Core practical: insoluble salt preparation

Teacher / technician

YEAR 10 / LESSON 57 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Shared-core solubility desk task plus explicitly Chemistry-only staff demonstration. One small-scale preparation; pupils do not handle lead. No chromate/silver practical, sink disposal or claim of pupil practical completion.

Coverage and delivery

Shared core: 2.34 solubility rules, question 1 and step 1. Chemistry-only extension: 2.41C/2.43C, steps 2–7 and questions 2–6; staff lead(II) sulfate demonstration, not learner hands-on completion.

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

Requisition • one staff demonstration for 30

Item	Per pair / setup	Class total
Booklet / writing tools	1 per learner	30 sets
Learner eye protection	1 each while viewing	30; staff protection separately
Demonstration apparatus / tray / filter	Staff-only single setup	1 setup; suitable fine papers
0.100 M $Pb(NO_3)_2$ / Na_2SO_4	Staff-only 5.0 / 5.5 cm^3	10 cm^3 each incl. spare
Deionised water / labelled sample dish	Staff-only rinse/wash	20 cm^3 available; 1 dish
Lead-waste containers / gloves	Staff-only; per local assessment	Separate liquid and solid streams

Immediate safety

Lead compounds are hazardous. Pupils observe only; staff prevent contact, dust and aerosols. Wear eye protection. Every reagent, filter, product, filtrate and washing stays in the designated lead-waste system; nothing goes down the sink.

Preparation and delivery

Read alongside the student method

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1. Teach the 2.34 solubility-rule desk task to all learners. Only Chemistry learners continue to the lead-salt demonstration; Double Award learners refine their rule summary using question 1. Do not hide this whole lesson from Double Award.

2. One demonstration for the class, not 15 pupil reactions. Only trained staff use an approved local procedure and exact reagent SDS for lead compounds. If authorisation/lead-waste arrangements are unavailable, use a recorded demonstration and label that evidence accurately.

3. For one proposed small-scale run, use 5.0 cm^3 0.100 M $Pb(NO_3)_2$ and 5.5 cm^3 0.100 M Na_2SO_4. Keep 10 cm^3 of each working solution available including spare. Staff obtain prepared solutions; no stock-powder weighing recipe is included.

4. Use a tray, small beaker, separate graduated pipettes, stirring rod and a securely supported small filter funnel with suitable fine filter paper. Add sulfate to the lead solution and stir gently. Trial this scale/filter combination before class; fine precipitate may pass through unsuitable paper.

5. Filter the mixture and retain the residue. Rinse the beaker into the filter with a small amount of deionised water, then wash the residue with two approximately 2 cm^3 portions. Collect every filtrate/washing in a labelled lead-waste container.

6. Allow drainage, then leave the labelled filter/product to air-dry in a secure dust-protected staff location. Do not grind, blow, scrape into the air or heat the dry powder. Keep the follow-up sample enclosed; staff collect the entire filter/product as hazardous waste after observation.

7. Use eye protection and the gloves/other controls specified by the local assessment. Avoid all skin contact, aerosol and contamination; keep the viewing distance and clean the station with the assessed wet-cleaning procedure. No eating/drinking. Wash hands after glove removal.

8. Provide dedicated closed lead-liquid and contaminated-solid waste containers for disposal through the school hazardous-waste route. Remove the unrelated chromate/silver demonstration entirely: no chromium(VI), silver reagent or drain disposal is part of this lesson.

Close of lesson

• Learners return booklets and viewing eye protection without handling the apparatus.

• Staff retain product and collect all lead-contaminated solids/liquids; wet-clean the tray under the approved procedure 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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• Shared core: NaCl soluble (sodium salt/chloride); KNO_3 soluble (potassium/nitrate); $CaCO_3$ insoluble (carbonate exception does not apply); $PbSO_4$ insoluble (sulfate exception); AgCl insoluble (chloride exception); NaOH soluble (hydroxide exception).

• $Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$; Na^+ and NO_3^- are spectator ions.

• Keep the residue for $PbSO_4$. For copper sulfate from CuO, the first filtration removes excess CuO and the desired salt remains in the filtrate.

• Washing removes soluble sodium nitrate and excess soluble reagent. Small portions limit loss of sparingly soluble product and reduce contaminated liquid volume.

• Lead compounds remain hazardous; low solubility does not prevent ingestion/dust exposure. Dry product and contaminated filters remain under staff control.

• Some lead may remain dissolved, and fine particles may pass through. Collect all filtrate, wash water, solid and contaminated items; do not infer that a clear liquid is safe.

• Staff capacity check: 0.00050 mol Pb^{2+} and 0.00055 mol sulfate; theoretical $PbSO_4$ maximum $0.00050 \times 303 = 0.1515$ g. Recovery may be lower; never present this as measured yield.

References and provenance

Pearson Chemistry specification

RSC lead-salt precipitation: chemistry and hazards

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.