Lesson 1: What is a Plant?

Summary
This discussion and activity serves as an introduction for the unit. Students will be introduced to some organisms that they may or may not be able to identify as plants. The discussion centers on what defines a plant, whether plants and parts of plants are alive, and how we know. This leads into the question of how we can get new plants from old ones.

Objectives
• Students will be able to communicate ideas about what “counts” as a plant.
• Student will demonstrate their prior knowledge of plants.
• Students will begin thinking about plants as a diverse group of organisms.
• Students will discuss what “counts” as being alive.

Materials
Blank paper (one per child)
Crayons
A variety of plants, cuttings, and seeds. Some suggestions can be found in ‘Resources’ section.
Carrot or beet
Sweet potato
dead plant
broken branch
Fake flower/plant
Insect or class pet dead or alive
Glass jars of seeds
Algae Water or limu (seaweed)
Prepared chart papers (see teacher prep) and pens
1 Homework sheet-What is a Plant?

Making Connections
Students will have some well-developed ideas about plants, and what “counts” as a plant. Most will use the presence of leaves, green parts, roots, or flowers as “evidence” that they are looking at a plant. Most children in Hawaii will have some connection to plants thanks to the shade they provide, leis they have made or worn, and our rich agricultural heritage. Although they are probably aware that plants can die, they may not really be ready to believe that they are organisms—living things—in the same way that animals are organisms.

What is a Plant?
Teacher Prep for Activity

1. Conduct Unit Pre-Assessment (described under Assessment, below).
2. Start Algae jar: Several weeks before the activity, set a glass jar of (preferably untreated) water on a windowsill. Cover with a paper towel (not plastic wrap) and a rubber band to keep out mosquitoes. Algae—Earth’s most ancient plants—will begin to grow in the jar. (Limu is also a kind of algae—you can pick some up off the beach, or at the poke counter at the grocery store).
3. Decide on whether you’d like students to work in groups or as a class. This lesson plan will treat the class as one group.
4. Gather plants or cuttings of plants that represent a diverse array of forms. Providing both whole plants and cuttings (pieces) of plants will help stimulate discussions about whether each is alive. Also include a fake flower or leaf.
5. Gather an array of seeds of different sizes (remember, a coconut is a seed!) and forms (winged, tufted, hard, fleshy, etc). If you have students in groups, be sure to get enough to let each group have several of each kind.
6. Place small seeds in glass jars with lids, so they can be observed without being lost.
7. You will need 4 charts for this activity, plus a word bank (ongoing list of vocabulary words) and a summary chart. If possible, arrange your 4 charts in a circle on the wall (it might be easier to do this as you finish writing on each chart). Each chart will end up with a record of a different step of the scientific method on it, and we really want to emphasize that the scientific method is a cyclical process—there is no correct start or end.

Chart Headings:
1. (Is it a) Plant? Alive? How do we know?
2. How can we find out?
3. I predict that…
4. What we can learn: (If…then…)
5. Summary: We know we are looking at a plant if….We know something is alive if…

Background

This is a discussion-based activity that revolves around three questions: Is it a plant? Is it alive? And how do you know? The idea is to gather information about student’s prior knowledge or misconceptions about plants, and to encourage them to generate ideas about how to test whether their ideas are right or not. The point is not to enforce a particular, rigid definition of “plant” or “alive” at this time, but to map out the process scientists use to make these decisions. One idea has been provided for mapping out this process on charts—but you certainly may come up with your own way of organizing and displaying these ideas.

One important job of a scientist is to classify organisms into logical categories. Classification systems simplify the task of recording and remembering lots of information, and help illuminate patterns in processes and functions in the natural world. For instance, the discovery of photosynthesis was almost certainly helped along by the understanding that plants are different from animals, even from those animals that are green. Imagine a space alien researcher trying to understand how a school functions: If he/she first correctly classifies students and teachers into different groups, each with a different function, he/she will be heading in the right direction.

What is a Plant?

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While the process of sorting seems very simple, there are almost always gray areas, or discrepant
events, that throw any classification scheme into question. The platypus is a perfect example. It
has fur, and warm blood, like a mammal, but it has venom, like a reptile or insect, and lays eggs
and has a duck-bill, like a bird. Similarly, a classification rule that says an organism with leaves
is a plant, may need to be changed the first time a cactus is encountered. And how do you
determine whether something like a seed is alive at the moment it is encountered?

Classifying objects requires us to ask the most fundamental of scientific questions: “Is this a
_______?” And if it is a scientific question, one can use the scientific method to answer it. In
school, most students learn the five-step, linear version of the scientific method:

1. Question
2. Prediction (Hypothesis)
3. Experiment
4. Observation
5. Conclusion

While this was fine for doing a science report, much of the scientific community has agreed that
it gives students and the general public false ideas about science as an absolute and strictly
analytical process. Scientific research rarely follows these steps in order, and almost always
makes several passes through the entire process backwards and forwards, before getting to a
useful conclusion. Further, many steps are left out, particularly social input, ethics, inspiration,
and reflection.

The true nature of science is cyclical, in that science should always be heuristic: one conclusion
should lead naturally to another set of related questions. There is no “right” path through the
multitude of steps; as luck, timing, creativity, and inspiration are critical components of all
scientific discovery, great or small. This lesson outlines the scientific method as you classify
some plant-related items into groups. You will record the traditional steps on chart paper to
identify these steps, but will hopefully show your students that the route through the steps
meanders, and returns to the start.

**Procedure**

1. Gather at the rug. Start with a typical plant. A typical plant to a second grader has leaves,
a stem or trunk, branches, roots, may or may not have flowers or fruits, and is rooted into
soil.
2. Ask the students to describe it using their senses—what is it? Is it alive? How do you
know? What does it feel like? Does it move? Etc.
3. Fill in Chart 1, Line 1: Plant’s name, yes/no, yes/no. (Students will most likely agree
that it is a plant and that it is alive). How do they know it is a plant? How did they
decide?
Sample Chart 1: Observations and Questions
(note: these are examples of possible answers from students: not meant to be correct answers!)

<table>
<thead>
<tr>
<th>Item</th>
<th>Plant?</th>
<th>Alive?</th>
<th>How do we know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marigold</td>
<td>yes</td>
<td>Yes</td>
<td>Green leaves, flowers, wet dirt, leaves are soft</td>
</tr>
<tr>
<td>carrot</td>
<td>no</td>
<td>no</td>
<td>No leaves, no dirt--plants need dirt to live</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>yes</td>
<td>I grew a carrot plant from a carrot top in kindergarten.</td>
</tr>
<tr>
<td>seed</td>
<td>no</td>
<td>no</td>
<td>not a plant yet. all dried up, it will come alive after you water it</td>
</tr>
</tbody>
</table>

4. Add evidence to the chart under the heading “How we know it’s a plant.” Evidence might include: being green, having leaves, stem, flowers. Weak evidence might include being tall and thin. Include even wildly incorrect ideas, to be corrected as you go.

5. Add evidence for the plant being alive. Students may have a hard time articulating why they think this obviously living thing is alive. “It looks alive” is a typical answer. Other evidence might be: It’s green, it’s not brittle, it’s growing (how do they know this?), it looks pretty, it moves in the wind. These may not be the scientific criteria for life, but they are valid second grade criteria.

6. Repeat with less “typical” plants, such as a grass, cactus, jade plant, plastic or silk flowers, pictures of plants, algae jar, or limu from the ocean.

7. Add to, or challenge the evidence in the “how we know” list.

8. Pass around the seeds. What are these? Are they plants? Are they alive? While you may know that a seed contains all the necessary material to develop into a whole plant, the students may not. They may decide that it is only part of a plant. Can part of a plant be alive? Write “not sure” or “part of a plant,” if the students can’t decide.

9. What about cuttings, potatoes, or beet tops? These can all grow into whole plants, but do the students know that or consider them plants now?

10. Place show & tell plants in groups: living plants, dead ones, living or dead plant parts, fake plants, not sure. Tell the students that they have created a way to “classify” the objects: an important job of a plant scientist.

11. Discuss ways to make sure the items in each category are correctly classified. How can we decide which category the “not sure” items should be in? How can we find out if a seed is alive?

12. List ideas for experiments on Chart 2 (“Plant the seeds and wait to see if they grow”),

Sample Chart 2: Experiments

<table>
<thead>
<tr>
<th>How can we find out...</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>if a seed is alive?</td>
<td>Plant it and wait for it to grow</td>
</tr>
<tr>
<td></td>
<td>Cut it open and see what’s inside</td>
</tr>
<tr>
<td>if a carrot is a plant?</td>
<td>Make a list of all the parts a plant needs, and see if it has them.</td>
</tr>
<tr>
<td></td>
<td>Try to grow it into a plant</td>
</tr>
<tr>
<td></td>
<td>Look it up on the internet</td>
</tr>
<tr>
<td>What parts a plant needs?</td>
<td>Look it up on the internet</td>
</tr>
<tr>
<td></td>
<td>Try to grow it without leaves or roots</td>
</tr>
</tbody>
</table>
13. Predict what the outcome(s) might be. Write their predictions on Chart 3 [“they will grow” or “they won’t grow” or “some will grow”].

Sample Chart 3: Predictions

<table>
<thead>
<tr>
<th>I predict that...</th>
<th>Then:</th>
</tr>
</thead>
<tbody>
<tr>
<td>if we plant the seeds...</td>
<td>They will grow</td>
</tr>
<tr>
<td></td>
<td>They won't grow</td>
</tr>
<tr>
<td></td>
<td>Some will grow, but not all</td>
</tr>
<tr>
<td>If we take the leaves off the marigold</td>
<td>It will die</td>
</tr>
<tr>
<td></td>
<td>It will grow back new leaves</td>
</tr>
<tr>
<td>If we take the roots off the marigold</td>
<td>It will die</td>
</tr>
</tbody>
</table>

14. State conclusions that can be drawn, if predictions come true. Record on Chart 4. This is a really key step, since it’s often hard for students to remember to go back to their original question and think about whether they’ve got the answer. [“We will know that the seeds were alive after all” or “we will know that the seeds were dead”]. Make some silly, irrelevant conclusions here [If the seed grows, then we know Professor Sprout came into the room and cast a magic spell], to show what a realistic conclusion is.

Sample Chart 4: Conclusions

<table>
<thead>
<tr>
<th>If...</th>
<th>...then we know that...</th>
</tr>
</thead>
<tbody>
<tr>
<td>if the seeds grow into plants, then...</td>
<td>they were alive</td>
</tr>
<tr>
<td></td>
<td>they were plants.</td>
</tr>
<tr>
<td>If the marigold dies without leaves, then...</td>
<td>plants need leaves to live</td>
</tr>
<tr>
<td>If the marigold dies w/o roots, then...</td>
<td>plants need roots to live</td>
</tr>
<tr>
<td>If the carrot grows, without leaves or roots...</td>
<td>Maybe some plants don't need roots or leaves</td>
</tr>
<tr>
<td></td>
<td>Maybe plants can live for a little while</td>
</tr>
<tr>
<td></td>
<td>without roots or leaves</td>
</tr>
<tr>
<td></td>
<td>Maybe carrots have magical powers</td>
</tr>
</tbody>
</table>

15. Make up more questions! Drawing a conclusion is not the last step in the Scientific Method! It’s a cycle, so try to bring the students’ thought process back to the “beginning” again, with more questions. Follow up questions could include: if seeds don’t grow, we decided they were dead…Does that mean they aren’t plants? Are seeds plants? How could we answer that question? [we could get more seeds of the same kind, and if some of them grow, maybe they are plants, even though our first ones were dead].

16. Summarize the student’s “evidence” for life, and for being a plant, on a Chart 5—use all the criteria the students decide to keep: they can decide through experiments during the unit what they will keep on or cross off the list. “We know something is a plant if…” and “We know a plant is alive if…”
Chart 5: Summary “How we know”

<table>
<thead>
<tr>
<th>We know something is a plant if...</th>
<th>We know a plant is alive if...</th>
</tr>
</thead>
<tbody>
<tr>
<td>It has leaves</td>
<td>We plant it and it grows</td>
</tr>
<tr>
<td>It has sap</td>
<td>If we break it and sap comes out</td>
</tr>
<tr>
<td>It has roots</td>
<td>It is growing</td>
</tr>
<tr>
<td>It grows in the ground...</td>
<td>It looks green and healthy</td>
</tr>
<tr>
<td>It is part of a plant that can grow bigger</td>
<td>Its flowers are bright and not dried up</td>
</tr>
<tr>
<td>It came from a plant</td>
<td>It’s not dried up...</td>
</tr>
</tbody>
</table>

17. Keep the Summary (Chart 5) around for the whole unit, looking for opportunities to add to or challenge the items on the list. Hang the other charts in a circle on the wall, so they are arranged as a cycle, not a line 1-4. Add arrows showing how the cycle keeps going around.

18. Homework sheet: At home, the students find 3 items around the house or yard that might be plants. Students write down what they found, how they know what it is, and whether they think it is alive. Encourage students to bring in items they find that might be tricky. (Be sure to mention plant safety concerns such poisonous or prickly plants, not collecting in someone else’s yard, etc).

Assessments
Lesson Assessment: Students should be able to fill out the alive/not alive homework sheet on their own, based on items provided by the teacher, or found in the school/home yard.

Resources
What plants to choose? Here are some suggestions by theme…

Native plant theme:
- Ohia (extremely tiny seeds)
- Koa
- Naupaka
- Native hibiscus
- Kupukupu or hapuu (ferns)
- Uki uki, pili, or other native sedge/grass
- Hala

Canoe Plant theme:
- Coconut (world’s largest seed)
- taro
- sweet potato
- breadfruit
- sugar cane
- mountain apple

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“First Hawaiian Lu‘au” (a collection of edible plants that the first Polynesian settlers found when they arrived in Hawai‘i)

- aweoweo
- ho‘io or watabi (fern shoots)
- hapu‘u (the starchy corm—hard to show and tell)
- limu
- ohelo and akala berries

Peculiar Plants:

- Venus fly trap (carnivorous, and it moves)
- Sleeping grass (aka sensitive grass/mimosa—also moves)
- Pitcher plant (carnivorous)
- Jade plant (can grow from just a leaf)
- Miconia or macaranga (enormous leaves, extremely invasive)
- Corn. (Corn?! What’s so weird about corn? It’s one of the only plants whose seeds come out of a very different part of the plant then the flowers.
- Peanuts (how does a bee-pollinated seed grow under the ground?)
- Limu
- Algae (this is what the jar of water is for)
- Cactus
- Moss

Background Information taken from the FOSS New Plants Kit and Cuddihy and Stone.

**Extension Activities**

Do the experiments: Students will want to try the experiments they proposed, so be prepared! A small tray of potting soil or vermiculite, and a glass jar of water should suffice to test seeds and cuttings by planting them.

Field Trip: One exciting way to kick off a plant unit is to visit a place where plants have gone through a major disturbance. If you are able to get to a lava flow area where there are few or no plants yet growing, or a fire burn scar, or even a recently flood-scoured stream bed, what a great way to stimulate ideas about the need for plants to reproduce! Students can search for seeds along the surface of the scar, and begin to think about how they got there, whether they can grow in the spot they landed, and if the place is close enough to school, consider marking and monitoring their development month by month.

**Art Connection**

Ask students to draw a plant from memory then have them observe a plant closely and draw it. Discuss in small groups what they noticed the second time. Label parts on their plants. Did they have more things to label in the second? That’s the beauty of making and recording careful observations!
Math Connection
Pattern recognition, measurement, and comparing numbers will be easy to integrate with most lessons. Start looking for opportunities to fit your lessons into the science period. Since this unit is pretty time consuming, double-dipping will help you keep on top of all standard content areas.

Lay out the leaves you collected for the show and tell discussion or on a student walk. Also lay out geometrical shapes (blocks, cut-outs, whatever you have on hand). As a group, search for geometric shapes in the leaves. Find lines of symmetry in the leaves. Classify them by shape and symmetry. How many groups? How many in each group? Check out the book “Eating Fractions!” by Bruce McMillan, then try making leaf and seed fractions.

Literature Connection
Literature: Any book that reflects the excitement and wonder of growing plants is a great supplement at this point.
Some suggestions:
Pumpkin Day, by Nancy Elizabeth Wallace
The Carrot Seed, by Ruth Krauss, illustrated by Crockett Johnson

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Name: _______________________________ Date: ______________

**Homework: What is a Plant?**

Go outside and look for something that you think could be a plant, or part of a plant. Look around. Try to figure out what it is and where it came from. Is it a seed from a tree nearby? Is it an unusual tree, or one of many small bushes? Then fill in the worksheet. If you can find something really tricky, bring it to class to share with us!

1. I found a: ____________________________________________________________.
   I can tell that’s what it is because: ______________________________________
   _________________________________________________________.
   I noticed: ____________________________________________________________
   _________________________________________________________________.
   I think it is alive or not alive because: _________________________________
   _____________________________________________________________.

2. I found a: ____________________________________________________________.
   I can tell that’s what it is because: ______________________________________
   _________________________________________________________________.
   I noticed: ____________________________________________________________
   _________________________________________________________________.
   I think it is alive or not alive because: _________________________________
   _____________________________________________________________.

3. I found a: ____________________________________________________________.
   I can tell that’s what it is because: ______________________________________
   _________________________________________________________________.
   I noticed: ____________________________________________________________
   _________________________________________________________________.
   I think it is alive or not alive because: _________________________________
   _____________________________________________________________.

What is a Plant?