

Lesson 06

Title of the Experiment: Determination of pH value of a soil sample using a pH meter
(Activity number of the GCE Advanced Level practical Guide - 06)

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Introduction:

Acidity in soil occurs due to several reasons. Covalently bonded hydrogen in reactive hydroxyl, phenolic, and amine groups of humus present in soil can dissociate releasing H^+ ions into soil making soil acidic. Hydrous oxides which are principally hydrated oxides of aluminum and iron occur in amorphous or crystalline colloidal form as coatings on other mineral particles would undergo stepwise hydrolysis releasing H^+ into solution.

Soil pH affects availability of nutrients to plants. pH is a measure of hydrogen ion concentration and ranges from $pH=1$ to $pH=14$. A pH of 7 is neutral while a pH below 7 is acidic and above is alkaline. Most plants prefer soil pH from 5 to 8 as given in the figure 1.

Active acidity of soil is represented by H^+ concentration, or actually, H^+ activity in soil solution and is often measured with a pH meter equipped with a glass electrode

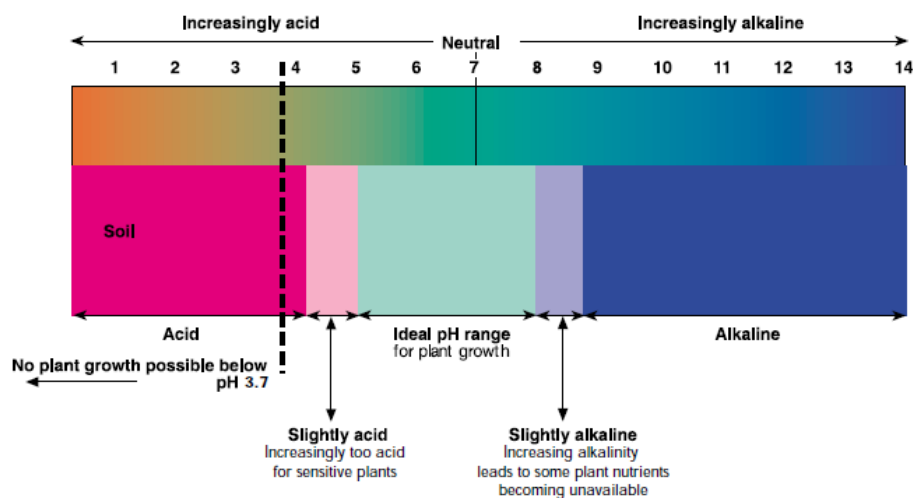


Figure 1: Plant growth and soil pH scale

Learning outcomes:

At the end of the experiment, students will be able to

- develop skills to calibrate a pH meter and measure pH of a soil sample accurately
- understand the soil pH scale for plant growth

Materials/Equipment:

pH meter

Distilled water

Beakers

pH=4, pH=7 and pH=10 standard buffer solutions

0.01 mol dm⁻³ CaCl₂ solution

2 mm sieve

Methodology/Procedure:

- 1) Calibration of the pH meter
 1. Use the pH=4, pH=7 and pH=10 standard buffer solutions for the calibration.
 2. Immerse the pH electrode in a buffer solution and take the reading of the pH meter.
 3. Rotate the knob for correction in the pH meter until the correct pH value is obtained.
 4. Repeat the steps 2 and 3 for the other two standard buffer solutions.
 5. Now use the calibrated pH meter to measure the pH of the soil sample.

- 2) Preparation of a solution of soil
 1. Grind the soil sample and sieve.
 2. Measure 20 g of soil into a beaker and add 100 mL of distilled water.
 3. Stir the soil sample for 1 min and let the soil suspension stand for 5 min to settle.
 4. Immerse the pH electrode into the solution and measure the pH value.

Discussions:

pH electrode must be washed with distilled water in between different solutions.

Exchangeable acidity of a soil sample is obtained by extraction soil with a neutral salt such as CaCl₂.

Exchangeable H⁺ ions in soil are replaced by the cations (Ca²⁺) of the neutral salt and exchangeable acidity of a soil sample is measured as below.

Into a 250 ml beaker weigh 20 g of dry soil and then add 100 ml of 0.01 mol dm⁻³ CaCl₂ solution into the beaker. Stir the suspension several times. Then allow the solution to settle for about 30 minutes. Calibrate the pH meter using pH=4, pH=7 and pH=10 buffer solutions. Decant the supernatant solution of the soil sample and measure the pH value as exchangeable acidity.

References:

Soil Sampling and Methods of Analysis (*Second Edition*) 2006, Edited by M.R. Carter and E.G. Gregorich, Canadian Society of Soil Science, Taylor & Francis Group.