**Botany Basics**

**Summary**
Students will learn how to identify plants by looking at the parts of a plant in more detail. This will be done by completing leaf rubbings and drawing a plant. Students will draw these parts in detail and proportion to a live specimen.

**Objectives**
- Students will learn the importance of plant identification in science.
- Students will learn the importance of plant identification in Hawaiian culture.
- Students will participate in plant identification using observation skills.

**Materials**

*Parts of a Leaf* Diagram, Pg. 6 (1 per student)
*Leaf Me to be Observant* Worksheet, Pg. 7 (1 per student)
*The Botanist in Me* Worksheet, Pg. 8 (1 per student)
*The Difference Between* Worksheet, Pg. 9 (1 per student)
*The Medicine Plant* Story, Pg. 10-11 (1 per student)
*A Botanical Beginning* Test, Pg. 12 (1 per student)
Pencils (1 per student)
Potted plants (1 per group) or place on campus where students can sit
Medium-sized leaves (about 5 inches in length) (1 per student)
Flowers 1 per student
Crayons
Clipboards – If option C is chosen (1 per student)

**Making Connections**

Apples or oranges, lemons or limes, lettuce or cabbage. In our everyday lives we make distinctions between many things by looking at their characteristics. This is an important skill, especially if we are identifying things we plan to eat, some plants are poisonous and some are edible. Furthermore, when looking for plants to research for medicinal use it is important to be able to distinguish between plants, or remember the characteristics of a plant that is useful.

**Teacher Prep for Activity**

1. Print *Leaf Me To Be Observant* and *The Botanist In Me*, 1 per student.
2. Gather potted plants. Potted plants can be purchased at a gardening store or stores with garden sections OR grow your own potted plants.
Plant Collection Criteria: Characteristics to follow for all options in step 2.
1. Choose two different plant types for students to draw. (Students will split up into groups and later compare their characteristics.
2. Choose plants with leaves that are not fleshy (such as Mamaki, Hibiscus, or other plant leaves: if you crush them and a watery or slimy substance leaks out it is too fleshy) students will be making rubbings of these leaves; fleshy leaves will soak through paper and not provide a good rubbing.
3. Choose potted plants that have flowers on them.
4. If possible choose common native plants such as Mamaki or Hibiscus.
Note: Because students will be comparing the two plants, choose plants that are distinctly different from each other.
Example: A potted orchid and a rose plant.

3. Set up stations: Stations should include five students or less. Class will be divided into two groups. Place 1 potted plant in the middle of each station, divide the two different plant types among the groups. (Half of the groups will have one plant type and the other half will get the other plant) Pass out 1 leaf per person from the plant that is assigned to each group. Pass out 1 pencil per student.

Background
Botany is a branch of biological science focusing on plants. In Hawai‘i, botany is a very important science as plants make up the majority of living organisms here. One key concept needed to be a botanist is plant identification. Sounds simple enough but this task can be quite difficult, especially among plants that are almost identical.

When identifying a plant one looks at characteristics of the plant that will differentiate it from other plants. For example, one can look at its growing habit (tree, shrub, herb, vine, or crawls on the ground), the shape of its leaves, shape and color of its flowers, how it is branched (at what angle and position branches come off of the main stem or trunk) and even what habitat it is growing in.

In Hawai‘i, botanists will look toward The Manual of the Flowering Plants of Hawai‘i, a wonderful resource of all plants found in the Hawaiian Islands. This book contains detailed descriptions of the plant and helps to narrow down a plant to a family, genus, and a species. The family, genus, and species are groupings that are broad at the family level (general characteristics) and become more specific at the species level.

When keying out a plant (Looking at a botanical key to figure out what plant it is) you would need to have a keen eye for detail. In this lesson students will be observing a plant in whole, and look at a leaf in detail.

When we look at the plant as a whole we will look at its growing habit (tree, vine, shrub, herb, or crawls on the ground), its flowers (color, shape, size, texture), and its leaves (color, shape, size, texture).
When keying out a leaf (Looking at the part of the botanical key that focuses on leaf type) we will look at the **apex** (the leaf tip’s shape), the **base** (the opposite end of the leaf tip, that part that is connected to the leaf stem), the **margin** (the shape of the edge of the leaf), surface texture (hairy, bumpy, smooth, waxy, etc.) and its **venation** (how the veins of the leaf look). To illustrate this see, *Parts of a Leaf*.

**Vocabulary**

**Botanists**: A person who studies plants.

**Botany**: The scientific study of plants.

**Characteristic**: A feature or quality of a person, place, or thing, usually to identify it.

**Identify**: To recognize or indicate someone or something.

**Observe**: To notice or perceive and to register as being significant.

**Introduction (30 Min.)**

1. If completed *Taxonomy and Me!* lesson prior, have students review what a **characteristic** is. If lesson has not been previously done, do following activity to illustrate this term.

   **Activity**: To group these organisms the things we look for are called traits or characteristics. Have a volunteer stand up in front of the class. Ask the class what are characteristics of this student as if they were describing him/her to someone who did not know him/her. For example: He is a boy, he has short hair, he has brown hair, he has brown eyes, he is wearing a red shirt and shorts, he is about 5 ft. tall. This is similar to how a botanist separates plant species into different groups, by looking at their characteristics.

2. Explain, “A botanist is a type of scientist that studies plants, a big part of their job is to identify them.” Ask, “Why do you think it is important to identify one kind of plant from another.” Take answers and write them on the board, (Looking for answers such as: So we don’t eat poisonous plants, so we know which we can use for medicine, which we can eat, which is best for making rope or clothing, or even building a house.)

3. Read *The Medicine Plant* story out loud to the entire class.

4. Ask Questions from the story:

<table>
<thead>
<tr>
<th>Question</th>
<th>Possible Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was the main character of the story training to be?</td>
<td>A doctor, medicine man, or a Kahuna la’au lapa’au.</td>
</tr>
<tr>
<td>Why did his grandfather choose him to be trained? What characteristics?</td>
<td>He was smart, observant, kind, helpful.</td>
</tr>
<tr>
<td>What does a Kahuna la’au lapa’au do?</td>
<td>He makes medicine, helps people get better.</td>
</tr>
<tr>
<td>What did Kamaka need to learn to find the medicine plant?</td>
<td>He needed to know what the plant looked like, its characteristics, where it could be found.</td>
</tr>
<tr>
<td>When Kamaka entered the forest why did he look down to find the plant?</td>
<td>Because his grandfather said the plant was not taller than his knee.</td>
</tr>
</tbody>
</table>
5. Explain: “When identifying a plant you need to look at the fine details and characteristics of that plant, just as Kamaka did in the story. You need to look at all parts of the plant: its flowers, leaves, and fruits, how it grows (is it a vine, a tree, a shrub, etc.), and how big it grows. These are the parts that you look at to identify a plant. For example, one plant has heart shaped leaves and the other may have oval leaves, one plant has purple flowers and the other yellow, one plant grows up into a tall tree, the other grows into a vine that grows along the ground.

**Activity (50 Min.)**

1. Explain worksheet: Display *Parts of a Leaf Diagram,* and pass out *Parts of a Leaf Diagram.* Explain, “First you will complete the worksheet titled *Leaf It To Me To Be Observant.* To do this you will need to take out a crayon (either brown or green). Put your leaf in front of you.” Explain, “To identify a plant you need to look at the different parts of its leaves.” Go over the different parts and have students say the parts with you. Explain, “To look at the different parts we will be doing plant rubbings of each part.” Explain, “Place the part of the leaf under your paper in the back of the labeled square. Take crayon and rub paper over the leaf part so the image shows up on the paper.” Hint: Using the side of the crayon rather than the point helps a lot, if the point is used it may be too dark and you will not be able to see the detail.

**Note:** Do the worksheet in front of class so students get an idea of how this is done. Allow students 15 minutes to complete.

2. Explain: “Today you will be botanists and look at the characteristics of the plants you have before you.” Have students sit at their prepared stations. Pass out *The Botanist In Me Worksheet.*

3. Explain worksheet, “Now you will complete the worksheet titled ‘*The Botanist In Me.*’” Explain, “Looking at the flowers and the structure of a plant is also a great way to identify it. Now we will observe a whole plant, its leaves, and flowers. To do this you will draw each part in its proper square. You are expected to draw in as much detail as possible. This is so anyone will be able to tell what plant you drew just by looking at your picture. You will be graded on your drawings and on the amount of effort you put into your drawings and how neat you draw. It is fine if you are not a good artist, most botanists are not, but it is necessary to draw in detail.” Ask students to look at each part, how the branches come off of the main stalk and where the leaves are on the plant. Allow students 30 min to complete. Instruct students to draw plants parts proportionally to its other parts (Example: Flowers should not be drawn half the size of the plant).

4. Have each student pair up with another student that had a different plant from the plant they were assigned. Have students sit together and write characteristics that are different from the plants that they have drawn. Have students compare each part (leaves, flowers and whole plant’s structure) using their drawings and looking at their specimens. Have students fill out *The difference between us.* Assign one plant “#1” and the other plant “#2” for student worksheet.

**Assessments**

*Leaf it to me to be Observant Activity Sheet*
*The Botanist in Me Activity Sheet*
*The Difference Between Activity Sheet*
Partnerships for Reform through Investigative Science and Mathematics

A Botanical Beginning Test

**Extension Activities**

**Research Project:** Have students research a plant that is used in medicine. Students may choose to do a plant used in Hawaiian medicine. Instruct students to write a paragraph about the plant, what part of the plant is used for medicine, where the plant is found, what the medicine is used for, and a detailed description about how the plant looks.

**Art Connections**

**Coloring Exercise:** When the worksheet *The Botanists in Me* is complete have students color their drawings true to the color of the plant that they drew. Explain, “Color is a very important characteristic when identifying plants, especially their flowers.”

**Math Connections**

**Measuring Activity:** Measuring activity: Have students measure the height or length of the entire plant and write it next to their drawing. Have students measure the length and width of a leaf of that plant and write it next to their leaf drawings. Have student measure the length of the flowers of that plant and write it next to the flower that they drew. Plants are usually measured in metric measurements. Students may measure in metric or measure in standard measurements and convert to metric. Explain, “Because our drawings are smaller than that actual plant and plant parts it is important to write the measurements next to each drawing. If someone only had your drawings to find this plant they would need to know its size.”

**Literature Connection**

Descriptions activity: Have students write detail descriptions for the plant and each plant part. Have students think of as many descriptive words as possible. For example: The branches of this tree are attached at a small angle. The bark of this plant is papery and pealing. The leaves are light green, waxy in texture, and small like an orange. If I squash this leaf in my hand it cracks in half making crackling noises as I do it. Explain, “Many times botanist in the field will describe a plant by writing about its characteristics, especially if he/she does not have a camera or time to draw it.” Ask students for some of the descriptive words that they used for each part, write these on the board. It will be fun to see the different words used to describe the same thing!
Parts of a Leaf

- Apex
- Margin
- Veins
- Base
Botany Basics
<table>
<thead>
<tr>
<th>Whole Plant</th>
<th>Flowers</th>
<th>Leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Number 1</td>
<td>Plant Number 2</td>
<td>Plant Part</td>
</tr>
</tbody>
</table>

The Difference Between
Kamaka and the Medicine Plant
By: Anya Tagawa

Kamaka saw a single grey wisp of smoke rising in the corner of the pili thatched hut. Curious, he took a few steps towards it, watching intently with every step. He watched it twist and curl climbing higher and higher until it thinned and disappeared. The others in the room were talking; Kamaka ignored them, keeping a close watch on the rising smoke. “He has only witnessed three planting seasons, he is too young. Those considered for medicinal training are usually much older,” said the boy’s father. “Yes, this is true but he is bright and observant” Replied Kamaka’s grandfather, the Kahuna la’au lapa’a‘au. They watched as Kamaka observed the medicine that was left to cook in the back of the room as they discussed the young boy’s future. Kamaka had soon grown sleepy and climbed into his mother’s lap, falling asleep to the sound of his elder’s voices. They discussed the details surrounding his birth and his kind personality.

The Kahuna then stood and picked up the sleeping child from his mother’s lap. The kahuna examined him closely; he gently brushed Kamaka’s silky brown hair from his face rocking him back and fourth. The Kahuna was very fond of the young boy. At only three years old he shows more compassion than anyone the Kahuna has ever known and he is far brighter than the other children his age. “He is a special child indeed,” said the kahuna, “I will train him to take my place as the Kahuna la’au lapa’a‘au, the one that holds the knowledge of herbal [plant] medicine.” Kamaka’s mother and father both nodded in agreement.

Soon after, Kamaka was taken to live with his grandfather to be trained. At times he missed his mother and father, but he also loved his grandfather. The Kahuna enjoyed taking Kamaka into the forest. He loved to watch Kamaka feel the different textures of the leaves and laughed when Kamaka copied the swaying motions of the large trees in the wind. As time went on Kamaka learned a lot about the ways of a la‘au lapa’a‘au. As he got older his grandfather taught him the names of the different plants, he showed him which plants could be used for medicine, and where these plants could be found. Kamaka learned by watching his grandfather; he saw how his grandfather treated wounds, prepared medicine using various plants, and how kindly he treated his patients.

One afternoon while Kamaka was preparing wound medicine, his good friend Pikoi came to bring a message. “Aloha Kamaka” Said Pikoi. Kamaka looked up from his work and put down the heavy stone he was using to pound limu kala and salt together. “Aloha,” replied Kamaka with a large grin, happy to see his friend. “Your grandfather has sent me, he asked for you to go into the uplands to get a plant” Said Pikoi. “What sort of plant?” asked Kamaka curiously, for he and his grandfather usually went together, never has he been asked to go alone. “He said to tell you, it is a small medicine plant, it grows no higher than your knee, and its leaves are no larger than the largest opihi. The tops of the leaves are light green and the bottom a beautiful red. It grows where the rain falls often, and is a days journey from here,” described Pikoi. Kamaka thanked Pikoi and was on his way.

Kamaka knew just where these plants grew, for he had traveled to this place with his grandfather many times before. Kamaka arrived in the uplands quickly, and began his venture into the forest looking for the medicine plant. As he walked, he kept his eyes on the ground focusing on any plant that fit his grandfather’s description. He found many plants that were no
taller than his knee, but they all had very large leaves. He saw many others that had come close, but each was missing one characteristic: none were red.

Three hours went by and Kamaka grew anxious, his grandfather needed this plant but there were only a few hours left of daylight. He began to walk faster, becoming clumsier with every step. “Ahhhh,” Kamaka screamed, he had lost his footing on the muddy forest floor and slipped. With a loud “THUMP” he landed on his bottom and began to slide down hill, painfully hitting little rocks and tree branches as he went. Finally he slowed to a stop. He was in pain; his bottom ached and his arms were scratched.

Lying quietly on the muddy forest floor he wiped the mud from his face. When the pain lessened Kamaka turned on his side to see where he was, and as he did so he saw a glint of beautiful red. Sitting up to get a better view, Kamaka realized this was the plant grandfather needed. Examining the plant, he said its characteristics aloud. “It is not taller than his knee, had leaves no bigger than the biggest opihi, the tops of the leaves were different shades of green, and the underneath was a beautiful red!” Kamaka laughed out loud. He had been walking past these plants for the last hour or two, but never thought to turn over their leaves! Kamaka felt silly, but was happy to find the plant non-the-less. He now knew why his grandfather had sent him by himself, it was to learn to be more observant, to look closely at detail, and to get close to the plant and look at all of its characteristics. “Next time it won’t take me so long to find a plant that is so common” he thought. Kamaka gathered the little medicine plants and made his way home. “A successful trip” he thought as he proudly brought the medicine plant to his grandfather’s pili thatched hut.
A Botanical Beginning

1. What is botany? (Circle the correct answer)
   a. The study of robots
   b. A type of plant
   c. A type of shoe
   d. The study of plants

2. When identifying a plant we look at its _________________.
   Fill in the blank
   Circle all that are characteristics below.
   a. Colorful
   b. Tall
   c. Pretty
   d. It is a cow
   e. Smooth
   f. Has four legs
   g. Can fly
   h. It is cute
   i. 5 inches long
   j. It is squishy

3. List three things we looked at to identify a plant.
   a. __________________________
   b. __________________________
   c. __________________________

4. List 2 reasons why you think it is important to identify a plant.
   a. __________________________
   b. __________________________

5. A ________________ person who studies plants.
   Fill in the blank

6. Fill in the blanks: In the story The Medicine Plant Kamaka was training to be a ________________, He needed to be ________________ to learn to identify the plants that were used the plants used in medicine.