

## Soil Secrets-Cabbage Chemistry!

**Objective:** Students will conduct an experiment to measure the acidity of their soil samples.

Standards: SL.K.1 SL.K.1a K-ESS2-2 SP4

Subject(s): Science

 60 minutes

### Hook - 5 minutes

I ring my chime to get the class's attention. I announce that we were about to begin the fourth Science lesson in our unit about soil. I ask them to return to the carpet squares and 'Show Five'. I aim to always start lessons with a way- however simple- to connect the material with a real life application.

Once seated, I ask for a volunteer. Usually, there are several students who want to help so I tend to pick a Daily Helper. When they come up, I ask them to stick out their tongue and I put a drop of lemon juice on it. "What do you notice about the taste?" "It's very soooooour!" "Do you think you could drink this all the time?" "Yuck..no!" "Every living thing needs to have the right kind of water to help it survive."

### RESOURCES



Acid Soil Hook.mp4 <https://betterlesson.com/lesson/resource/3203966/acid-soil-hook-mov>

### Whole Group Instruction - 10 minutes

This is a short, fun, and important lesson. Normally, the concept of a soil's Ph might be seen as a bit too abstract to connect to their lives..what's the point? I feel, though, this experiment an enjoyable way to learn about soil conditions that it's well worth the time. I chose the soil types (rocks, sand, humus) after a discussion with a local horticulturist to see what would provide the students with an optimal visual result. He told me it depends on a great many factors like amount of rain, soil condition, and what has grown at that location in the past. Since these factors can have dramatic geographic differences, it may be worth it find an expert in your area. Think about garden centers, 4-H clubs, or community colleges as resources. The background information is often adds a valuable dimension to your teaching.

"The lemon juice introduces the chemical property of **acid**. The opposite of acid is **alkaline**. Practice those words with me. Acid..." "Acid" "And alkaline.." "Alkaline". "The amount of acid and alkaline is measured on something called a **Ph Scale**. It's important for geologists to know this level in the soil so they can make adjustments and add things to create a healthy environment for plants to grow. What would make one soil different from another?" "What about what it's made from?" "That's exactly right. Soils with more organic matter- ones that come from decomposed wood, animals, and leaves- have a neutral Ph, which means that it provides an environment that's just right, not too acid and not too alkaline (the opposite of acid)." "Like Goldilocks"" "Exactly like Goldilocks!" Here, I use two important strategies. First, I introduce key vocabulary and have the students repeat it. This helps cement the knowledge and practice correct pronunciation, important both with this age and English Learners. The next

thing I do is to take advantage of a teachable moment and connect it to something familiar. Whenever you do this- use a moment “Like Goldilocks?”- children attach new learning to something familiar. That helps their retention and increases engagement. Both make life much easier for you!

“To test the Ph of our soil, we’re going to use a solution. That means we are going to add a mineral or chemical to a liquid. We did something similar before. Anyone remember?” “With the salt crystals!” “Right. I made this solution by cooking some red cabbage in water, then taking it out so I was just left with the sol...” “Solution” “The cabbage has to be red because the color helps us see the effect of acid or alkaine. We use this solution as a base, a way to see and measure the Ph.” As above, I connect today’s experiment a previous lesson. It helps increase comfort and applies prior knowledge.

## Small Group Instruction - 10 minutes

### Materials:

- Soil samples (3)
- Sample jars (3)
- Red Cabbage solution (Boil half of a red cabbage in 1/2 gal. of water)

I ring the chime and ask them to go to their tables. “How do we know if the soil is a healthy place for the plant to grow?” “We figure out the kind of soil?” “OK, so what should be the first thing we do?” “Look at the different soils?” “Right. Since we separated the soil in the last lesson, we have different specimens to study. Remember, people who study soil test it and figure out the Ph levels so they can change it and make a successful place for plants to grow. There’s several steps we need to follow to do this.” Experiments like this are simple ways to invite students into the Scientific process.

- First, put two spoons of soil into the jars that are labeled with the different soil names.
- Next, add the cabbage solution so the jar is almost full. Put on the lid and shake up the jar.
- Then, set it back down on the table and watch how the color changes.
- After, match color in the jar against the Ph Scale on the table. Analyze the results and decide-
  - \* What is the Ph of the dirt? What number is next to the solution color?
  - \* Is it alkaline, acid..or neutral?
- Last, record your answer on the chart next to the kind of soil.

As I give directions, I count them out on my fingers to give them a visual cue and ask the students to repeat the directions with me. This may seem like a lot of steps for Kindergarteners so I designed them to be very simple and quickly implemented.

I put three jars on each table next to the containers of soil, as well as the colored Ph Scale they will use in the next part of the lesson. I review each step as they begin to implement them. I also remind them, “Collaboration is an important part of the Science process. Be sure to discuss what you observe with the others at your table.” I walk around with a pitcher of cabbage solution (yes, it can be smelly so prepare the students!) to add to the jars. As the students proceed, I walk around and help them as needed. This has been some quick, intense learning time, so when these steps are complete, I ring a chime and dismiss them to recess.

After recess, I have the students go to their carpet squares to review what we need to do when we look for the Ph of soil. This observation piece is a key way to analyze data, so I model the process:

1. Observe the soil color- “Hmmm..I need to figure out the color of the soil.”
2. Compare it to the Ph Scale. - “I notice the solution in the jar of rocks is..what would you say?” “Kind of blue” “OK, so now I’m comparing that to the Ph Scale. It shows that this blue is a Ph of about 10.”
3. Decide if this is Acid or Alkaline- I run my finger up on the chart to show them the diagnosis. “That means that this soil is acid. I’m going to take the recording chart, find the section for rocks, and record 10 on the line for Alkaline.”

I want to make instruction a quick piece of the lesson so they’ll have adequate time to conduct the experiment and discuss the results. I ring the chime to dismiss the class to their tables. As they begin their observation part of the experiment, I again mingle through the groups to observe their process, listen to the comments, and help guide them when necessary. I give them 5-7 minutes to finish up before I ring the chime and ask them to return to their carpet squares with their charts to review the results.

## RESOURCES

-  Ph Scale.jpg <https://betterlesson.com/lesson/resource/3201176/ph-scale-jpg>
-  Ph Recording Chart.pdf <https://betterlesson.com/lesson/resource/3201177/ph-recording-chart-pdf>
-  Acid Soil Product.jpg <https://betterlesson.com/lesson/resource/3203968/acid-soil-product-jpg>
-  Acid Soil Process\_2.mp4 [https://betterlesson.com/lesson/resource/3203970/acid-soil-process\\_2-mov](https://betterlesson.com/lesson/resource/3203970/acid-soil-process_2-mov)
-  Acid Soil Product\_2.jpg <https://betterlesson.com/lesson/resource/3203971/acid-soil-product-2-jpg>
-  Acid\_Alkaline Scale.jpg <https://betterlesson.com/lesson/resource/3203980/acid-alkaline-scale-jpg>



### LESSON DESIGN IS LIKE A PUZZLE: Staircase of Complexity

While the concepts can be complicated, the chemistry experiments to illustrate them don't need to be. How do we break them down? We do this by realizing there's just as much enjoyment and enriching knowledge that comes out of something simple. To bring this concept of soil Ph to the student level, I did a great deal of scaffolding in this lesson. Everything from connecting to prior knowledge to repeating new vocabulary to breaking down step by step directions helps make the material much more accessible. Additionally, since I suspected the concept the soil Ph could be rather dry, I purposely chose a visual delivery of this concept to heighten the engagement of the students. These elements of lesson design are all important to remember. At the end of the day, Keep It Simple and Make It Fun both help access the complex ideas without increasing the complexity of the instruction. Both guidelines sound obvious, though when we are working hard to translate the required material, they're easy to forget. When we see an end product that become an enriching experiment by Scientists..our students..it turns into an ideal classroom lesson for everyone!

## Wrap Up - 5 minutes

I have an enlarged (ledger size is fine) version of the chart ready to record their findings.

*"Let's share some of the things we observed. What did you discover about rocks?" "Rocks were mostly 6. That's alkaline." "Great. Let's record that on our chart and put '6' next to alkaline, under 'rocks'. What about humus?" "Humus is a 4. That's acid." "Great. Let's record that on our chart and put '4' next to acid, under 'humus' The last soil category would be..." "Sand" "Yep. What did we find about about sand?" "Rocks were mostly 6. That's alkaline." "Awesome. Let's record that on our chart and put '6' next to alkaline, under 'rocks'. As I said above, this is a simple lesson and simple formative assessment. It helps us gain valuable experience with the experiential process and gets students excited about learning more about the simple element of soil. Ultimately, that's what it's all about!*