Metals and alloys: structure and use

Teacher / technician

YEAR 10 / LESSON 33 / CHEMISTRY ONLY

Staff preparation and answer guidance. Keep separate from student sheets. Chemistry-only paper model and materials reasoning. No lead melting, casting, metal scratching or measured hardness claims.

Coverage and delivery

Chemistry only: 2.25C–2.27C; properties and uses of aluminium, copper, iron and steels; alloy definition and hardness model.

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
Equal / larger paper discs	24 equal + 6 large per pair	360 equal + 90 large
Work mats / property cards	2 mats + 1 card set per pair	30 mats; 15 card sets

Immediate safety

Desk activity. Use pre-cut paper discs; keep pieces off the floor and out of mouths. No metal heating or sharp-edged samples.

Preparation and delivery

Read alongside the student method

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1. This entire lesson is Chemistry-only. Use 15 sets of 24 equal discs and six larger discs, and 30 paper mats. No sharp metal scraps, scratch tests or heat sources are required.

2. The equal-disc and mixed-disc models are original paper analogies. Learners should keep the same mat area and compare arrangements, not report force values that were not measured.

3. Remove the inherited lead/tin melting and pouring instructions from the active lesson. No lead, tin, carbon powder, crucibles or molten alloy are requisitioned.

4. Allow 15 minutes modelling, 20 minutes property-based choices and 15 minutes explanation/correction. Show that carbon atoms can occupy spaces in iron; different-sized substitutional discs do not represent every alloy mechanism.

5. Avoid “all alloys are always harder” as a universal claim. This introductory model explains a common trend; composition and heat treatment matter. Stainless steel is corrosion-resistant, not absolutely immune.

Close of lesson

• Collect and count model pieces for reuse; retain material-choice reasoning.

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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• An alloy is a mixture of a metal with one or more other elements. Steel contains iron and carbon, a non-metal; alloys need not be compounds with a fixed formula.

• Equal discs form regular rows. Mixed sizes distort that order and make simple sliding more difficult in the model.

• Different-sized atoms disrupt regular layers, resisting sliding and often increasing hardness. The atoms have not grown and extra covalent bonds are not the general explanation.

• Copper conducts electricity well and can be drawn into wire. Cable insulation is a separate material selected for electrical insulation.

• Low-carbon steel: formable body panels. High-carbon steel: hard cutting edges with brittleness trade-off. Stainless steel: corrosion-resistant cutlery.

• Discs are 2D and do not show electrons, metallic forces, dislocations or interstitial carbon accurately. A harder material may be more brittle or harder to shape; no numeric hardness is measured.

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.