

5.2.3 Link catalyst cycles and chelation to evidence

Name: _____ Class: _____ Date: _____

Total: 16 marks

KEY WORDS evidence • conditions

Objective

Link catalyst cycles and chelation to evidence. All questions and marking guidance are original.

1 Key knowledge and worked examples

A catalyst is regenerated. Add its steps and cancel intermediates to recover the overall reaction. Homogeneous catalysts share a phase with reactants; heterogeneous catalysts act at a different-phase surface. Product-catalysed acceleration is autocatalysis.

■ Worked method

$\text{S}_2\text{O}_8^{2-} + 2\text{Fe}^{2+} \rightarrow 2\text{SO}_4^{2-} + 2\text{Fe}^{3+}$, followed by $2\text{Fe}^{3+} + 2\text{I}^- \rightarrow 2\text{Fe}^{2+} + \text{I}_2$, gives $\text{S}_2\text{O}_8^{2-} + 2\text{I}^- \rightarrow 2\text{SO}_4^{2-} + \text{I}_2$. Iron ions are regenerated. Replacing six water ligands with three bidentate ligands releases more free particles, often giving a favourable entropy change without increasing coordination number.

2 Practice

2.1 Define homogeneous and heterogeneous catalysis, giving one example of each from this unit. [2]

2.2 Add the two worked iron steps and identify the regenerated species. [2]

2.3 Explain why carbon monoxide binding to haemoglobin interferes with oxygen transport. [2]

3 Exam-style questions

3.1 Use $\text{V}_2\text{O}_5 + \text{SO}_2 \rightarrow \text{V}_2\text{O}_4 + \text{SO}_3$ and $2\text{V}_2\text{O}_4 + \text{O}_2 \rightarrow 2\text{V}_2\text{O}_5$ to derive the overall equation. Explain the role of variable oxidation states. [4]

3.2 An acidified manganate(VII)/ethanedioate mixture starts slowly then speeds up. Explain this without claiming reactant concentrations rise. [3]

3.3 Six water ligands are replaced by three bidentate en ligands. Explain why the product may be favoured and why “twice as many bonds” is incorrect. [3]
