

Exercise walk-through

1.3

Transition metals – chemistry only (4.1.3)

AQA · GCSE · Chemistry

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The method

Method — Worked example

The **transition elements** (Cr, Mn, Fe, Co, Ni, Cu are your examples) sit between Groups 2 and 3. Compared with Group 1 they have:

- **higher melting points** (except mercury, a liquid);
- **higher densities**;
- greater **strength** and **hardness**;
- **lower reactivity** with oxygen, water and halogens.

Typical properties:

- **ions with more than one charge** – Fe^{2+} and Fe^{3+} , Cu^{2+} and Cu^{+} (Group 1 is always +1);
- **coloured compounds** – Fe^{2+} pale green, Fe^{3+} yellow-brown, Cu^{2+} blue;
- **catalytic activity** – iron in the Haber process, nickel in hydrogenation.

Method — Worked example

Worked example (3 marks). A student says “copper and sodium are both metals so they behave the same.” Correct them with two properties.

No – copper is a transition element and sodium a Group 1 alkali metal (B1); copper is harder, denser and has a much higher melting point (B1); copper is much less reactive – it does not react with cold water, while sodium fizzes violently (B1).

Exercises 2.1·2.3

2.1 Give two differences between transition metals and Group 1 metals in physical properties. [2]

2.2 Give the two common ions of iron and the colour of each compound. [3]

2.3 Name the transition metal used as a catalyst in the Haber process. [1]

Exercises 2.1·2.3

2.1 Give two differences between transition metals and Group 1 metals in physical properties. [2]

2.1 Any two: transition metals have higher melting points; higher densities; harder; stronger.

2.2 Give the two common ions of iron and the colour of each compound. [3]

2.2 Fe^{2+} – pale green compounds; Fe^{3+} – yellow/brown compounds.

2.3 Name the transition metal used as a catalyst in the Haber process. [1]

2.3 Iron.

Exercises 3.1·3.3

3.1 Compare the reactions of potassium and copper with water and with dilute hydrochloric acid, explaining the difference in terms of reactivity. [4]

3.2 Explain why iron(II) sulfate and iron(III) sulfate are different compounds, even though both contain only iron, sulfur and oxygen. [3]

3.3 Scandium is the first transition element of period 4. Predict three of its properties and one use of a compound of any transition metal. [4]

Exercises 3.1·3.3

3.1 Compare the reactions of potassium and copper with water and with dilute hydrochloric acid, explaining the difference in terms of reactivity. [4]

3.1 Potassium reacts vigorously with cold water – fizzing, melting into a ball, producing hydrogen and potassium hydroxide; copper has no reaction with water. Potassium reacts explosively/fast with dilute acid; copper does not react with dilute hydrochloric acid – it is below hydrogen in the reactivity series. Transition metals are much less reactive than Group 1 metals.

3.2 Explain why iron(II) sulfate and iron(III) sulfate are different compounds, even though both contain only iron, sulfur and oxygen. [3]

3.2 The iron is present as different ions – Fe^{2+} in iron(II) sulfate and Fe^{3+} in iron(III)

3.3 Scandium is the first transition element of period 4. Predict three of its properties and one use of a compound of any transition metal. [4]

3.3 Predictions: high melting point; high density/hard/strong; a coloured compound; low reactivity – no reaction with cold water. Use of a transition-metal compound: e.g. iron(III) oxide as a catalyst; any correct use.