The pH scale: measuring and interpreting

Student activity • small-scale investigation

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The question

How much does a colour chart tell you about pH?

Estimate pH for five teacher-selected aqueous samples using universal-indicator paper. Compare estimates with their known buffer values after testing and distinguish pH from acid strength.

Equipment

- Eye protection; white tile, five sample wells/cups and separate labelled pipettes
- Universal-indicator paper with its matching colour chart
- Teacher-issued buffer samples A–E at nominal pH 2, 4, 7, 9 and 12; 1.0 cm^3 of each per pair

Wear eye protection. Treat acidic and alkaline standards according to their supplier labels; avoid skin/eye contact. Keep samples separate and report spills. No tasting, mixing or heating.

Course coverage: Shared core: 2.29–2.31. Approximate pH with universal indicator and the syllabus classification bands; pH does not alone identify acid strength or chemical identity.

Plan, model or apparatus sketch

Draw a pH scale and label the classification bands.

Method and reasoning

Read the whole sequence before starting

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1. Wear eye protection and use only the five teacher-issued aqueous samples. Label clean wells A–E. Do not mix samples.

2. Place 1.0 cm^3 of each sample in its labelled well using a separate pipette. Put a fresh indicator-paper strip on the white tile for each measurement.

3. Transfer a drop of sample onto the paper without dipping paper into the stock bottle. Compare the colour with the manufacturer’s matching chart at its stated reading time.

4. Record the colour and approximate pH or pH interval. Repeat on fresh paper if uncertain; do not report a precision finer than the chart supports.

5. Classify each solution using the reference bands. Reveal the teacher’s nominal values and compare the estimates; discuss contamination, lighting and colour matching.

6. Explain why pH alone cannot identify the solute or decide whether an acid is chemically strong or weak. Use the optional particle-concentration comparison in the questions as a model.

Cleanup

- Collect used paper and liquid residues as directed by staff; rinse equipment and wash hands.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Syllabus bands for aqueous solutions: pH 0–3 strongly acidic; 4–6 weakly acidic; 7 neutral; 8–10 weakly alkaline; 11–14 strongly alkaline. These describe pH regions, not degree of ionisation. Neutral water has equal H^+ and OH^- concentrations and is approximately pH 7 at room temperature. The school scale shown is 0–14; it is not an absolute limit for all solutions.

Sample	Colour observed	Estimated pH	Classification
A			
B			
C			
D			
E			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Record and classify all five samples, including uncertain colour matches.

2. Why is an indicator-paper result approximate rather than an exact measurement?

3. Does pH 4 prove that the solute is a weak acid? Explain.

4. At the same temperature, how do H^+ and OH^- concentrations compare in a neutral aqueous solution?

5. Using the dilute-solution model, compare hydrogen-ion concentration at pH 3 and pH 5.

6. Explain why bleach, battery fluid and unidentified cleaning products must not be used as casual classroom pH samples.