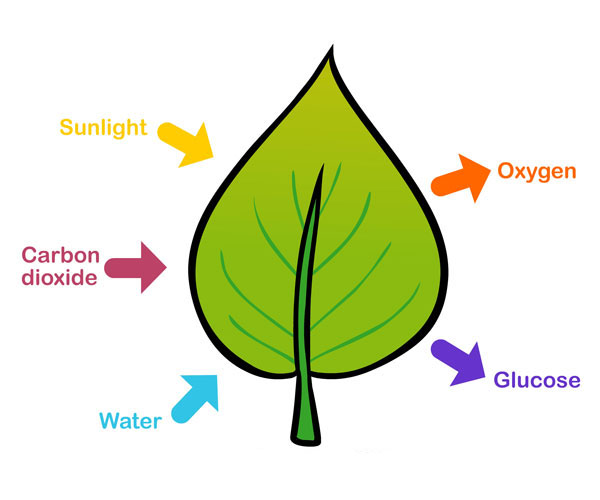
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**Alaska Indoor Gardening Curriculum**

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**Plant Parts: Leaves**

**Author/Source:** Mel Sikes, Alaska Ag in the Classroom

**Suggested Grade Levels:** 3-6

**Time:** 45 minutes to 1 hour

**Teaching Goal:**

To introduce students to how leaves produce food for the plant in the process known as Photosynthesis.

**Learning Objectives:**

Students will observe a leaf and learn the function of the parts of the leaf.

**Core Ideas:**

* Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Photosynthesis
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)

**Alaska State Science Standards:** 3-LS4-4, 4-LS1-1, 5-LS1-1, 5-LS2-1, MS-LS1-1, MS-LS1-2, MS-LS1-4, MS-LS1-6

**NGSS Standards:** 3-LS1-1, 4-LS1-1, 5-LS1-1, MS-LS1-1, MS-LS1-2, MS-LS1-6

**Materials Needed**

* Leaves of various kinds
* Copies of the Leaf Observation Worksheet
* Crayons, Colored Pencils
* Magnifiers
* Crayons, colored pencils, or markers
* Paper
* pencils
* Toothpicks
* Paper Towels

**Vocabulary:**

1. *Carbon Dioxide:* One of the ingredients that plants use to make their food found in the air.
2. *Chlorophyll:* A green pigment that captures light energy for photosynthesis.
3. *Chloroplasts:* Are the tiny structures in plant cells where photosynthesis happens.
4. *Leaf:* The flat, green, areas of a plant that are attached to the stem.
5. *Oxygen:* A reactive element that is found in water, rocks, and free as a colorless tasteless odorless gas which forms about 21 percent of the atmosphere. Oxygen is capable of combining with almost all elements, and that is necessary for life. Also, a by-product of the photosynthesis process.
6. *Photosynthesis:* The process by which plants, algae, and some bacteria use sunlight, carbon dioxide, and water to make food.
7. *Stomata:* One of many openings in a leaf or a stem of a plant that enables gas exchange to occur.

**Background for Teachers:** Leaves are adapted to perform their function of processing sun, carbon dioxide, and elements in the air to produce sugars which the plant needs to grow. For example, they have a large surface area and many chloroplasts to absorb sunlight.

*Chloroplasts* are the tiny structures in plant cells where photosynthesis happens. Chloroplasts contain *chlorophyll*, a green pigment that absorbs light energy for photosynthesis. Leaves contain many cells with chloroplasts.

However, chloroplasts are not found in all plant cells. For example, they are not found in *root hair cells*. These cells absorb the water needed by the plant for photosynthesis. However, since they are usually underground and in the dark, they are unable to photosynthesize anyway.

Leaves are often broad so that they have a large surface area to absorb sunlight. Broader leaves enable more sunlight to be absorbed. Narrower leaves often found on evergreen plants still photosynthesize, but generally more slowly. Their narrow shape and the fact that they are often coated with a waxy substance allows them to handle cold temperatures, remain on the plant and photosynthesize year-round.

**Procedure:**

1. Optional Opening Task: Write soil, water, carbon dioxide, oxygen, plant food, sunlight, chlorophyll, leaf litter, and calcium on the board or a poster with space above the words. Give each student three stickers or sticky notes. Tell students that plants use three of the things on the board/poster to make their own food. Tell the students to place their stickers above the 3 ingredients they think plants use to create their own food. After the class has cycled through and finished indicating their choices, tell the students that after the lesson they will have a chance to change their choice.
2. Distribute a magnifier and a leaf to each student.
3. Distribute copies of the Leaf Observation worksheet, crayons and colored pencils. Have the students draw their leaves on the worksheet with as much detail as possible. After the students have had adequate time to draw their leaf, point out some of the observations that certain students made about their leaves and the details that they included. Give students the time and opportunity to add to their sketches. For example, point out a child who did a great job showing the leaf edges, used different colors to reflect the true color in the leaf assigned, someone who does a great job recording the veins, etc. This will help other students in the class make more detailed observations and may help classes just beginning to use science journals or science sketching.
4. Explain that plants are the only living things in the world that don’t have to find or gather food to eat. They make their own food within their leaves. This process is called **photosynthesis**.
5. Just as we follow a recipe and use different ingredients, plants need many ingredients to make their food. Just as we use an oven to change food into something we can eat, plants use sunlight to change their ingredients into food they can use. Plants use many ingredients to make food: **Sunlight,** **Chlorophyll (that is already present in the plant), Water, Nutrients from the soil, and Carbon Dioxide.**
6. Explain that the green in the leaves come from CHLOROPHYLL, a green pigment found in the plant cells that allows plants to absorb the energy from sunlight.
7. Have the students take a deep breath and let it out slowly. Tell them most of their breath out is CARBON DIOXIDE – one of the ingredients that plants use to make their food.
8. Have the students take another breath and tell them that OXYGEN is a leftover in the process of making food. When we breathe out, we exhale mostly carbon dioxide and when plants breathe out, they breathe out oxygen.
9. Talk about how the leaves soak up sunlight to make food. This process is called photosynthesis. Have them repeat that word a few times. You can have the students echo the way you say the word. Consider whispering, yelling, rapping, saying it like an older person, an alien, etc. Using the carbon from the carbon dioxide, water, chlorophyll and sunlight, the plant produces sugars which feed the plant. Just like a factory makes products, the plant is a factory that makes food. The plant and other organisms make use of this food. Moisture is also released during the process of making food.
10. Tell them that the plant sends the food it makes in the leaves to the stem to be distributed to the rest of the plant. Have them look closely at the veins of the leaf and then at their own wrists, compare leaf veins to our veins. Let them use the toothpicks to open up the leaves and look at the veins with their magnifying lenses. Have them draw what they see. Tell students that a major difference between the veins in our bodies and the way plant veins work is that we have veins that take blood to and from our heart, like a circular system. Plants have veins that only work “one way,” the extra fluid does not return to the roots. This is a common misunderstanding that students have.
11. If you are using fresh leaves, have the students squish the leaves vigorously with the paper towel to release the chlorophyll. This can also be done by placing the leaf between two pieces of paper and rubbing vigorously with a book or ruler.
12. Have the students add the words they learned to their drawing, perhaps making a diagram of how the leaf works using arrows. You may choose to model this on the board so that students better understand how labels are added to diagrams if this is a skill your students need to see first.
13. Have students share their work with another classmate to find 5 similarities and 5 differences between their plants.
14. Have students change their choices on the survey if you chose to open with it or orally discuss the three correct answers with the class as a closing.

**Extensions:** Do You Know the Parts of Plants Lesson,Hydroponic Plant Growth Lesson

**Assessment:** Successful completion of Leaf Observation Worksheet. Student can explain how a leaf produces sugars. Consider having the students to flip over their leaf observation worksheet and write a few sentences to describe the necessary ingredients that plants use to create food. You could offer them these words that they must use in their response: Photosynthesis, CO2, water, sunlight, sugar, food, and leaves.

**References:**

**Books:**

*The Budding Botanist (AIMS Activities Grades 3-6) Investigations with Plants*

by Evalyn Hoover, Howard Larimer, Sheryl Mercier, Michael Walsh, Dave Youngs and Beverly Tillman 2009 ISBN: 1-881431-40-1

*The Classroom Hydroponic Plant Factory*

by Foothills Hydroponics, inc. 2010 ISBN: 0-9669557-1-4

*Gardening Indoors with Soil and Hydroponics*

by George Van Patten 2007 ISBN: 978-1-878823-32-8

*How to Hydroponics*

by Kenneth Roberto 2014 ISBN: 0-9672026-1-2

*Hydroponic Basics: The Basics of Soilless Gardening Indoors*

by*George F. Van Patton 2004 ISBN: 978-1-878823-25-0*

*Plant Plumbing: A Book About Roots and Stems* (Growing Things)

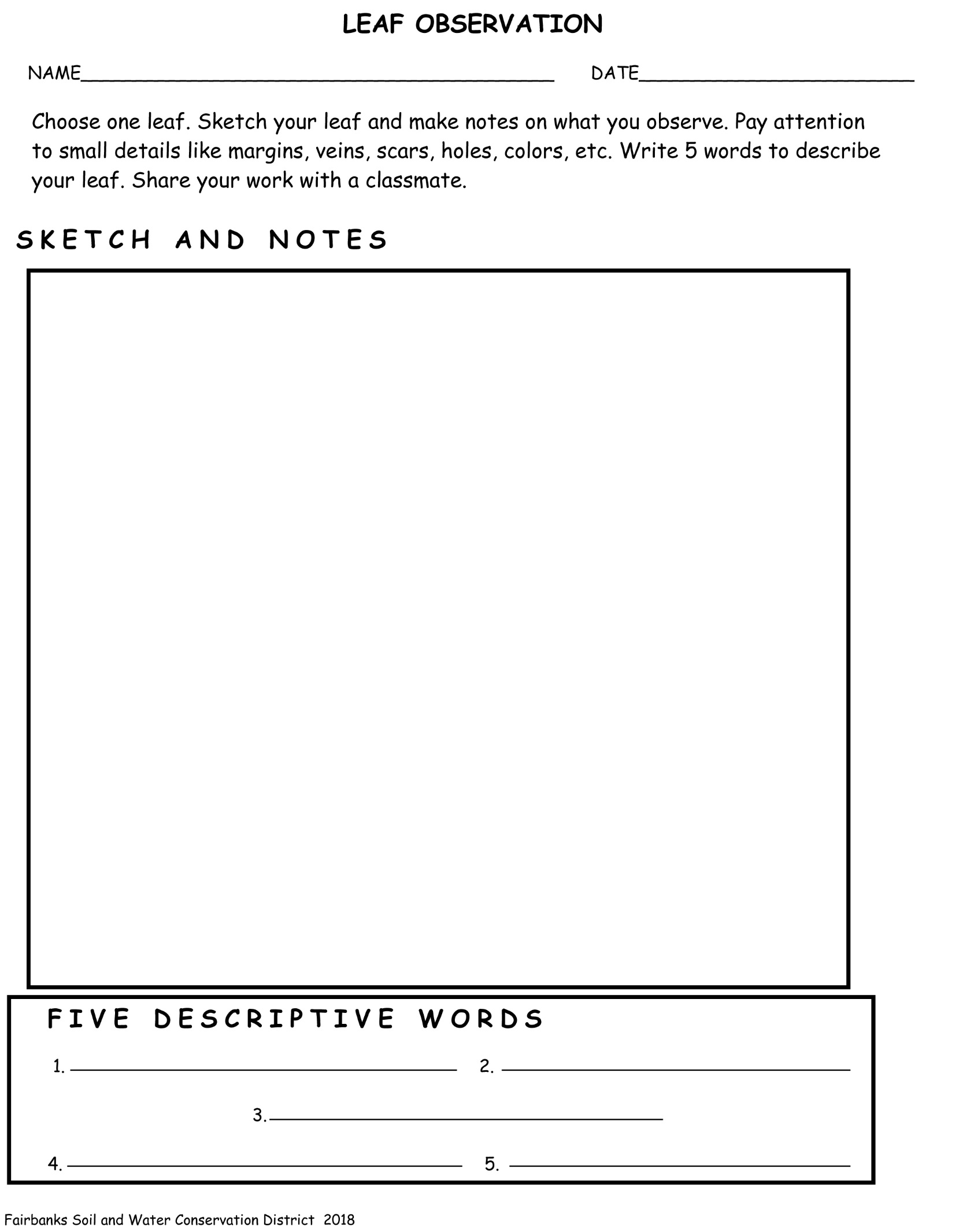
by Susan Blackaby 2003 ISBN: 1-4048-0109-X; ISBN: 978-1-4048-0385-5

**Websites**

*Illinois ACES College of Agricultural, Consumer and Environmental Sciences* <http://www.aces.uiuc.edu/vista/html_pubs/hydro/require.html>

*Gardening Know How* <https://www.gardeningknowhow.com/special/children/how-plants-grow.htm>

*Simply Hydroponics and Organics*:[*http://www.simplyhydro.com/system.htm*](http://www.simplyhydro.com/system.htm)

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