

3.2 Rates and equilibria

Name: _____ Class: _____ Date: _____

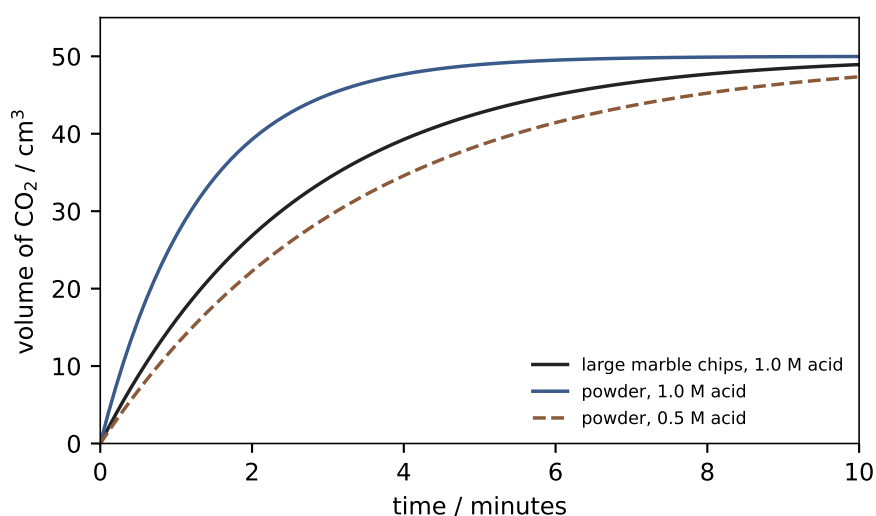
Total: 23 marks

Objective

Cover rates of reaction (3.9–3.16) and equilibria (3.17–3.22C): the four rate levers with collision theory, catalysts, (C) reaction profiles, reversible reactions and the shifts of dynamic equilibrium. Original IGCSE-level practice.

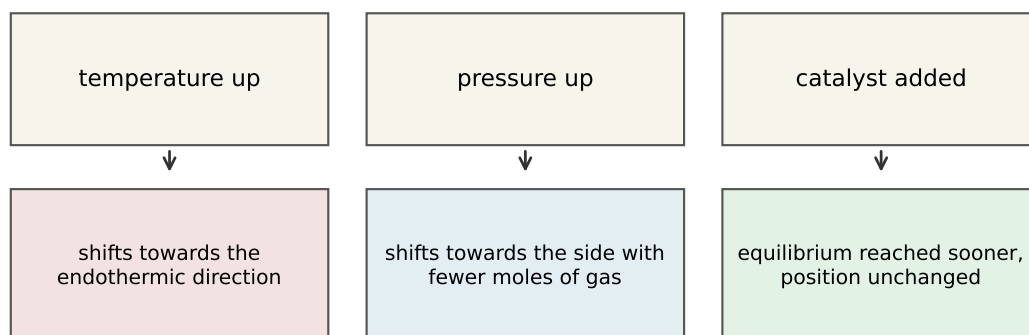
1 Key knowledge and worked examples

■ Four levers, one explanation



Surface area, concentration, pressure and temperature all work through **collisions**: more frequent (area, concentration, pressure) or more energetic (temperature – the only lever raising the fraction that beats the activation energy). A **catalyst** lowers the activation energy by an alternative pathway, unchanged at the end.

■ (C) Equilibrium shifts



Temperature up → endothermic direction; pressure up → fewer gas moles; catalyst → faster both ways, position unchanged. Forward and reverse rates equal; concentrations constant.

2 Practice

2.1 State four factors that affect the rate of reaction. [4]

2.2 Explain, using collision theory, why a higher concentration speeds a reaction. [2]

2.3 Which factor increases the energy of collisions? [1]

2.4 Define a catalyst. [2]

2.5 (C) Give the two characteristics of a reaction at dynamic equilibrium. [2]

3 Exam-style questions

3.1 Explain two differences between the effect of raising temperature and the effect of adding a catalyst on a reaction. [4]

3.2 Marble chips react with dilute hydrochloric acid. Describe how the rate changes when the acid concentration is doubled and when the chips are crushed, and explain each. [4]

3.3 (C) For $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ (forward reaction exothermic), state and explain the effect on the yield of SO_3 of (a) increasing the pressure and (b) increasing the temperature. [4]
