Bases, alkalis and proton transfer

Teacher / technician

YEAR 10 / LESSON 54 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Desk-based models and equations only; no ammonia handling or gas demonstration.

Coverage and delivery

Shared core: 2.35–2.38. Proton donors/acceptors; metal oxides, hydroxides and ammonia as bases; alkalis as soluble bases.

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
Periodic table / optional counters	1 set per pair	15 sets

Immediate safety

No laboratory chemicals or heating are used. Keep any small reusable model pieces away from mouths.

Preparation and delivery

Read alongside the student method

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1. Prepare 30 booklets and 15 periodic tables; optional counters represent atoms/ions only. Do not bring out ammonia solution or acid bottles for this desk activity.

2. Use three contrasting examples: insoluble oxide CuO, soluble hydroxide NaOH and molecular NH_3. Separate solubility from the ability to accept a proton.

3. Correct the previous reversed base/alkali statement. Avoid defining every base solely by production of salt and water: ammonia is an explicit counterexample.

4. Check conservation of charge as well as atoms. H^+ is the syllabus shorthand for the hydrated proton in water.

5. Allow 10 minutes recall, 20 models/equations, 20 application and 10 corrections. Do not present this activity as an ammonia practical.

Close of lesson

- Return counters, retain corrections and clear the desk.

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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- All alkalis are bases, but some bases are insoluble: CuO is a suitable counterexample to “all bases are alkalis”.
- $CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$; copper(II) nitrate.
- $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$. Na^+ and Cl^- are spectator ions.
- NH_3 accepts H^+ to form NH_4^+; being a base does not require an OH group.
- $NH_3 + HCl \rightarrow NH_4Cl$. No water is made in this equation, so the broad slogan fails for this base.
- $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$. Some water molecules transfer a proton to ammonia; the resulting OH^- makes the aqueous solution alkaline.

References and provenance

Pearson Chemistry specification

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.