Soluble salt preparation by titration

Student activity • supervised practical

YEAR 10 / LESSON 56 / CHEMISTRY ONLY

The question

How can two soluble reactants make an uncontaminated salt?

Use titration to determine reacting volumes, then repeat with those volumes without indicator. Concentrate the clean salt solution and collect the product at a follow-up.

Equipment

- Eye protection; 50 cm^3 burette, stable stand/clamp, filling funnel, 25.0 cm^3 volumetric pipette and filler
- 250 cm^3 conical flask, white tile, labelled reagent beakers and deionised-water wash bottle
- 0.100 mol dm^{-3} HCl and NaOH; teacher-issued methyl orange, two drops per titration
- Clean shallow dish, label, staff-managed warm water bath, heat mat and absorbent paper

Wear eye protection and report splashes. Use a pipette filler. Fill a securely clamped burette below eye level and remove the funnel before use. Staff supervise warming; no boiling dry. Laboratory salt is not food.

Course coverage: Chemistry only: 2.33C and 2.40C. Acid–alkali titration and soluble-salt preparation. Titration and crystal collection may need separate sessions.

Plan, model or apparatus sketch

Sketch the titration apparatus and label the meniscus and jet.

Method and reasoning

Read the whole sequence before starting

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1. Wear eye protection. Rinse the burette with a little HCl and the pipette with a little NaOH; collect rinsings as directed. Rinse the conical flask with deionised water. Use a pipette filler, never your mouth.

2. Clamp the burette securely and lower it below eye level to fill. Fill the jet and remove air bubbles. Remove the filling funnel, then read the bottom of the meniscus at eye level and record the initial reading.

3. Transfer 25.0 cm^3 NaOH into the conical flask and add two drops of methyl orange. On a white tile, add acid while swirling. Near the colour change, add dropwise until the first persistent orange endpoint; do not continue to deep red.

4. Record the final reading and calculate the titre. Do one rough run, then fresh accurate runs until two agree within 0.10 cm^3. Record all results; do not alter a titre to make it concordant.

5. Calculate the mean of the concordant accurate titres. With clean apparatus, combine a fresh 25.0 cm^3 NaOH with that measured HCl volume, this time with no indicator. If results are not concordant, ask staff before preparing the salt.

6. Transfer the clean solution to a labelled shallow dish. Concentrate gently in a teacher-managed water bath, then leave for further evaporation/crystallisation in the designated tray. Do not boil or heat the dish dry.

7. At the follow-up, collect and blot the crystals as directed. Record actual appearance/recovered mass. Do not taste the laboratory salt.

Cleanup

- Collect used solutions as directed under the school waste plan. Rinse apparatus and return pipettes safely.
- Leave labelled product dishes in the designated tray for collection later; wash hands.

Record your evidence

Blank spaces are for your own work

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Reference and task data

HCl + NaOH → NaCl + H_2O (1:1). Titre = final minus initial burette reading. Keep actual readings separate from this invented practice example: accurate titres 24.80, 24.85 and 25.40 cm^3; use the concordant pair only. For nominal 25.0 cm^3 of 0.100 mol dm^{-3} NaOH, the theoretical NaCl mass is calculated using M(NaCl)=58.5 g mol^{-1}. Cooling alone crystallises little NaCl: its solubility changes only slightly with temperature.

Run	Initial / cm^3	Final / cm^3	Titre / cm^3
Rough			
Accurate 1			
Accurate 2			
Accurate 3			

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Why are the burette and pipette rinsed with their reagents, but the conical flask with deionised water?

2. Explain why the filling funnel is removed and the burette jet must contain no air bubble.

3. For the invented titres, select the concordant pair and calculate their mean. Why exclude the third?

4. Explain why the salt preparation is repeated without indicator rather than using the titrated flask.

5. Calculate the theoretical mass of NaCl from the nominal alkali amount. Why might recovery be smaller?

6. Explain why careful evaporation and a later collection session are needed for this dilute NaCl solution.