YEAR 3–4

Taste the pH Rainbow

Hands-on Horticulture

In collaboration with Hort Innovation, Primary Industries Education Foundation Australia (PIEFA) has developed a series of practical scientific investigations exploring Australian grown fruit and vegetables.

The **Hands-on Horticulture** resources have been designed to engage students in hands-on Australian Curriculum aligned investigations that explore Australian grown fruit and vegetables. The resources incorporate science understanding and science inquiry skills to provide meaningful learning experiences for primary-aged students. Each resource contains guidance for a teacher-led lesson to be completed in the classroom, along with a '**Take me Home!**' extension activity for students to consolidate their scientific investigation and explore the production of fruits and vegetables.

During this practical activity students will conduct an investigation to test the pH levels of citrus fruits.

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Background information

The **pH scale** is a way to measure how **acidic** or **alkaline** (basic) a substance is. pH can affect how chemicals react with each other, how biological processes take place and even the taste of foods. Substances with a **pH less than 7 are acidic**. Examples of acidic substances include lemon juice, vinegar and the acid in our stomachs that helps to break down foods. A pH of 7 is neutral. Substances with a **pH greater than 7 are alkaline** (basic). Examples of alkaline substances include baking soda, spinach and soap.

Understanding the pH of different substances allows people working in science and design and technologies occupations to make informed decisions about efficient production, health and safety and environmental sustainability.

Producers working in Australia's horticulture industry regularly test the pH of their soil to ensure optimal growing conditions for their crops. Understanding soil pH allows them to make informed decisions about farm management to continue to produce high-quality food products for the Australian and export markets.

For consumers, understanding pH levels can contribute to the selection and preparation of foods for healthy eating. Knowing the pH of different foods helps in understanding their susceptibility to spoilage and the need for proper storage conditions to prevent microbial contamination. pH also influences the taste of foods. Some foods are more sharp or tangy due to their lower pH levels, while others are more bitter because of their higher pH levels. Understanding pH can help in preparing flavoursome meals that combine a balance of acidic and alkaline ingredients or in determining the ripeness of fruits and vegetables for optimal taste and nutritional value.

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LESSON

Taste the pH Rainbow

RISK ASSESSMENTS

Note: Schools are responsible for generating their own risk assessments for activities. Risk assessments should address the potential hazards associated with using fruits and vegetables in the classroom, including food-borne illnesses, allergies, slips/falls, and cross-contamination, and propose control measures such as proper cooking, allergy awareness, accident prevention, and hygiene practices to ensure a safe learning environment for students.

LESSON OBJECTIVE

Students will learn about the pH levels of different fruits and vegetables to understand the impact of acidity or basicity on taste and ripeness.

SUCCESS CRITERIA

I can describe how pH affects the taste of different fruits and vegetables.

ACTIVITY LENGTH

60 minutes

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Taste the pH Rainbow

Materials (whole class)

- A sample of foods representative of each of the five flavours (e.g. Sweet – strawberries, Sour – lemon, Salty – popcorn, Bitter – broccoli, Umami – tomato)

Materials (per student)

- A sample of foods representative of each of the five flavours (e.g. Sweet – strawberries, Sour – lemon, Salty – popcorn, Bitter – broccoli, Umami – tomato)
- pH strips
- Plastic knives
- Cutting boards
- 3 bowls
- Pipette
- **Taste the pH Rainbow** student worksheet

Instructions

1. View the video Your Tongue: The Taste-Maker! (3:51) to learn how our tongues perceive taste.
2. Distribute a copy of the **Taste the pH Rainbow** student worksheet and read the information on the first page as a class.
3. Present students with a sample of foods representative of each of the five flavours (e.g. **Sweet** – strawberries, **Sour** – lemon, **Salty** – popcorn, **Bitter** – broccoli, **Umami** – tomato). Facilitate a discussion about the different flavours and textures of each of the foods. Allow students to sample each of these foods to observe their flavour and texture, recording their observations on the first page of their worksheet.
4. Read the information on the second page of **Taste the pH Rainbow** student worksheet to learn about the concept of pH and its relevance to the flavour and texture of foods. Encourage students to reflect on the taste testing activity to consider which of the sample foods could be acidic (low pH) (e.g. lemons, tomatoes) and which could be alkaline (high pH) foods (e.g. broccoli) based on the descriptions provided in the text.
5. Allocate students into groups of three to four and distribute the required materials for the practical activity.
6. Model safely cutting, juicing and testing the pH level of a sample citrus fruit to provide students with guidance for the correct task procedure. Remind students not to touch their eyes or face after handling the pH strips and citrus fruits.

Instructions (cont'd)

7. Students work in their groups to follow the instructions on the student worksheet or complete each of the following steps with teacher instruction.

8. Using a chopping board and a plastic knife, students safely cut each fruit in half.

   (Depending on student abilities, teachers may wish to pre-cut fruit prior to the commencement of the task and skip this step).

9. Using a juicer or by hand, students squeeze the juice of each of the fruits into their three containers or glasses, rinsing the equipment and ensuring they do not mix the juices of the fruits during this process.

10. Students lay a pH test strip in front of each container or glass.

11. Using a pipette, groups will carefully take a sample of juice from the first container, and place a few drops onto the corresponding pH strip.

12. Students use three different pipettes or clean and then flush with water before repeating this step with the second and third juice containers.

13. Using the pH indicator chart, groups compare the juice of the three fruits to determine their pH level, recording the results on their worksheets.

14. Reconvene as a class to discuss the results of the pH investigation.

15. Facilitate a class discussion about the significance of understanding the pH level of different fruits and vegetables to determine their taste and ripeness. Discuss how the pH might affect the taste (sourness for acids and bitterness for bases). Talk about how ripeness affects acidity, with many fruits becoming less acidic (more sweet) as they ripen. Understanding the pH levels of food can help us to determine which flavours will work well together in recipes and how different foods should be stored to keep fresher for longer.

16. Students complete the remaining activities on the student worksheet.

LEARNING AREA

Science (Year 3–4)

AUSTRALIAN CURRICULUM CONTENT

Describe the ways food can be selected and prepared for healthy eating (**AC9TDE4K04**)

Pose questions to explore observed patterns and relationships and make predictions based on observations (**AC9S3I01**, **AC9S4I01**)

Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment (**AC9S3I02**, **AC9S4I02**)

Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (**AC9S3I03**, **AC9S4I03**)

Construct and use representations, including tables, simple column graphs and visual or physical models, to organise data and information, show simple relationships and identify patterns (**AC9S3I04**, **AC9S4I04**)

Compare findings with those of others, consider if investigations were fair, identify questions for further investigation and draw conclusions (**AC9S3I05**, **AC9S4I05**)

Write and create texts to communicate findings and ideas for identified purposes and audiences, using scientific vocabulary and digital tools as appropriate (**AC9S3I06**, **AC9S4I06**)

References

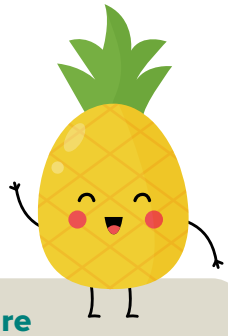
SciShow Kids. (2016). Your Tongue: The Taste-Maker! In YouTube. https://www.youtube.com/watch?v=C4rdqXXzPGU

The Investigation. (2019). PH Levels in Different Citrus Fruits. https://science-investigation.weebly.com/the-investigation.html

Taste the pH Rainbow

Our tongue plays an important role in our sense of taste. It allows us to experience the flavours of **sweet**, **salty**, **bitter**, **sour**, and **umami**. Our tongues are covered in small bumps called papillae which contain tiny taste buds that allow us to experience all of these flavours when we eat. Our sense of taste not only allows us to enjoy a variety of nutritious foods, it also helps us to identify if foods are safe to eat. If food is spoiled (unsafe to eat), our taste buds send a message to our brains letting us know the food tastes bad, giving our bodies a warning that the food might make us sick.

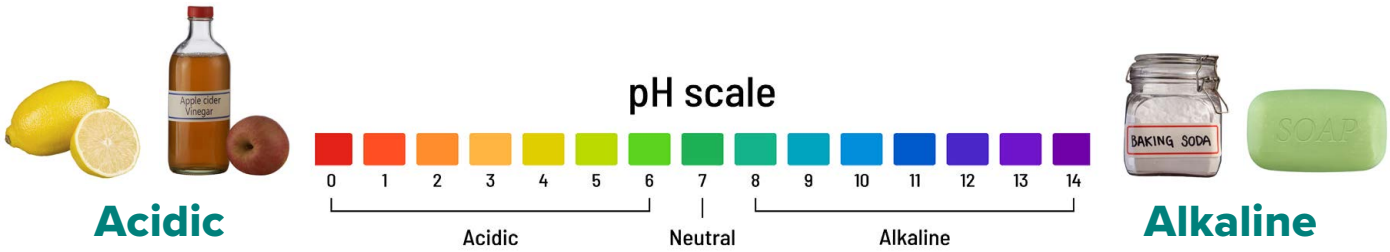
1. **Conduct a taste test to sample each of the five flavours (sweet, salty, bitter, sour, and umami). Record your observations about the flavour and texture of each of the foods in the space below.**



Name of food	Flavour (How a food tastes)	Texture (How a food feels in our hands or mouths)

Taste the pH Rainbow (cont'd)

The **pH scale** is a way to measure how **acidic** or **alkaline** (basic) a substance is. pH can affect how chemicals react with each other, how biological processes take place and even the taste of foods. Substances with a **pH less than 7 are acidic**. Examples of acidic substances include lemon juice, vinegar, and the acid in our stomachs that helps to break down foods. A **pH of 7 is neutral**. Substances with a **pH greater than 7 are alkaline** (basic). Examples of alkaline substances include baking soda, spinach, and soap.



Knowing the pH of different substances helps us to better understand the world around us, so we can make informed decisions in our daily lives, stay healthy, and care for the environment. **pH is all around us!**

Farmers need to regularly check the pH levels of their soil. Some plants grow better in acidic soils while some prefer alkaline soils. Farmers can adjust the pH of their soil using fertiliser and other nutrients to provide their fruit and vegetable crops with the conditions they need to grow.

Water treatment plants need to check the pH levels of drinking water to make sure it is safe. Water that is too acidic or too alkaline can be harmful to pipes and may be unsafe to drink. It is important to keep water between around 6.5 and 8.5 on the pH scale, for safe drinking water.

The taste of food can be affected by its pH level. Acidic foods (with low pH levels), like lemons and tomatoes, often taste tangy or sour, while alkaline (basic) food and drinks (with higher pH levels) are often bitter. The texture, smell and appearance of different foods can also be affected by their pH. As fruits and vegetables ripen, their pH can change. Knowing about pH levels can be helpful when cooking as a mix of acidic and alkaline ingredients can give recipes balanced flavours. pH levels can also help to know when a fruit or vegetable is ripe (when it has the best taste and nutritional value).

Taste the pH Rainbow (cont'd)

EQUIPMENT

Collect these materials before you start the experiment:

Sample of foods representative of each of the five flavours

3 clear bowls or containers

pH testing strips

Chopping board

Plastic knife

Pipette

INSTRUCTIONS

1. Use a chopping board and a plastic knife to cut each of the fruits in half.
2. Squeeze the juice of each of the fruits into separate containers.
3. Lay a pH test strip in front of each of the containers.
4. Record your prediction about the pH of each of the fruits on page four of your worksheet.
5. Using a pipette, carefully take up a sample of juice from the first container, placing a few drops onto the corresponding pH strip.
6. Clean the pipette before repeating this step with the second and third juice.
7. Using the pH indicator chart, compare the juice of the three fruits to find their pH, and record the results on your worksheet.

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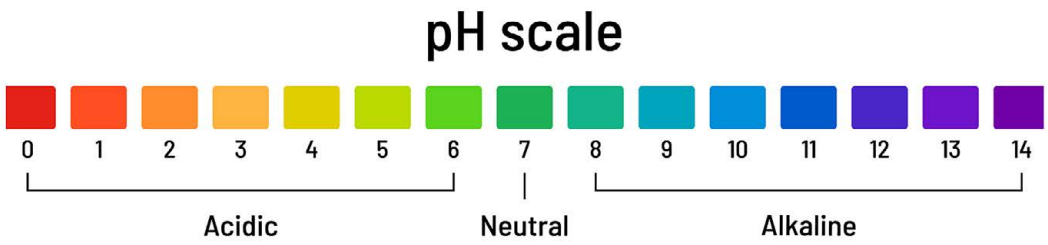
Taste the pH Rainbow (cont'd)

2.

Make a prediction about the pH level of each of the fruits.

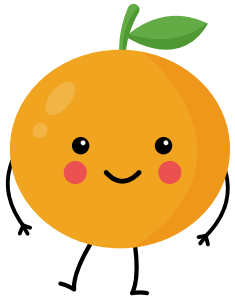


Name of fruit	My prediction (pH)

3.

Tick the statement you predict will be correct (✔).

- **All** of the fruits will have **alkaline pH** levels. ☐
- **All** of the fruits will have **acidic pH** levels. ☐
- **Some** of the fruits will have **alkaline pH** and some will have **acidic pH** levels. ☐



4.

Record a sentence to explain your predictions.

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Taste the pH Rainbow (cont'd)

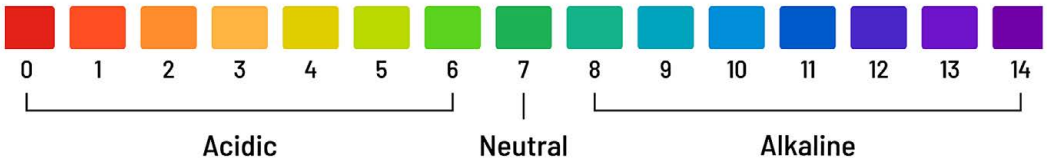
5. **Draw and label a diagram of your pH experiment.**

6. **Record the results of the pH experiment in the table below.**

Name of fruit	pH level

Taste the pH Rainbow (cont'd)

7. **Draw and label where each of the fruit belongs on the pH scale.**

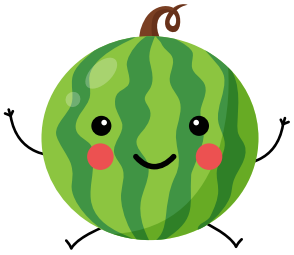


8. **Was your prediction correct? Why/why not?**

9. **Which of the fruits was the most acidic?**

10. **Which of the fruits was the least acidic?**

Taste the pH Rainbow (cont'd)



11. **Explain what the pH level of each of these fruits tells us about their flavours.**