TUTORWOW

H_3O^+

Module 6

Acid & Base Chemistry

HSC Chemistry Syllabus Notes

OH^-

Inquiry Questions 1–3 • Nomenclature • Reactions • Titrations • Buffers

2 Preparation & Use of Indicators

2.1 Red Cabbage Indicator (Practical)

Procedure

1. Cut red cabbage leaves into fine pieces.
2. Place into a 500 mL beaker and cover with distilled water.
3. Gently boil with a Bunsen burner; stir for uniform heating.
4. Decant the extract (purple/dark red) into a separate beaker; discard leaves.
5. Pour equal volumes into five numbered test tubes.
6. Add 0.01 M HCl, acetic acid, ammonia, and NaOH to tubes 1–4. Tube 5 is the control.
7. Swirl and record colour changes. Repeat for reliability.
8. Optionally test with other indicators.

Expected Results

Condition	Colour
Acidic solution	Purple → pink/red
Basic solution	Purple → green/yellow
Neutral (water)	Remains purple

Risk Assessment

- Dilute ammonia still releases toxic fumes — avoid inhaling.
- HCl is corrosive; NaOH is caustic. Wash immediately if skin contact occurs.
- Wear safety goggles at all times.
- Steer clear of naked flames and boiling water burns.

Improvement: Use a pH probe for better accuracy (requires calibration).

2.2 How Indicators Work

Indicators are weak acids or bases that form an equilibrium in solution. The conjugate form has a different colour.

$$\mathrm{H_2In(aq) + H_2O(l) \rightleftharpoons 2\,H_3O^+(aq) + In^{2-}(aq)}$$

- **Acid added:** Equilibrium shifts **left** to minimise increased $[H^+] \Rightarrow$ colour of **reactants**.
- **Base added:** Equilibrium shifts **right** as $[H^+]$ decreases $\Rightarrow$ colour of **products**.

Indicator Accuracy

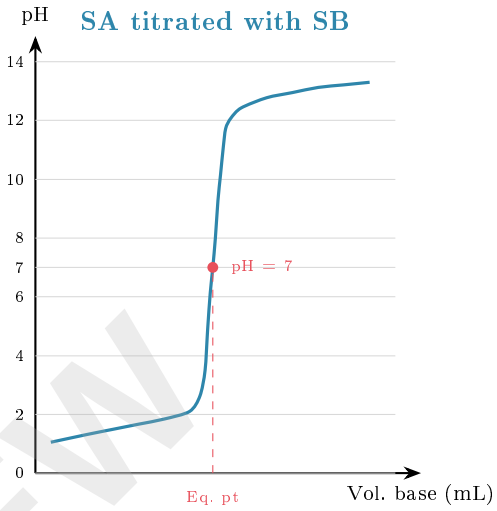
Smaller pH range = more accurate indicator. However, a **pH probe** is the most precise method.

13 Titration Curves

13.1 Strong Acid + Strong Base

Key Features

- Equivalence point at **steepest** part of curve.
- At equivalence: **pH = 7**.
- Only water determines pH at equivalence.
- **Indicators:** Bromothymol blue, phenolphthalein, or methyl orange all work.
- No pK_a/pK_b (strong acid $pK_a < 0$).



13.2 Weak Acid + Strong Base

Equivalence Point: pH > 7

- Conjugate base of weak acid produces OH^-.
- **Use:** phenolphthalein.
- **pK_a** at **half** the equivalence volume.
- Buffer region: pH changes slowly.