BIO FAX!

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Seed Identification Kit

Introduction

Seeds are found in a tremendous variety of sizes, shapes, and colors. Each species of tree produces its own unique seeds. In this activity various tree seeds will be classified and identified.

Science Concepts

- Seed identification
- Dispersal of seeds
- Angiosperms
- Gymnosperms

Background

Seeds are reproductive packages that contain a plant embryo and a stored supply of food all within a protective seed coat. Many seeds can withstand adverse environmental conditions such as intense heat or extreme cold. Seeds do not need a supply of standing water to reproduce. This means that seed-bearing plants may reproduce anywhere at almost anytime (unlike mosses and ferns which require standing water to reproduce).

There are two main types of live seed bearing plants—Gymnosperms and Angiosperms. *Gymnosperms* are seed plants that have exposed seeds (the seeds are not formed in a fruit) that are usually in a cone-shaped structure. *Angiosperms,* on the other hand, are flowering plants or trees whose seeds develop within an ovary that becomes a fruit.

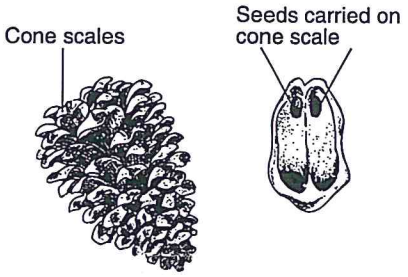

Figure 1. Gymnosperm

Gymnosperms, which include conifers, usually have two types of cones—*male cones* and *female cones*. Male cones produce pollen and female cones produce eggs. When the pollen is blown from the male cone and enters the female cone, fertilization may occur. If the female cones become fertilized and produce seeds, they are known as seed cones. When the seeds become fully mature, the scales of the cone eventually open and the seeds are dispersed by the wind (see Figure 1).

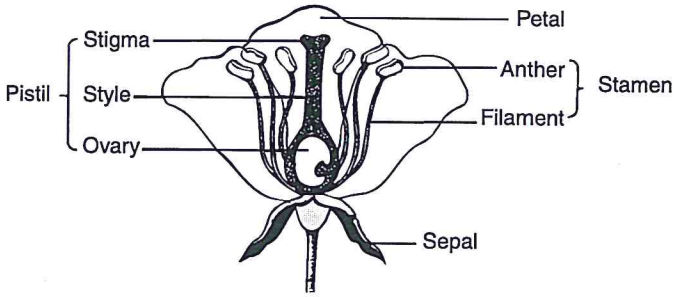

Figure 2. Flower Structures

The flowers of angiosperms are composed of female and male structures. The female structure of a flower is known as the *pistil*. The pistil is composed of a stigma, style, and ovary (see Figure 2). The male organs of a flower are known as *stamens*. Stamens are composed of two parts—a *filament* and an *anther*. The filament is the stalk-like structure which gives rise to the anther (see Figure 2).

When the anthers of a flower mature, they open up and release pollen (the sperm cell of a plant). If and when a pollen grain lands on the sticky surface of the stigma, *pollination* occurrs. The pollen grain begins to form a structure known as a *pollen tube*. The pollen tube grows downward through the stigma and style and eventually reaches the ovary (the reproductive organ of a flower that contains egg cells). Once the pollen tube reaches the ovary, the egg and sperm cells unite and *fertilization* occurs. The fertilization process eventually produces an embryo (seed) and an endosperm.

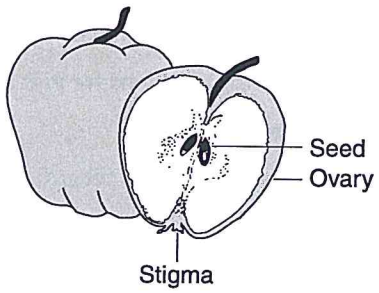

Figure 3. Fruit

As nutrients enter into the flowers of an angiosperm, the nutrients are used by the endosperm tissue (the food source of the growing seed). Many nutrients are also absorbed in the wall of the ovary that surrounds the seed. Over time, the wall of the ovary thickens and combines with parts of the plant, such as the sepals, petals and stem, to collectively form a fruit (see Figure 3).

Fruits come in various shapes and sizes and can be broken down into six generic categories: winged, nut, pod, berry, cone, and capsule.

Winged—fruit contains an elongated "fan"-like structure
Nut—fruit has a hardened ovary wall that forms a protective outer shell
Pod—fruit splits open on two sides; seeds are exposed when pods are opened
Berry—fruit has soft outer shell and generally contains a large amount of seeds
Cone—fruits have seeds that are exposed; seeds form in a scale-like form
Capsule—fruit usually contains small seeds that are surrounded by a hardened seed coat

The way a seed is dispersed from a fruit is important for species survival. The chances of survival of an individual tree or plant species increases if the seed can be carried away from the plant to a variety of environments. Four different methods of seed dispersal are common: water, wind, animal and mechanical dispersal.

Water is used as a dispersal agent for fruits such as water lilies or coconuts. Both of these fruits have membranes that allow the seed from the fruits to float on water. The seeds are usually dispersed through waterways such as lakes, rivers or oceans.

Wind is a major dispersal agent for many types of seeds. Seeds such as the ash or maple are flattened and tend to be caught by the wind as they fall through the air. Seeds that are in the form of tufts of hair can also be propelled for long distances by the wind.

Dispersal of seeds by animals is done in various ways. First of all, seeds of fruits can be eaten by animals and deposited in different areas after the seeds travel through their digestive tract. Fruits that are brightly colored tend to attract animals and birds and are good candidates for this type of dispersal. Many seeds also need to be exposed to the digestive juices in the animal in order to help break down the tough seed coat before germination can occur. Secondly, some plants have developed mechanical adaptations such as hooks or burrs that catch onto the fur of animals. The seeds are then carried away, fall off the animal's fur and are deposited in other locations.

Materials

Seed samples, unknown, 12
Seed Identification Key

Procedures

Part I. Seed Identification

1. Obtain a copy of the Seed Identification Key.
2. Obtain one of the unknown samples. Use the Seed Identification Key to classify the unknown sample.
3. When looking at the key, you will have options at each step. For example:

   1a. Fruit is a woody cone, ½ to 2″ long. . . . . Scotch pine

   1b. Fruit is not a cone 2

   You will choose an option at each step (i.e., if the fruit is not a cone, continue on to step 2). Work your way through the key until all of the samples have been identified. Record the identities of the samples in the Seed Identification Data Table.
4. Obtain another unknown seed and repeat step 2.
5. Continue classifying until all of the unknown samples have been identified.
6. Answer the questions for Part I in the *Post-Lab* section.

Part II. Forms of Fruit

7. Obtain one of the 12 identified samples.
8. Record the seed name next to its number in Part II of the Data Table.
9. Classify each sample as an angiosperm or gymnosperm in Part II of the Data Table.
10. Identify the fruit type of the sample. Use the fruit classifications from the *Background* section.
11. Repeat steps 5–8 with the remaining seed samples.
12. Answer the questions for Part II in the *Post-Lab* section.

Name: _____

Seed Identification Worksheet

Data Tables

Part I. Seed Identification

Unknown Seed #	Seed Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Part II. Forms of Fruits

Seed #	Seed Name	Angiosperm (A) or Gymnosperm (G)	Fruit Type
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Name: _____

Seed Identification Worksheet, con't.

Post-Lab Questions

Part I. Seed Identification

1. What are some identifiable features that are used to classify the unknown samples?

2. What other features could be used to classify seeds and fruits?

3. Which of the samples tested in this lab do trees in your area produce?

Part II. Forms of Fruit

4. How is a fruit produced?

5. What is the difference between an angiosperm and a gymnosperm?

6. What fruit type was most prevalent in the unknown samples?

7. Why are some types of trees genetically engineered to produce no seeds or fruit?

Seed Identification Key

1a. Fruit is a woody cone 2

1b. Fruit is not a woody cone 3

2a. Cone is smaller that 1″ . . . . . Eastern Hemlock

2b. Cone is 1.5″ or longer. . . . . Scotch Pine

3a. Fruit is a nut or is round. 4

3b. Fruit is not a nut or round 5

4a. Seed is dark and large with many rough grooves and ridges. . . . . Black Walnut

4b. Seed is not large and has no rough grooves or ridges 6

5a. Fruit is flat or wing-shaped, not pod-shaped 8

5b. Fruit is a pod-shaped 9

6a. Seed is less than ½″ . . . . . Little Leaf Linden

6b. Seed is larger than ½″. 7

7a. Seed is brown, surrounded by a dark, spiny or warty capsule. . . . . Horse Chestnut

7b. Seed is pale, 1″ to 1 ¼″ . . . . . Shagbark Hickory

8a. Fruit is flat and circular or oval in shape . . . . . Siberian Elm

8b. Fruit is not circular or oval in shape 10

9a. Pod is over 5″ in length, dark brown, hairy, curved ant twisted. . . . . Honey Locust

9b. Pod is 2 ½″ to 3 ½″, flat oblong pointed at ends . . . . . Redbud

10a. Fruit is long, flat and slender, not a true wing shape . . . . . Green Ash

10b. Fruit is wing shaped. 11

11a. Fruit has dark brown solid wing, 1–2″. . . . . Norway Maple

11b. Fruit has feathery wing and is light in color, 1.5–3″ . . . . . Silver Maple

Teacher's Notes

Seed Identification Kit

Materials Included in Kit

Eastern hemlock sample, unknown, #1, 2

Norway maple sample, unknown #2, 2

Green ash sample, unknown #3, 2

Little leaf linden sample, unknown, #4, 2

Scotch pine sample, unknown #5, 2

Horse chestnut sample, unknown, #6, 2

Honey Locust sample, unknown #7, 2

Shagbark hickory sample, unknown, #8, 2

Redbud sample, unknown #9, 2

Siberean elm sample, unknown, #10, 2

Black walnut sample, unknown, #11, 2

Silver maple sample, unknown, #12, 2

Additional Materials Needed (for each lab group)

Collected seed samples (optional)

Safety Precautions

The materials given in this kit are considered non-hazardous. Follow all normal safety guidelines.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The seed samples may be saved and used as many times as desired. All items in this kit may be disposed of according to Flinn Suggested Disposal Method #26a.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Content Standards: Grades 9–12
Content Standard C: Life Science, matter, energy, and organization in living systems

Tips and Extensions

- The seeds provided in this kit may vary from the actual material list due to availability. All efforts will be made to match the same type of sample (shape, size, etc.) as needed.
- The reproducible Seed Identification Key, Data Tables and Post-Lab Questions should be copied and given to students.
- The tree seed samples may be saved and used as many times as needed.
- Two packages of each type of seed are included.
- Have students identify the genus and species names of each seed.
- As an extension, have students predict the dispersal method for each seed. Have students drop several seeds from the same height and see which seeds travel the farthest. Repeat the experiment again on a windy day or drop the seeds in front of a fan.
- You may wish to have students collect their own seeds outside of class. Have students classify the seeds and what type of plant or tree the seed came from using seed or tree identification guides.
- Have students write their own classification guides for their collected samples.

Teacher's Notes *continued*

Sample Data Tables

Part I. Seed Identification

Unknown Seed #	Seed Name
1	Eastern Hemlock
2	Norway Maple
3	Green Ash
4	Little Leaf Linden
5	Scotch Pine
6	Horse Chestnut
7	Honey Locust
8	Shagbark Hickory
9	Redbud
10	Siberean Elm
11	Black Walnut
12	Silver Maple

Part II. Forms of Fruits

Seed #	Seed Name	Angiosperm (A) or Gymnosperm (G)	Fruit Type
1	Eastern Hemlock	G	Cone
2	Norway Maple	A	Winged
3	Green Ash	A	Winged
4	Little Leaf Linden	A	Nut
5	Scotch Pine	G	Cone
6	Horse Chestnut	A	Nut
7	Honey Locust	A	Pod
8	Shagbark Hickory	A	Nut
9	Redbud	A	Pod
10	Siberean Elm	A	Winged
11	Black Walnut	A	Nut
12	Silver Maple	A	Winged

Possible Answers to Questions

Part I. Seed Identification

1. What are some identifiable features that are used to classify the unknown samples?

   Size of seeds and fruit, color, shape, etc.

2. What other features could be used to classify seeds and fruits?

   Method of dispersal, the type of tree the seed came from and the tree's associated features (leaf shape, tree height, type of bark), etc.

3. Which of the samples tested in this lab do trees in your area produce?

   Answers will vary.

Teacher's Notes *continued*

Part II. Forms of Fruit

4. How is a fruit produced?

   When an egg is fertilized by a pollen grain (the male spore of a plant), a seed forms within the ovary. As nutrients enter into the flowers of an angiosperm, the nutrients are obtained by the endosperm tissue (the food source of the growing seed). Many nutrients are also used in the wall of the ovary that surrounds the seed. Over time, the wall of the ovary thickens and combines with parts of the plant, such as the sepals, petals and the stem, to collectively form a fruit.

5. What is the difference between an angiosperm and a gymnosperm?

   Angiosperms are flowering plants whose seeds develop within a ripened ovary (fruit). Gymnosperms have exposed seeds that are usually in a cone type shape.

6. What fruit type was most prevalent in the unknown samples?

   Nut-shaped fruits were the most prevalent.

7. Why are some types of trees genetically engineered to produce no seeds or fruit?

   Seedless fruits are produced commercially for supermarkets. Also, certain trees may be genetically engineered to be seedless for lawn cleanup purposes.

Reference

Gotfried. S.; Hampton, C. D.; Hampton, C. H.; Leibel, W.; Madrazo, G.; LaMoine, M.; Motz, L.; Sinclair, D.; Skoog, G. *Prentice-Hall Biology;* Prentice-Hall, New Jersey, 1990; Chapter 23.

The *Seed Identification Kit* is available from Flinn Scientific, Inc.

Catalog No.	Description
FB0489	Seed Identification Kit

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.