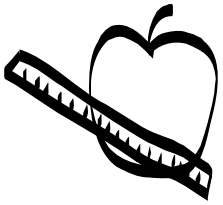


Botanical Discoveries
Grade Six

OBJECTIVES

Students will understand the chronology of major events of the Lewis and Clark Expedition. Students will use primary and secondary resources to obtain information about the plants identified by Lewis and Clark. Students will learn about characteristics of leaves, apply the information to Lewis and Clark plants, and estimate the surface area of a leaf.

CLASS TIME

Four 45- to 60- minute sessions

NATIONAL STANDARDS

This lesson plan reflects some of the national standards of learning as defined by the National Council for the Social Studies (NCSS), the National Council for Teachers of English (NCTE), and the National Council of Teachers of Mathematics (NCTM). These standards are listed below:

- Social Studies: People, Places, and Environment
- Social Studies: Time, Continuity, and Change
- Social Studies: Science, Technology, and Society
- Science: Science as Inquiry
- Science: Life Science
- Language Arts: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- Language Arts: Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Mathematics: Measurement

MATERIALS

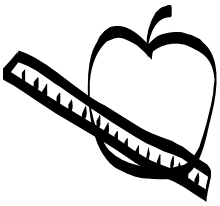
- Copies of the worksheets attached to this lesson plan (see "Preparations")
- 1 copy of the Westward Journey Nickels Series™ Lesson PlansResource Guide (available at www.usmint.gov/kids)
- 1 overhead projector
- Blank overhead transparencies
- Copies of field guides that provide basic information on plants and trees that Lewis and Clark identified (see "Preparations")

Botanical Discoveries

- Chart paper
- Markers
- Colored pencils
- Magnifying glass
- Rulers or tape measures
- Index cards
- Collection of leaves (see "Preparations")

PREPARATIONS

- Make copies of the following:
  - "Westward Journey Nickels Series" worksheet (from the Resource Guide, 1 per student)
  - "Anatomy of Leaves" worksheet (1 per student)
  - "Lewis and Clark Plants" chart (2 per student)
  - "Leaf Observation" worksheet (1 per student)
  - "Centimeter Graph Paper" (optional) (1 per student)
- Make overhead transparencies of the following:
  - "Journey of Lewis and Clark" map (from the Resource Guide)
  - "Westward Journey Nickels Series" worksheet (from the Resource Guide)
  - "Anatomy of Leaves" worksheet
  - "Lewis and Clark Plants" chart
  - "Journal Entry Rubric"
  - "Dear Diary" page
  - "Leaf Observation" worksheet
  - "Centimeter Graph Paper" page (optional)
  - "Estimating Surface Area" worksheet
- Copies of field guides that give basic information about plants and trees, such as:
  - *First Field Guide: Trees* by National Audubon Society
  - *Peterson First Guides: Trees and Shrubs* by George A. Petrides
  - *Trees of North America* by C. Frank Brockman
  - *Trees* by Herbert S. Zim and Alexander C. Martin
  - *Flowers* by Herbert S. Zim and Alexander C. Martin
  - *First Field Guide: Wildflowers* by National Audubon Society



Botanical Discoveries

  - *Field Guide to Wildflowers, Western Region* by National Audubon Society
  - *Botanica: North America* by Marjorie Harris
- Gather tools for observing leaves, such as a hand lens or microscope, rulers, tape measures, pencils, and pens.
- Gather extra leaves from plants or trees for students who do not bring in leaves for Session 4.

GROUPINGS

- Whole group
- Pairs
- Small groups
- Independent work

TERMS AND CONCEPTS

- Obverse (front)
- Reverse (back)
- Monticello
- Botany
- Naturalist
- Parts of a leaf (axil, lamina, leaf apex, midrib, petiole, stem, stipule, vein)
- Leaf structures (groupings, shape, margins, arrangements, venation)

BACKGROUND KNOWLEDGE

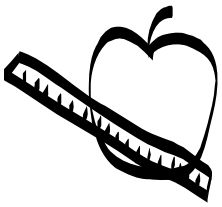
The students should have a basic knowledge of:

- Louisiana Purchase
- President Thomas Jefferson
- Classifying

STEPS

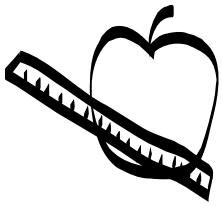
Session 1

1. Display the "Journey of Lewis and Clark" overhead transparency. Have the students note the position of the Louisiana Purchase in relation to your school's location. Explain to the students that the map shows the journey that soldiers Meriwether Lewis and William Clark took to explore the land President Jefferson acquired for the United States through the Louisiana Purchase. Ask the students to recall what they already know about the journey. Record the students' responses on chart paper.



Botanical Discoveries

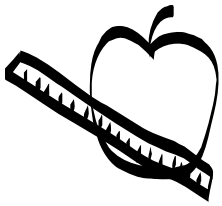
2. Make sure that the students understand the following:
   - President Thomas Jefferson, the third president of the United States, commissioned Meriwether Lewis to put together a crew to make the journey; Lewis chose William Clark as co-leader.
   - Lewis and Clark and the Corps of Discovery were the first Americans to make this trip.
   - President Jefferson had three main goals for the mission: to study the plants, animals, and land; to form relationships with American Indian tribes; and to search for a water route from St. Louis, Missouri, to the Pacific Ocean.
3. Tell the students that the focus of this lesson will be the plants that were found by Lewis and Clark on their journey. Explain to the students that Jefferson was fascinated by botany (the scientific study of plants). Jefferson saw farming as the backbone of the new American economy and believed that society would be built by farmers. In addition, he loved gardens and the beauty of plants and flowers, which he planted and studied at Monticello, his home in Virginia.
4. Distribute one copy of the "Westward Journey Nickels Series" worksheet to each student. Ask the students to examine the worksheet and to look for similarities between the images on the coin reverses. Lead the students to the conclusion that all of the images contain:
   - The Latin phrase "E Pluribus Unum," which is translated as "out of many, one."
   - The coin's denomination.
   - The name "United States of America."
5. Tell the students that, now that they have identified similarities between all the nickel designs, they will discover what makes each of these designs different. Ask the students to begin the worksheet by recording what they see in each nickel's design that may relate to the Lewis and Clark Expedition. Ask the students to hypothesize why each image was selected and its relationship to the Expedition. If desired, allow the students to use their textbooks and other classroom resources. Ask the students to record their answers on their "Westward Journey Nickel Series" worksheet.
6. Allow the students time to complete the worksheet individually.
7. Lead a class discussion regarding the students' answers on their completed "Westward Journey Nickel Series" worksheets. Use the students' responses to complete a model "Westward Journey Nickel Series" worksheet on the overhead transparency. Explain that the new 2006 "Return to Monticello" nickel is the last of the Westward Journey Nickels Series.
8. Collect the students' worksheets.



Botanical Discoveries

Session 2

1. Explain the following to the students:
   - Before Lewis and Clark began their expedition, Lewis was sent by President Jefferson to Philadelphia to learn about botany from a notable botanist, Benjamin Smith Barton. There, Lewis learned how to collect, preserve, and dry specimens, and to make notes about each plant.
   - Both Lewis and Clark kept journals using quill pens and ink or pencils, a handheld magnifying glass, and a tape measure. They extensively described the plants and trees they encountered and drew pictures of them.
   - They collected seeds and pressed leaves or flowers to preserve them before sending them back to President Jefferson. President Jefferson planted the seeds in his own gardens at Monticello. Unfortunately, the environmental conditions in Virginia were not as favorable for many of these plants as they were in the West. Many of the plants either died or did not grow as well as they had along the Expedition's route.
   - Lewis and Clark identified about 178 plants during the 2 years of their expedition.
2. Display the "Anatomy of Leaves" overhead transparency and distribute one copy of the "Anatomy of Leaves" worksheet to each student. Review the definitions with the students, showing them the appropriate space for each term.
3. Tell the students they will take a look at a small sampling of the plants and trees that Lewis and Clark identified and describe each one in the same way that Lewis and Clark did.
4. Divide the students into groups and assign each of them one of the four plant groups. For example, you could use these groupings with your student groups.
   - Group A: Douglas Fir, Osage Orange, Lewis' Prairie Flax, Red Columbine
   - Group B: Red Alder, Saskatoon (Western) Serviceberry, Jerusalem Artichoke, Violet Prairie Clover
   - Group C: Paper Birch, Sandbar Willow, Rocky Mountain Bee Plant, Western Jacob's Ladder (Western Polemonium)
   - Group D: Paw Paw, Lewis' Monkey Flower, Western White Pine, Indian Tobacco
5. Distribute one "Lewis and Clark Plants" chart to each student. Explain to the students that they will identify the characteristics of the four plants they have been assigned. Tell the students that they will work in pairs for this activity, but they will individually fill in their own chart.
6. Distribute various field guides to the students. Demonstrate how to use the field guides to find the plants or trees listed and the information and pictures about the different leaf structures. Discuss the different characteristics listed on the "Lewis and Clark Plants" chart. Using an example from one of the trees Lewis and Clark identified, show pictures of each characteristic listed and model how to fill in this chart (see the teacher key to the chart).



Botanical Discoveries

7. Allow the students time to fill in their charts, then collect them.

Session 3

1. Return the completed "Lewis and Clark Plants" charts to the students. Display the "Dear Diary" overhead transparency.
2. Explain to the students that they will write two journal entries focusing on two different plants from their chart. Explain to the students that they are to imagine they are on the Lewis and Clark Expedition. They will write for President Jefferson two very detailed journal entries about their chosen plant. Review the three examples on the "Dear Diary" overhead.
3. Display the "Journal Entry Rubric" overhead transparency and review it with the students.
4. Allow time for the students to complete the journal entry, leaving the rubric displayed.
5. Collect the students' charts and journal entries.

   Note: In preparation for session 4, ask the students to bring in a leaf from a plant or tree from their home or found in their neighborhood. The teacher should also bring in a variety of leaves for the students to use.

Session 4

1. Have the students place their leaves on a plain sheet of notebook paper. Distribute one "Leaf Observation" graphic organizer to each student. Tell the students that they will complete the worksheet for the leaf they chose. Distribute one leaf to each student who didn't bring one to class.
2. Direct the students to use all of the following tools when making their observations: hand lens, tape measure or ruler, and pencil or pen. Explain that these tools are similar to the ones Lewis and Clark used more than 200 years ago.
3. Tell the students that they will be working in pairs to examine their leaves but will fill in their "Leaf Observation" graphic organizers individually for their own chosen leaf.
4. Display the "Estimating Surface Area" overhead transparency. Review the overhead transparency with the students. Display the "Centimeter Graph Paper" overhead transparency. Place a leaf on top of the transparency and trace its shape. Remove the leaf and model the process of figuring the leaf's surface area for the students.
5. Distribute field guides to the students to help them with identifying some of the characteristics of the leaf. Allow time for the students to complete the "Leaf Observation" worksheet.
6. Collect the students "Leaf Observation" graphic organizers.
7. Divide the students into small groups and have them discuss and record on chart paper their experiences of learning about the various characteristics of their observed leaves as compared to Lewis and Clark's experiences in identifying the many plants on their expe-

dition. Also, have the students discuss and record on note cards what other tools Lewis and Clark might use today to record their botanical discoveries. Lead a brief class discussion on this topic. Collect the "Leaf Observation" graphic organizers and the note cards.

ASSESSMENT

Use the students' responses on the worksheet to evaluate the extent to which the students met the lesson objectives.

ENRICHMENTS/EXTENSIONS

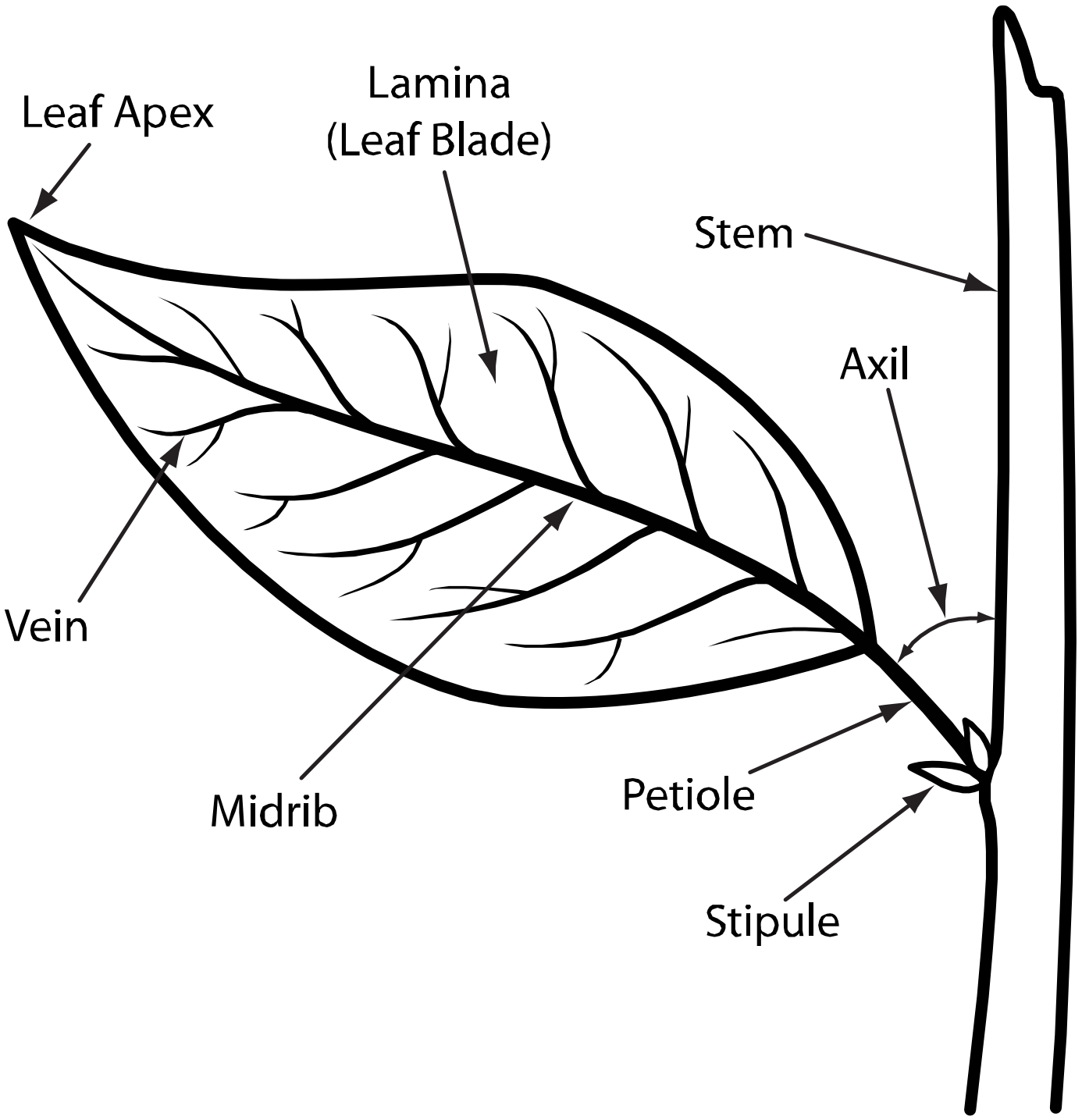
- Have students research John Muir and his conservation efforts. Direct students to the 2005 California quarter information found on the United States Mint H.I.P. Pocket Change™ Web site at www.usmint.gov/kids.
- Have students research what is currently being done to restore and preserve many of the plants and trees Lewis and Clark encountered during their expedition as that area of the country has developed.
- Have students collect and identify leaves and flowers in their area, press and preserve them like Lewis and Clark did, and put them into a class notebook.
- Have students plant a garden of some of the western species that Lewis and Clark identified and are suitable for gardens in most areas of the United States such as Blanket Flower, Clarkia, Lewis' Prairie Flax, Narrow-Leaved Coneflower, and Western Jacob's Ladder.
- Have students locate information about other plants identified by Lewis and Clark such as: Bitter Root, Ragged Robin, Snowberry Bush, Rocky Mountain Maple, Camas, Oregon Grape Holly, and Bearberry.

DIFFERENTIATED LEARNING OPTION

- Have students work in pairs throughout the lesson.
- Provide materials on a variety of reading levels about the plants and trees identified during the Expedition.

Name _____

Anatomy of Leaves



Name _____

Lewis and Clark Plants

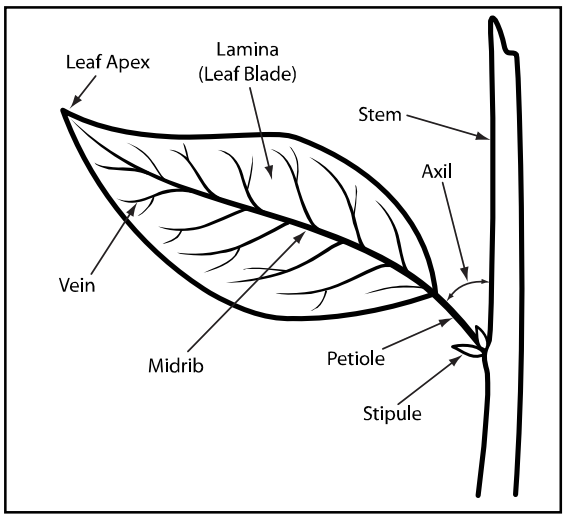
Directions: Using the field guide, fill in the following information about your group's four plants identified by Lewis and Clark.

1. Name of Plant: _____
2. Draw the leaf. Label the axil, lamina, leaf apex, midrib, petiole, stem, stipule, and vein.
3. If a tree, type (conifer, deciduous, evergreen): _____
4. Describe leaf structures
   - Groupings (simple leaf or compound leaf): _____
   - Shape (linear [narrow], lanceolate [lance shaped], oblong, elliptical, ovate [oval], heart shaped, round): _____
   - Margins (edges [toothed, untoothed, lobed]): _____
   - Arrangements (opposite or alternate): _____
   - Venation (palmate or pinnate): _____
5. Additional Information
   - Leaf length and width: _____
   - Flowers and fruit: _____
   - Native habitat: _____
   - Uses and other interesting facts: _____

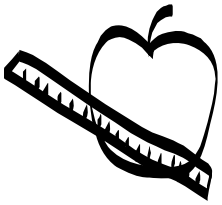
Lewis and Clark Plants

Example

Directions: Using the field guide, fill in the following information about your group's four plants identified by Lewis and Clark.



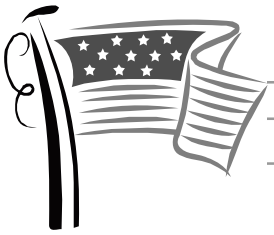
1. Name of Plant: Chokecherry tree
2. Draw the leaf. Label the axil, lamina, leaf apex, midrib, petiole, stem, stipule, and vein.
3. If a tree, type (conifer, deciduous, evergreen): Deciduous, small tree or shrub
4. Describe leaf structures
   - Groupings (simple leaf or compound leaf): Simple
   - Shape (linear [narrow], lanceolate [lance shape], oblong, elliptical, ovate [oval], heart shape, round): Elliptical
   - Margins (edges [toothed, untoothed, lobed]): Sharp-toothed
   - Arrangements (opposite or alternate): Alternate
   - Venation (palmate or pinnate): Pinnate
5. Additional Information
   - Leaf length and width: 1-1/2 to 3-1/4 inches long; 5/8 to 1-1/2 inches wide
   - Flowers and fruit: Flowers are 1/2 inch wide with 5 rounded white petals; bloom in late spring. Fruit is shiny dark red or blackish cherry, mature in summer.
   - Native habitat: Moist soil along streams in mountains, forest borders, and clearings.
   - Uses and other interesting facts: Can be a shrub or a small twisted tree that has small white flowers in the spring through early summer. Its fruit can be made into preserves and jelly. The fruit stones are poisonous and the wilted foliage can contains hydrocyanic acid, which can poison livestock. Birds love to eat the cherries. Tent caterpillars and webworms build their webs on the leaves.



Lewis and Clark Plants

Key

Name of Plant	Type of Plant	Leaf Groupings	Leaf Shape	Leaf Margins	Leaf Arrangements	Leaf Venation	Flowers andFruit
Chokecherry Tree	deciduous, small tree or shrub	simple	elliptical	sharp-toothed	alternate	pinnate	flowers and fruit
Douglas Fir	conifer, evergreen	needles soft, singly	linear	round and blunt at tip	—	—	flowers, fruit: egg-shaped cone w/thin scales
Osage Orange	deciduous	simple	ovate (oval)	untoothed	alternate	pinnate	flowers and fruit
Lewis' Prairie Flax	wildflower	simple	linear, narrow	toothed	alternate	pinnate	flowers and fruit
Red Columbine	wildflower (buttercup) family)	compound leaflets	scalloped leaflets	lobed	opposite	palmate	flowers
Paper Birch	deciduous	simple	ovate	toothed	alternate	pinnate	none
Saskatoon (Western) Serviceberry	deciduous small tree or shrub (rose fam.)	simple	ovate to obovate	toothed	alternate	pinnate	flowers and fruit
Jerusalem Artichoke	wildflower (sunflower fam.)	simple	lanceolate	toothed	upper opposite, lower alternate	pinnate	flowers
Violet Prairie Clover	wildflower	compound	linear, narrow	untoothed	alternate	pinnate	flowers
Red Alder	deciduous	simple	ovate to elliptical	toothed	alternate	pinnate	flowers and fruit
Sandbar Willow	deciduous	simple	linear narrow	toothed	alternate	pinnate	flowers
Rocky Mt. Bee Plant	wildflower	compound	lanceolate	untoothed	opposite	palmate	flowers
Western Jacob's Ladder	wildflower (polemonium) (phlox fam.)	compound	linear narrow	untoothed	opposite	pinnate	flowers
Paw Paw	small tree or shrub (apple fam.)	simple	oblong to ovate	untoothed	alternate	pinnate	flowers and fruit
Lewis' Monkey Flower	wildflower	simple	lanceolate	toothed	opposite	pinnate	flowers
Western White Pine	conifer evergreen	needles in bundles	linear, long	—	—	—	Cones thin, thornless
Indian Tobacco	wildflower (bluebell fam.)	simple	ovate	toothed	alternate	pinnate	flowers



Name _____

Leaf Observations

Graphic Organizer

Directions: Carefully observe your leaf. Use the following materials to help you in recording your information: hand lens, ruler or tape measure, and pencil or pen.

- Draw your leaf and identify the major parts of the leaf.

- Leaf length: _____
- Leaf width: _____
- Leaf shape: _____
- Leaf margins: _____
- Leaf venation: _____
- Name of plant or tree if known: _____
- Plant or tree's habitat, care, and any other interesting information:

  _____

  _____

  _____

- Trace your leaf onto graph paper and estimate the surface area.

Name _____

Centimeter Graph Paper

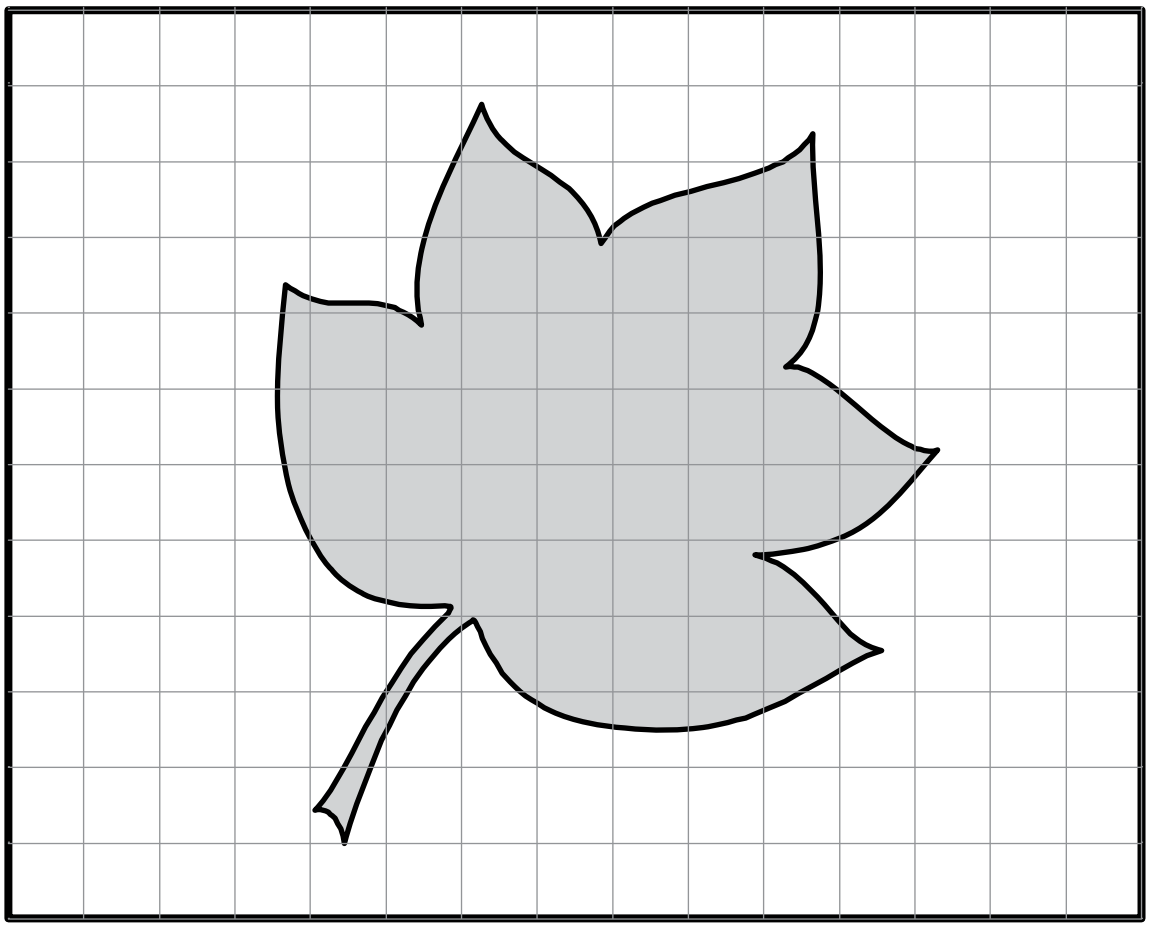
Directions: Trace your leaf and estimate the surface area.

Name _____

Estimating Surface Area

Directions

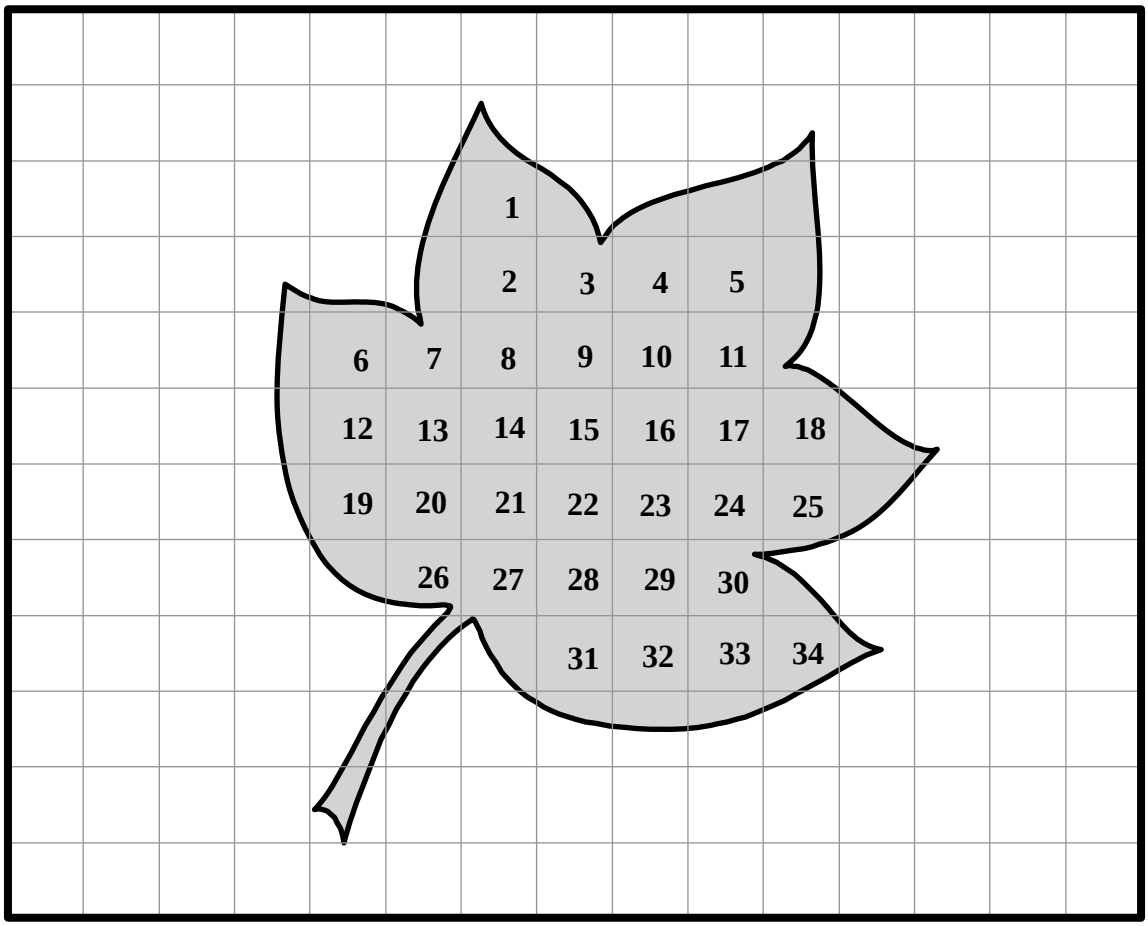
1. Number all the whole or nearly whole squares of the leaf (do not include the petiole) and record the number found.
2. Looking at the partial squares, use different colored pencils to shade in as many partial squares that would become equal to or about whole squares. Record that number found.
3. Add the two numbers together to get the estimated surface area of the leaf.
4. Write the estimated surface area in square centimeters.



Estimating Surface Area
Key

Directions

1. Number all the whole or nearly whole squares of the leaf (do not include the petiole) and record the number found. **34**
2. Looking at the partial squares, use different colored pencils to shade in as many partial squares that would become equal to or about whole squares. Record that number found. **About 10**
3. Add the two numbers together to get the estimated surface area of the leaf. **About 44**
4. Write the estimated surface area in square centimeters. **44 cm^2**



Dear Diary

Journal transcription courtesy of the Smithsonian Institution.
(Based on the original spelling, grammar, and punctuation.)

CURLYCUP GUMWEED

Capt. Lewis, August 17, 1804

Nº. 40 Taken at our camp at the Maha vilage August 17th 1804. it is a handsome plant about 3 feet high much branched bears a yellow circular flower carnished with meany small narrow ovate petals of the same colour, the leaf about an inch and a quarter in length thick smoth indent[ed] finely, incompassing the stalk about 2/3's and of a tongue like form; annual plant is covered with a gumlike substance which adheres to the fingers and yealds a pleasent smell.

VINE MAPLE

Capt. Lewis, February 10, 1806

In the same part of the country there is also another growth which resembles the white maple in it's appearance, only that it is by no means so large; seldom being more than from 6 to 9 inches in diamater, and from 15 to 20 feet high; they frequently grow in clusters as if from the same bed of roots spreading and leaning outwards. the twigs are long and slender. the stems simple branching. the bark smooth and in colour resembling that of the white maple. the leaf is petiolate, plane, scattered nearly circular, with it's margin cut with accute angular incissures of an inch in length and from six to 8 in number the accute angular points formed by which incissures are crenate, or cut with small accute angular incissures. or in this form. [*Captain Lewis included a drawing of the leaf here.*] it is three inches in length, and 4 in width. the petiole celindric smooth and one and a 1/4 inches long. the fruit or flower not known.

SNOW ON THE MOUNTAIN

Capt. Lewis, August 4, 1804

Nº. 27 Taken 4th of August, and furst observed at the bald prarie it is [a] beatifull plant with a variagated leaf these leaves incompass the flowers which are small and in the center of them; at a small distance they resemble somewhat a white rose the leaf near the large stem is green and is edged with white; they grow smaller and more numerous as they approach the flower or the extremity of the limb. the plant is much branched; the leaf is smoth on both sides and edge, of an ovate form and pale green colour, rises to five or six feet, is annual. at every point that it branches it has a pair of opposite leaves and from th[r]ee to four branches.

Name _____

Journal Entry Rubric

Directions: Include the following elements in your journal entry: the name of the plant, a detailed drawing of the leaf with anatomical labels, and a description of the leaf's grouping, shape, margin, arrangement, and venation.

CATEGORY	4	3	2	1	SCORE
CONTENT	The journal entry is well organized and includes all of the required information. Factual information is correct.	The journal entry is well organized and includes most of the required information. Most of the factual information is correct.	The journal entry is somewhat organized and includes some of the required information. Factual information somewhat correct.	The journal entry is disorganized. The journal entry contains little or no correct factual information.	
ORGANIZATION	The journal entry paragraph is well focused and logical including a main idea with a topic sentence and supporting details.	The journal entry paragraph is focused and mostly logical including a main idea with a topic sentence and supporting details.	The journal entry paragraph is not completely focused. There are supporting details, but not a clear main idea.	The journal entry paragraph does not have a clear main idea and seems to just list details.	
MECHANICS	Very few errors in spelling, capitalization, punctuation, and grammar.	Some errors in spelling, capitalization, punctuation, and grammar.	Several errors in spelling, capitalization, punctuation, and grammar.	Many errors in spelling, capitalization, punctuation, and grammar.	
TOTAL					
COMMENTS					