Choosing a metal extraction route

Teacher / technician

YEAR 10 / LESSON 32 / CHEMISTRY ONLY

Staff preparation and answer guidance. Keep separate from student sheets. Chemistry-only paper-model and process-evaluation activity. No lead compounds, heated powders or live electrolysis.

Coverage and delivery

Chemistry only: 2.22C–2.23C; process evaluation supports 2.24C without requiring detailed industrial memorisation.

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
Process cards / reactivity strip	1 set per pair	15 sets
Atom counters / drawing paper	1 set per pair	15 sets

Immediate safety

Desk activity only; use paper counters. No chemicals, heating, molten materials or electrical supplies.

Preparation and delivery

Read alongside the student method

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1. This entire lesson is Chemistry-only. Retain Double Award placeholders and exclude these PDFs from its requirements.

2. Print 15 sets of the three process cards and reactivity strips. Give pairs at least two iron, three oxygen and three carbon-monoxide counter groups for balancing, or use drawings.

3. Remove the inherited lead oxide, charcoal and hot crucible requisition. No oxide reduction experiment or molten-salt electrolysis is conducted by this edition.

4. Allow 10 minutes sorting, 15 equation modelling, 15 route reasoning and 10 evaluation. Carbon monoxide is the illustrated iron reducing agent; do not describe it as carbon dioxide.

5. Detailed blast-furnace operation is not required. If discussing carbon anodes, state they react and need replacement; avoid implying industrial aluminium electrolysis produces a permanent oxygen stream at inert anodes.

Close of lesson

• Return cards and retain explanations. Recycle waste paper.

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 ore is a material from which extracting a metal is economically worthwhile. Grade, energy costs and demand can change that judgement.

• Iron is below carbon and its oxide can be reduced using carbon-derived reducing agents. Aluminium is above carbon and is extracted by electrolysis instead.

• $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$. Iron oxide loses oxygen; carbon monoxide gains oxygen and is the reducing agent.

• Ions must move to carry charge to electrodes. The industrial electrolyte is molten and dissolves alumina; solid oxide has immobile ions.

• Uncombined gold is the element, not chemically bound to another element. Not every gold-bearing material contains only free gold.

• Recycling can reduce fresh ore extraction and energy demand, but collection, contamination and alloy separation impose costs. No precise saving follows from these cards.

References and provenance

Pearson Chemistry specification

RSC displacement and extraction concepts

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.