Metal-salt displacement on a microscale

Teacher / technician

YEAR 10 / LESSON 30 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Live microscale practical; stock concentrations and disposal must match the local risk assessment. No water/alkali-metal demonstration is included.

Coverage and delivery

2.16, 2.17 and 2.20: metal-salt displacement, evidence for reactivity and electron transfer.

Allow about 50 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
Student booklet / writing tools	1 per learner	30 sets
Nine-well tile / tray / forceps	1 set per pair	15 sets
0.1 mol dm^{-3} solutions: $CuSO_4$, $ZnSO_4$, $MgSO_4$	2 cm^3 each per pair	40 cm^3 each incl. spare
Mg ribbon / Zn foil / Cu foil	3 pieces of each per pair	45 pieces of each
Dedicated droppers / waste vessel	3 droppers per pair; shared waste	45 droppers; 1 vessel
Eye protection	1 per learner	30 plus staff

Immediate safety

Wear eye protection. Avoid skin/eye contact with salts; report splashes and rinse affected skin promptly. Keep magnesium away from ignition sources. Use forceps and a tray; all metal-salt waste is collected. Wash hands after cleanup.

Preparation and delivery

Read alongside the student method

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1. For 15 pairs provide 15 nine-well tiles, trays and forceps; 45 small pieces of each metal, approximately 5 mm ribbon or foil squares with smooth edges. Staff clean surfaces shortly before use. No metal powders or alkali metals.

2. Use labelled 0.1 mol dm^{-3} solutions from approved laboratory stock. Provide 2 cm^3 of each solution per pair (30 cm^3 each for class); 40 cm^3 each allows dispensing losses. Dedicated droppers prevent contamination. These are stock quantities, not quantities per well.

3. Check current supplier SDS and the local risk assessment before practical use. Copper and zinc salts require controlled collection; maintain eye protection and prohibit flames. Trial the chosen metal surfaces and stock solutions in advance.

4. Use roughly 10 minutes setup, 10 observation, 20 interpretation and 10 cleanup. Pair evidence can support Mg > Zn > Cu; Fe and other metals need external reference evidence.

5. Collect solutions, metal residues and first rinses in a labelled metal-salt waste container. Technician follows the school-approved disposal route; do not return used liquid to stock or send salts to drains.

Close of lesson

• Transfer mixtures and first rinses to the teacher’s labelled metal-salt waste vessel. Return tools after instructed cleaning; 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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• Students supply actual observations, including inconclusive wells. Do not copy expected outcomes into their results.

• Expected displacement pattern: Mg displaces Zn and Cu; Zn displaces Cu; Cu displaces neither. Same-metal wells provide controls. Surface films and kinetics can obscure changes.

• Zinc + copper(II) sulfate → zinc sulfate + copper; $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$.

• Sulfate ions remain in solution unchanged; they are spectator ions. Zinc loses two electrons; copper(II) gains two.

• Hydrogen can arise from acidic solution. No visible change in five minutes may reflect a surface film, slow reaction or small amounts; qualify conclusions.

• Repeat with fresh cleaned metal and uncontaminated solution, keeping size, volume and observation time comparable; compare with same-metal wells.

References and provenance

Pearson Chemistry specification

RSC metal-salt displacement

RSC reactivity video and technician resources

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.