Metallic bonding

Teacher / technician

YEAR 10 / LESSON 27 / CHEMISTRY ONLY

Staff preparation and answer guidance. Keep separate from student sheets. Separate Chemistry only. Desk model with optional gentle foil bending; no electrical, iodine/sulfur or heating experiment.

Coverage and delivery

CHEMISTRY ONLY: 1.52C–1.54C — two-dimensional metallic lattice, electrostatic attraction and typical properties including electrical conductivity and malleability. Not required for Science (Double Award).

Allow about 45 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	1 per student	30
Writing tools / blank paper	1 set per student	30 sets
Positive-ion discs / electron tokens	12 of each per pair	180 of each
Smooth-edged foil square (optional)	1 per pair	15

Immediate safety

Desk activity only. Use pre-cut blunt modelling pieces and keep small parts out of mouths. Keep the workspace clear; no chemicals, flames or electrical supply are required. Use smooth-edged foil only; do not tear it into sharp pieces. Stop if an edge is sharp.

Preparation and delivery

Read alongside the student method

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1. This entire lesson is separate Chemistry only. Keep the Double Award placeholder and do not add the lesson to Double Award teaching requirements.

2. For 15 pairs supply 180 paper ion discs and 180 electron counters, or use pencil symbols on reusable paper. An optional 10 cm × 10 cm aluminium foil square per pair should have folded/smooth edges; use no sharp metal pieces.

3. Remove the old iodine, sulfur, unknown-powder heating, Bunsen and circuit instructions. They are not needed for the stated modelling objectives and are not part of this requisition.

4. Allow 10 minutes for the lattice, 10 for electron mobility, 10 for row displacement, 5 for optional foil handling and 10 for explanation. Keep model movement separate from observed sample behaviour.

5. Challenge “metal ions carry the current through a solid” and “malleability breaks all metallic bonding”. Attraction is non-directional in this introductory model and remains as layers shift. The optional foil is not a strength or conductivity measurement.

Close of lesson

• Keep your evidence and corrections. Count and return reusable model pieces; recycle unwanted paper. No chemical waste is produced.

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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• Diagram: regular/offset rows of labelled positive ions surrounded by labelled delocalised electrons; a 2D slice of a 3D lattice. For the stated monovalent convention equal +1 ions and electron tokens give neutrality.

• Metallic bonding is electrostatic attraction between positive metal ions and delocalised electrons throughout the structure.

• Delocalised electrons can move through a solid metal and carry charge; the ions remain in lattice positions with vibration.

• Rows/layers can slide while attraction between ions and the surrounding delocalised electrons remains, so many metals change shape without shattering.

• Not all metals contribute one electron per atom. The electron tokens represent delocalisation, not fixed ownership by individual ions.

• Limits: 2D rather than 3D; not to scale; electrons are not coloured balls on fixed routes; ion sizes/spacing and forces are simplified. A bent foil shape is an observation; the bonding model is the explanation. No measurement of conductivity was made.

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.