Soil pH Testing

Sections

Joey Scouts
Cub Scouts
Scouts
Venturer Scouts
Rover Scouts

Scouts VICTORIA

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Challenge Areas

COMMUNITY
CREATIVE
OUTDOOR
PERSONAL GROWTH

Scout Method Elements

COMMUNITY INVOLVEMENT
LEARNING BY DOING
NATURE AND THE OUTDOORS
PROMISE AND LAW
PERSONAL PROGRESSION
PATROL SYSTEM
SYMBOLIC FRAMEWORK
YOUTH LEADING, ADULTS SUPPORTING

SPICES Growth Areas

CHARACTER
EMOTIONAL
INTELLECTUAL
PHYSICAL
SOCIAL
SPIRITUAL

The Adventure

Learn about pH and soil and its real-world applications such as in forensics or agriculture.

Plan

1. Investigate acids and bases and their properties. What acids and bases do you encounter in your everyday life?
2. Investigate the pH scale as a way to measure the strength of acids and bases. What is the pH of a weak acid, strong acid, weak base, and strong base?
3. Investigate what affects the pH of soil and the implications this may have on agriculture.
4. Investigate how soil has been used in criminal investigations.
5. Read the safety information and discuss with your leaders or another appropriate adult what safety equipment, precautions, and supervision may be required. Ensure that you have these safety measures in place before starting the 'Do' section.
6. Gather all the equipment that you need to make your soil pH testing experience. You will need the following equipment and ingredients: a pot, water (ideally demineralised), red cabbage, stove top, colander, soil samples, containers, soil additives such as citric acid and bicarbonate of soda, clear jars, and spoons.

Do

1. Get a leader or another patrol, which you can then swap with, to assemble the soil sets according to the following instructions:
   a. Into 4 separate containers, place at least 3 tablespoons of soil into each. Where possible, make sure that the soil is free from major debries such as twigs and stones.
   b. Label the containers with numbers 1-3 for the 'reference' samples, the fourth jar with the word 'suspect' for the unknown suspect sample. If building the activity a scenario, it may help to label the reference samples with corresponding locations.
   c. Into one of the non-suspect containers, add approximately half a teaspoon of citric acid and stir to combine. You will want the citric acid to be as incorporated into the sample as possible so that the soils cannot be matched by visual inspection. If you are not able to incorporate the additives sufficiently, you can add some water to each sample to dissolve the citric acid and bicrabonate of soda.
   d. Into one of the other non-suspect containers, add approximately half a teaspoon of bicarbonate of soda and stir to combine.
   e. Depending on which reference sample you want the suspect soil to match, add the same amount of additive to your suspect sample and stir to combine.
2. Chop up a red cabbage and boil it in water. As water can have different pH values depending on the impurities present, it is best if you use demineralised water, which can be purchased from the laundry section of a supermarket.
3. After about 10 minutes, the water will have turned a red or violet colour. Remove the pot from heat and strain the cabbage out, keeping the purple water, which is a cabbage-based pH indicator. Allow the cabbage water to cool.
4. Set up a series of clear jars or glasses in the same number of reference and suspect soil samples. If you do not have enough glasses, you can reuse glasses, washing them in between.
5. Place about 1 teaspoon of soil individually to each clear jar. .
6. Add about 2-3 tablespoons of cabbage juice to each soil sample and observe what happens. The cabbage water should change colour depending on the pH of the soil. Keep in mind that soil will darken the sample a bit and may make it hard to see the colour. If it is a blue/green colour then the soil is basic, if it turns pink then the soil is acidic, and if it stays the purple colour then the soil is neutral. A more detailed explanation of red cabbage indicator can be found here: https://www.compoundchem.com/2017/05/18/red-cabbage/
7. Determine which reference sample the suspect sample matches with.

Review

1. Were you able to correctly match the suspect soil sample with the corresponding reference soil sample? Why or why not?
2. Do you think this method is how soil would be tested in a real-life forensics case? Why or why not?
3. Was the colour change easy enough to see? If there were multiple reference samples that reacted similarly to the suspect sample, how do you think you could further analyse the soil to determine the source of the suspect sample?
4. What did you enjoy most about this activity? What did you learn?
5. What are some limitations to the use of cabbage indicator for measuring pH? What other methods of pH measurement could you use that may improve your analysis?

Safety

- Burn risk: This activity uses boiling water and a stove top. Adult supervision should be used depending on the section and for younger sections, the cabbage indicator may need to be made in advance by leaders or a responsible adult.

- Depending on where the soil is sourced from, it may contain harmful elements, microorganisms, and pathogens. Handle with care and ensure any crockery or glassware used is thoroughly washed before you reuse them for their normal purposes.
- Some additives may be harmful, even if they can be bought in the shops. For instance, bicarbonate of soda and citric acid may cause eye and skin irritation.

Variations

- This challenge card can pair well with other forensic science-based challenge cards such as other challenge cards such as the ‘Figuring Out Fingerprints’ series and Who Wrote It? Paper Chromatography, to create a forensics program or a ‘Whodunit’ night.
- This challenge card can also pair well with other challenge cards on pH and acids and bases.
- Other acidic or basic additives can be used if bicarbonate of soda or citric acid are not available. Vinegar and lemon juice are a good example of other good additives.
- Depending on the section, you can increase the difficulty of this activity by changing the number of reference soil samples and having multiple with the same additives but are visually different.
- Depending on the section and challenge area used, this challenge card can also be paired with a police station visit or some other law enforcement related community involvement.
- Without the use of additives, this challenge card could be adapted for an environment SIA looking at soil pH and what influences it.
- You can put a twist on this challenge card by using water rather than soil.