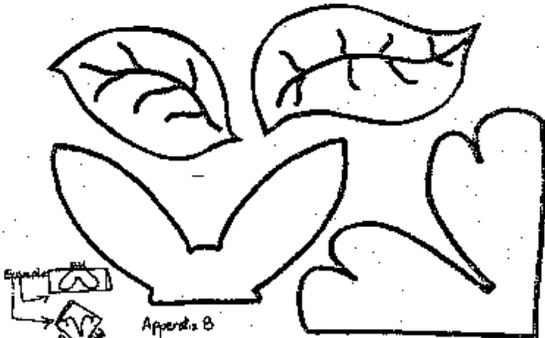
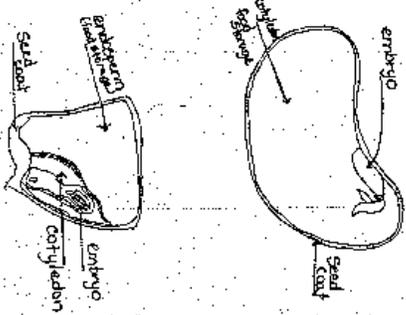
EXAMPLES OF DICOTS

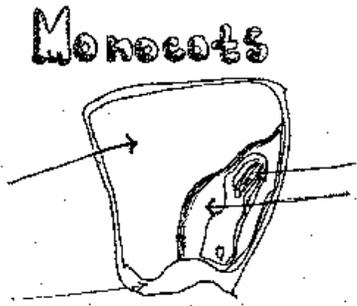
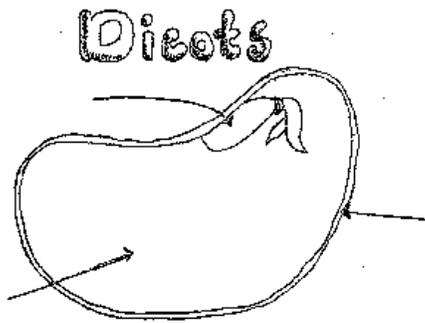
EXAMPLES OF MONOCOTS

Planting the Seeds of Knowledge

Grade 5

Appendix B





Planting the Seeds of Knowledge, Grade 5

Appendix D

My Garden Journal—Scoring Rubric

Content	Points Possible	Teacher evaluation
Cover page		
* Colored	2	
Why Plants are Important		
* Highlighted information	4	
Vascular & Non-Vascular Plants		
* Graphic Organizer complete	5	
Seed Parts		
* Graphic Organizer complete	5	
Reproduction		
* Graphic Organizer complete	5	
Vocabulary		
* 1/2 point for each word	25	
Planting Seeds		
* Photographs/watering schedule	5	
Plant Drawings		
* 1/2 pt for each completed drawing	5	
Plant Observations		
* Each day complete (1/2 pt for each day)	5	
* After plant grows, compare	2	
* 6 descriptive words of plant (1/2 pt for each)	3	
Transpiration		
* 1 pt for each drawing	4	
Photosynthesis & Transpiration		
* Questions complete	8	
Parts of a Flower		
* 1 pt for each part	15	
Seed Facts		
* Highlighted information	4	
Examples of Seeds		
* Types correct	4	
Labeling		
* Dicot	3	
* Monocot	4	
TOTAL POINTS	100	

Planting the Seeds of Knowledge, Grade 5

Name _____

Grade _____

Comments:

Appendix E