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Chemistry
Standard level
Paper 2

19 May 2025

Zone A morning | **Zone B** morning | **Zone C** morning

Candidate session number

1 hour 30 minutes

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Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **chemistry data booklet** is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.



Answer **all** questions. Answers must be written within the answer boxes provided.

1. Iron(II) sulfide can be produced by heating powdered iron and sulfur together.

(a) Describe the difference between an element and a compound.

[2]

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(b) Outline why solid iron(II) sulfide is a polar covalent compound. Use sections 9 and 17 of the data booklet.

[1]

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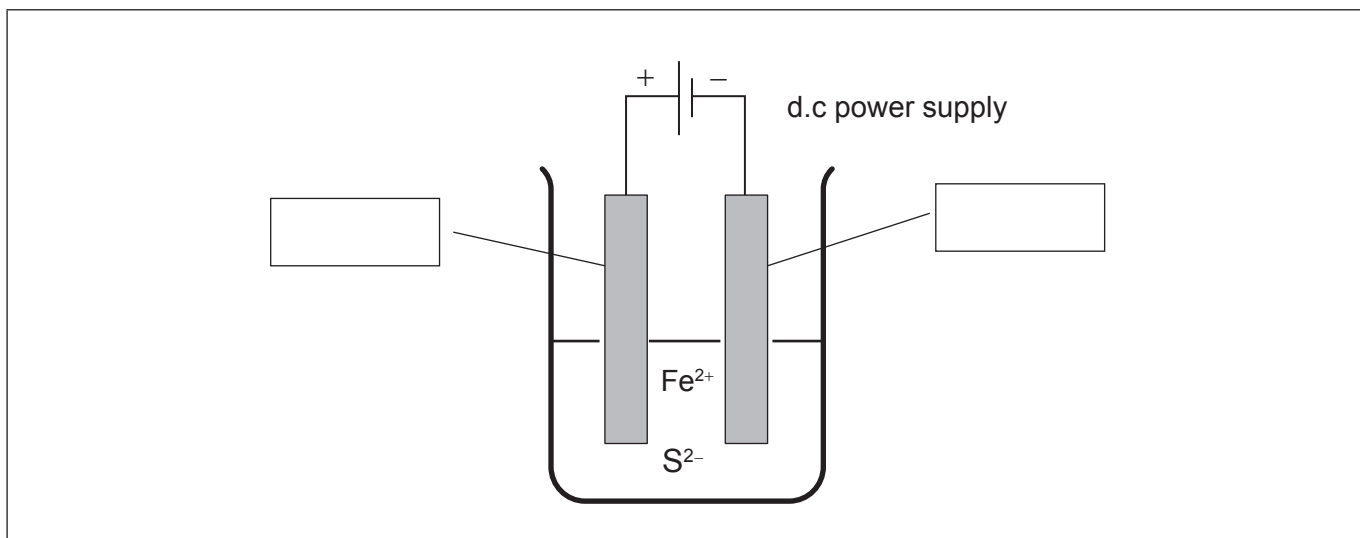
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(c) A student hypothesised that iron(II) sulfide is ionic and therefore can be converted back to iron and sulfur by electrolysis of the molten salt, using inert electrodes.

(i) Annotate the electrolytic cell with the terms anode and cathode, and show the direction of ion movement.

[2]



(This question continues on the following page)



(Question 1 continued)

- (ii) Write half-equations for the reaction occurring at each electrode. [2]

Negative electrode:

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Positive electrode:

.....

- (iii) Contrast **one** physical property of iron and iron(II) sulfide. [1]

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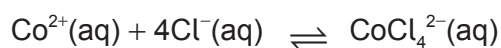
2. Cobalt ions form coloured compounds.

(a) Deduce the electron configuration of the Co^{2+} ion.

[1]

.....

(b) An equilibrium is established when hydrated cobalt ions are mixed with concentrated hydrochloric acid.



Pink

Blue

(i) State the equilibrium constant expression, K , for this equilibrium.

[1]

.....

(ii) Predict the effect on the value of K and the equilibrium position when solid sodium chloride, $\text{NaCl}(\text{s})$, is added to the mixture at constant temperature.

[1]

.....

(This question continues on the following page)



(Question 2 continued)

- (iii) Heating an equilibrium mixture that is initially pink changes the colour to purplish-blue. Deduce, giving a reason, whether the formation of $\text{CoCl}_4^{2-}(\text{aq})$ is an exothermic or endothermic process. [1]

.....

- (iv) Sketch an energy profile for this equilibrium, labelling reactants, products, activation energy, E_a , and enthalpy change for the forward reaction, ΔH . [3]

