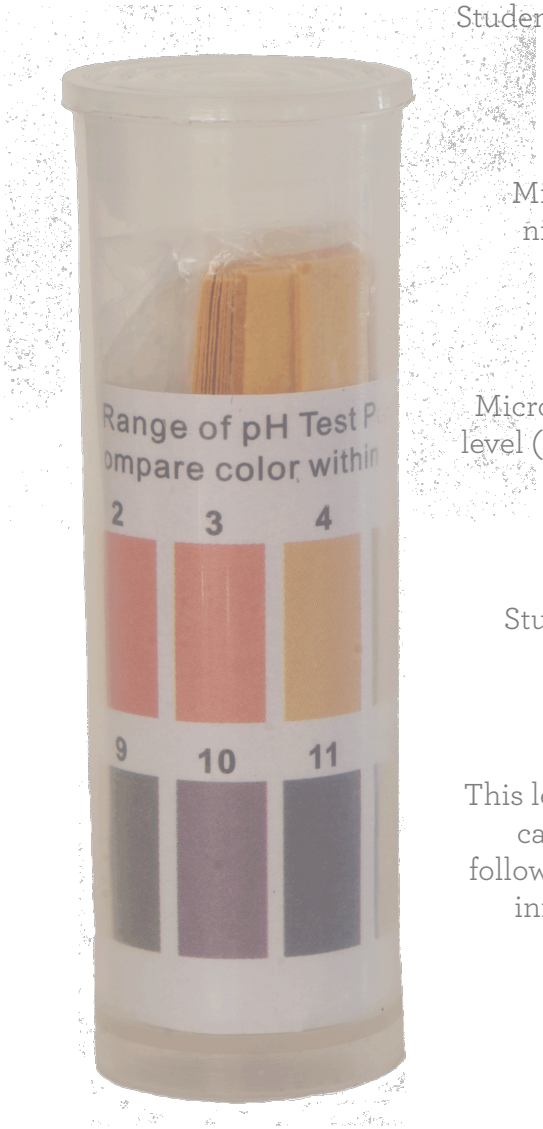
Garden Lesson G8-2

Soil pH



Communication

Students work together in small teams to collect and analyze data and make suggestions for raising or decreasing soil pH in areas of the garden, if necessary.

Sustainability

Microorganisms and soil pH are interconnected, an ideal pH will help provide nutrients like nitrogen or carbon to plants in an ecosystem, and testing is a best practice for farmers and gardeners as the pH of the soil fluctuates depending on season and abiotic factors.

Nourishment

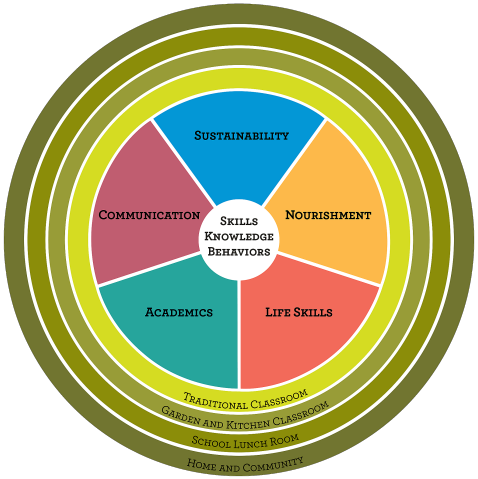
Microorganisms are responsible for making nutrients available to plants, and a slightly acidic pH level (between 6-7), is ideal so that the plants provide humans with the best possible nutrition when we eat them.

Life Skills

Students work together in small teams to complete research, focus on listening, speaking and following directions and participate in class routines.

Academics

This lesson fulfills Next Generation Science Standards for planning and carrying out investigations; Common Core State Standards for following multistep procedures; integrating quantitative or technical information; collaborative discussion; speaking and listening; language; and acquiring words and phrases.



Soil pH Lab Abstract

In this 8th grade science lesson, students test the **pH** levels of soil from three different sites in the garden to determine the level of acidity in the garden soil.

Objectives

After this lesson, students will be able to:

- Use scientific tools to determine whether the soil is **acidic**, **basic**, or **neutral**

Assessments

During this lesson, students will:

- Accurately test and record the **pH** of the soil using a **pH** strip and probe

Communication is strengthened by working together in small teams to collect and analyze data and make suggestions for raising or decreasing soil **pH** in areas of the garden, if necessary. ***Sustainability*** is highlighted by discussing how **microorganisms** and soil **pH** are interconnected, how an ideal **pH** will help provide nutrients like nitrogen or carbon to plants in an ecosystem, and that testing is a best practice for farmers and gardeners as the **pH** of the soil fluctuates depending on season and abiotic factors. ***Nourishment*** is explored by knowing **microorganisms** are responsible for making nutrients available to plants, and that a slightly **acidic pH** level (between 6-7), is ideal so that the plants provide humans with the best possible nutrition when we eat them. ***Life Skills*** are sharpened as students work together in small teams to complete research, focus on listening, speaking and following directions and participate in class routines.

Academics fulfill Next Generation Science Standards for planning and carrying out investigations; Common Core State Standards for following multistep procedures; integrating quantitative or technical information; collaborative discussion; speaking and listening; language; and acquiring words and phrases. See **Connections to *Academic* Standards** below for details.

Edible Schoolyard curriculum emphasizes developing community and personal stewardship, along with skills that will help students navigate different situations throughout their lives; and selecting, using, and caring for **scientific measuring tools** in the garden. See **Connections to *Edible Schoolyard* Standards** below for details.

This lesson follows the BEETLES Project's ***Learning Cycle*** (Invitation-> Exploration -> Concept Invention -> Application -> Reflection) and uses their ***Discussion Routines*** (Think-Pair-Share, Whip-Around). All are highlighted in ***Green**** with an asterisk for easy identification. See the documents BEETLES_Discussion_Routines.pdf and BEETLES_Learning_Cycle.pdf included in **Resources** below for more information. Games and activities from other sources are also identified in ***Green***, without an asterisk.

Connections to *Academic* Standards

Next Generation Science Standards, Middle School

Science and Engineering Practices:

- Planning and Carrying Out Investigations
  - Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.
  - Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.

Common Core State Standards, English Language Arts and Literacy, Grade 8

- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher- led) with diverse partners on *grade 8 topics, texts, and issues,* building on others' ideas and expressing their own clearly.
  - SL.8.1.a Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
  - SL.8.1.b Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.
  - SL.8.1.b Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
  - SL8.1.c Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.
- SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

- SL8.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 8 Language standards 1 and 3 on page 53 for specific expectations.)
- L.8.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
    - L.8.1.d Recognize and correct inappropriate shifts in verb voice and mood.
- L.8.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- L.8.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Connections to *Edible Schoolyard* Standards

Edible Schoolyard 3.0

In the Edible Schoolyard Program

- 1.0 Students work with each other and teachers to develop community and personal stewardship, along with skills that will help them navigate different situations throughout their lives.
- 1.1.1 – 1.3.12 This lesson fulfills all Edible Schoolyard Program standards, numbers 1.1.1 through 1.3.12. See ***The Edible Schoolyard Berkeley Standards*** for details.

In the Garden Classroom, 8th grade

- Tools 3.1.2 Select, use, and care for **scientific measuring tools** in the garden, measure precisely and understand what results mean.

Soil pH Lab Lesson

Materials

- G8-2 Visual Aid
- Watering cans
- Sticks for stirring
- **pH** strips
- **pH** color key
- Signs for sample areas
- Clipboards
- Pencils
- Soil **pH** Lab worksheets
- Calculator

Before You Begin

- Create the Visual Aid
- Copy the Soil **pH** Lab worksheet to hand out
- Label the sites and dig holes where samples will be collected
- Collect all the materials, then set them up to make a **pH** lab

Timeline Overview

Total Duration: 90 minutes

1. *Invitation** (5 minutes)
2. *Application** (60 minutes)
3. *Concept Invention* (20 minutes)
4. *Reflection** (5 minutes)

Procedures

At the Opening Circle

1. *Invitation**:

a. Welcome students and introduce the Soil **pH** Lab.
b. Ask students to explain what **pH** measures.
c. Explain that **pH** is relevant to the garden because it indicates nutrient availability.
    i. Tell them that the ideal acidity level for soil is between 6 and 7.
d. Explain that **microorganisms**, like bacteria, are most prevalent in slightly **acidic** soil (6-7) and that **microorganisms** are responsible for making nutrients available to plants.
e. Explain that students will use **pH** strips to test the **pH** of three different areas in the garden:
    i. An annual bed
    ii. A perennial bed
    iii. A compost pile
f. Prompt students to think about scientific procedures and why it is necessary to test three different areas of the garden.
g. Ask students to predict which site will be in the ideal 6-7 window on the **pH** scale and why.
h. Divide students into 4 working groups for garden jobs, and lead one of the groups to the **pH** lab for the first rotation.

In the Field (80 minutes total)
Garden Work Rotation

2. ***Application****: (60 minutes)
Students think about and discuss scientific procedures, **pH** and soil health while they work in the garden.
a. Each group rotates through the **pH** Lab as the other groups work in the garden.
    i. The first group jumps to **At the pH Lab** step **3**. ***Concept Invention**** while the other three groups begin their garden work.
    ii. When the first group is done with step **3**. ***Concept Invention****, they return to (or begin) their Garden Work Rotation and the next group starts the pH Lab.
    iii. It takes a total of 80 minutes of class time to get all groups through steps **2** and **3**.

3. ***Concept Invention****: (20 minutes)
a. Gather students around the **pH** lab table, and divide the group into three smaller groups.
    i. Each group should have:
        1) Watering can
        2) Stir stick
        3) Clipboard with a worksheet

4) **pH** strips with the color code key
5) Pencil

b. Each group of 2-3 students will test a sample from the site.
c. Bring students to their test site and demonstrate how to make a soil solution, dip the **pH** strip, and how to read the key.
d. Have each group take a reading from the strip, record their data on the worksheet and return to the station to derive a mean average.
e. Ask students to identify their samples as **acidic** or **basic**.
f. Ask students what abiotic factors might alter the **pH** of the soil. (*rain, sun, temperature*)
g. Prompt students to think about methods that can be used for maintaining the soil **pH** between 6 and 7. (*compost, amendments like lime stone and sulfur*)
h. Have students reset the **pH** lab for the next group and return to garden work.

At the Closing Circle

4. ***Reflection****:* (5 minutes)

a. Using the white board at the front of the Ramada, collect data from each group.
b. Ask students what they notice about the **pH** of each site and prompt students to think about methods that can be used for maintaining the soil **pH** between 6 and 7. (*compost, amendments like lime stone and sulfur*)
c. Have students serve a seasonal fruit, vegetable or herb tasting.

Vocabulary

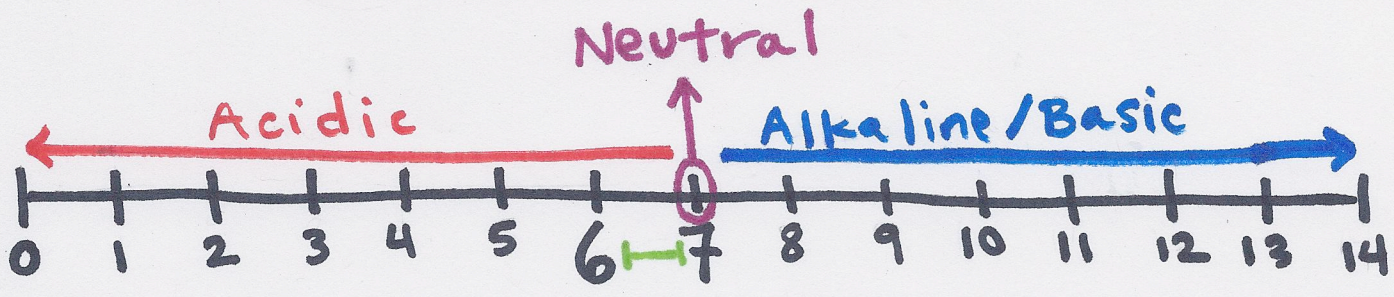
pH
Basic or alkaline
Acidic
Neutral
Microorganisms

Contributors

All lessons at the Edible Schoolyard Berkeley are developed in collaboration with the teachers and staff of the Edible Schoolyard and Martin Luther King Jr. Middle School.

Resources
G8-2_Visual_Aid.pdf
G8-2_Soil_pH_Worksheet.pdf
BEETLES_Learning_Cycle.pdf (See lesson G6-0)

SOIL pH



*Ideal Soil pH

Essential Elements are most available between pH 6 and 7

- Nitrogen: plant structure and leaf growth
- Phosphorous: activates root growth
- Sulfur: helps plants make proteins

	pH Strip	pH Probe
Area 1 Annual Bed		
Area 2 Perennial Bed		
Area 3 Hillside Orchard		

Soil pH

Soil Test Site: _____
Sample #: _____

Dip pH strips in our soil solution and leave submerged for at least 2 seconds.

Place your strips here. Observe color.

Compare your strips to the pH key above to approximate the pH of your soil solution. Estimating to the nearest decimal, what is the pH? _____

Fill in your row in the following data table.

	Strips
Sample 1	
Sample 2	
Sample 3	
Average	

Is the soil acidic, alkaline, or neutral? _____