Acids, alkalis and indicator evidence

Teacher / technician

YEAR 10 / LESSON 49 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Small-volume indicator comparison only; no unknown household chemicals, mixing of indicators or heating.

Coverage and delivery

Shared core: 2.28 and 2.31. Litmus, phenolphthalein and methyl orange; aqueous acids supply H^+ and alkalis supply OH^-.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, working in 15 pairs

Item	Per pair / setup	Class total
Booklet / writing tools	1 per learner	30 sets
Nine-well tile / sample pipettes	1 tile; 3 separate pipettes	15 tiles; 45 pipettes
Eye protection	1 each	30
A / N / B working samples	1.50 cm^3 each per pair	30 cm^3 each incl. spare
Three indicators	3 drops each per pair	5 cm^3 each incl. spare

Immediate safety

Wear eye protection; avoid contact with solutions and report splashes. Some indicator solvents are flammable: keep all flames and heat away. Do not taste samples or handle spills without teacher direction.

Preparation and delivery

Read alongside the student method

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1. Prepare three known samples: 0.010 M HCl, pH 7 buffer and 0.010 M NaOH, clearly coded A/N/B. Each pair uses 1.50 cm^3 of each; 15 pairs need 22.5 cm^3 each. Supply 30 cm^3 each with spare.

2. Issue one nine-well tile and three sample pipettes per pair; use separate indicator droppers. Each indicator needs 45 drops for the class; 5 cm^3 per indicator is ample including repeats at typical drop sizes.

3. Use school-approved dilute indicator formulations and check their SDS, particularly ethanol-containing phenolphthalein. No flames or heating. Do not assign the hazard of concentrated NaOH automatically to the 0.010 M solution.

4. Trial the exact indicators with the buffer and working samples. Keep solution strength and indicator dose consistent. Neutral-buffer litmus may be purple rather than a sharp diagnostic endpoint.

5. Allow 10 minutes setup, 20 testing, 20 interpretation and 10 cleanup. Retain unexpected observations and check contamination or reagent ageing.

Close of lesson

• Staff direct collection of small liquid residues under the school disposal plan. Rinse tiles, return droppers and wash hands.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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• Expected checks: acid A gives red litmus/red methyl orange/colourless phenolphthalein; buffer N gives purple/yellow/colourless; alkali B gives blue/yellow/pink. Exact shades depend on formulation; use actual observations.

• Methyl orange is already yellow above its acidic transition range, including neutral solutions.

• Phenolphthalein is colourless in acidic and neutral solutions; its transition occurs above neutral pH.

• Acids supply $H^+(aq)$; alkalis supply $OH^-(aq)$. In water, H^+ is hydrated; $H^+(aq)$ is the school-level notation.

• An alkali is a soluble base producing hydroxide ions in aqueous solution. Bases accept protons; insoluble bases need not be alkalis.

• Use a suitable broad-range indicator with its chart or a calibrated pH meter. Compare with known controls and do not infer exact pH from one single-range indicator.

References and provenance

Pearson Chemistry specification

RSC microscale indicator comparison

RSC indicator-language cautions

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.