LESSON PLAN: THE EFFECT OF PH ON SEEDS

Year Group: 4-6
Class Size: 10-40 students
Subject: Science
Duration: 1 hour

LESSON AIM:

- To introduce students to the concept of soil pH, its variations, and its effect on plant growth.

PRIOR KNOWLEDGE:

- Basics of seed germination and what plants need to grow.

SUCCESS CRITERIA:

- I can explain the pH scale and categorise substances as acidic, neutral, or basic.
- I can measure soil pH using pH strips.
- I can form a hypothesis about how pH affects plant growth.
- I can record and interpret data from the experiment.
- I can draw conclusions based on my findings.

LEARNING OBJECTIVES:

- Understand the pH scale and its relevance to plant growth.
- Define the terms acid, base, and neutral.
- Categorise common household substances as acidic, neutral, or basic.
- Use pH strips to measure the pH of different substances.
- Formulate a hypothesis on how soil pH might affect plant growth.
- Investigate the impact of soil pH on plant growth.
- Collect and analyse data from an experiment to understand the effect of pH.
- Draw conclusions based on experimental observations.

NATIONAL CURRICULUM REFERENCES:

- Recognise that environments can change and that this can sometimes pose dangers to living things.
- Describe the life process of reproduction in some plants and animals.
- Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

KEY VOCABULARY:

- pH
- Soil pH
- pH scale
- Acid
- Base
- Neutral
- Absorb
- Germinate

RESOURCES NEEDED:

- pH testing strips
- Waterproof markers
- Distilled water
- White vinegar/lemon juice (2L of Tap Water with 1.5tbsp vinegar)
- Bicarbonate of soda ((1 teaspoon to 1L of tap water)
- Teaspoon/scale
- Transparent glass jars
- String/stick
- Paper towels
- Bean seeds
- Cups (to mix solutions)
- 3 pre-prepared soil samples with three different pH levels
- Measuring cup
- Science exercise books
- Accompanying lesson PowerPoint
- Accompanying worksheets

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LESSON STRUCTURE:

Section	Teacher Activity	Student Activity
Starter **(10 mins)**	Grouping activity: provide students with images of liquids (vinegar, washing up liquid, orange juice, coca cola, lemon juice, water, bicarbonate solution) to categorise into three groups and explain why. Walk around to observe, listen to students reasoning and guide students. After 5 minutes, gather feedback, hand out worksheet and reveal correct answers on the board.	Work in small groups to sort liquids. Discuss ideas and share answers with the class.
Main Activity Part 1 **(20 mins)**	Introduce the concept of acids, bases and the pH scale. Ask students whether they think all soils are the same pH Mix a small amount of soil with bottled (non-sparkling) water before testing. Demonstrate how to test the pH of three different soil samples using pH strips (one acidic, one neutral, and one basic). Compare the soil pH results with the pH of bottled water, vinegar, lemon juice, and a bicarbonate of soda solution. Rotate the samples on tables and pH strips to allow students to have a try at measuring pH of the soil samples. **Reminder**: If you received a project pack from the University of Southampton, please record the soil pH on the datasheet using pH strips	Write down notes on acids, bases, and the pH scale in their exercise books. Discuss soil pH variations. Record colour and pH readings of the different soil samples. Suggest why pH is important for plant growth.
Main Activity Part 2 **(25 mins)**	Provide transparent glass jars with paper towels. Guide students in measuring the pH of the different pre-mixed solutions: one acidic (e.g., diluted vinegar or lemon juice, pH 4-5), one neutral (water), and one basic (e.g., bicarbonate solution, pH 8-10). Assist students in planting beans in the jars and ensure they label them correctly. Make sure all jars receive equal light, heat, and water.	Add different liquids to jars, measure and record pH, and plant bean seeds. Label jars, document initial observations in worksheet/table. Make predictions as to which pH is best for bean growth and explain why.
Plenary **(5 mins)**	Ask students to share their predictions with the class. Ask students to define acid, base, and neutral. Quiz questions and discussion on what would happen if pH variations and plant growth Ask students why farmers may need to know soil pH.	Share their predictions with the rest of the class. Summarise and reflect on the lesson and identify weak areas.

	Ask students if there are any areas of today's lesson that they need clarifying	Complete success criteria traffic lights to evaluate their progress during the lesson

ASSESSMENT:

- Ask students to match different pH numbers with acid, base, or neutral categories.
- True or False questions on soil pH (e.g. all plants love acidic soil), with explanation of their answer.

DIFFERENTIATION:

- *Lower ability:*
  - Provide a colour-coded pH scale for reference.
  - Support students in estimating the best pH range for plant growth.
  - Use fill in the gaps sentences to help students form predictions.
- *SEN:*
  - Use visual aids and step-by-step instructions.
  - Provide a video demonstration.
- *Higher ability:*
  - Ask students to investigate specific plants and their pH requirements.
  - How may farmers measure the pH of the soil more accurately?
  - Ask how farmers may adjust the pH of the soil.
  - Calculate the average pH from multiple testing.

HEALTH & SAFETY CONSIDERATIONS:

- Remind students not to ingest materials used during the session.
- Use only weak acids and bases.
- Remind students to be careful with acids and bases at home and not to try to test their pH at home

FOLLOW-UP ACTIVITIES:

- Students to observe plant growth over a week and update exercise books with drawings, measurements and observations.
- Discuss results in a follow-up lesson.
- Compare results to the predictions students made.

CROSS-CURRICULAR LINKS:

- *Geography*: Soil health, sustainable farming, crop rotation, and biodiversity.
- *Maths*: Accurate measurements, averages, and recording data in tables.