

Exercise walk-through

3.2

Rates and equilibria

Pearson Edexcel · International GCSE · Chemistry

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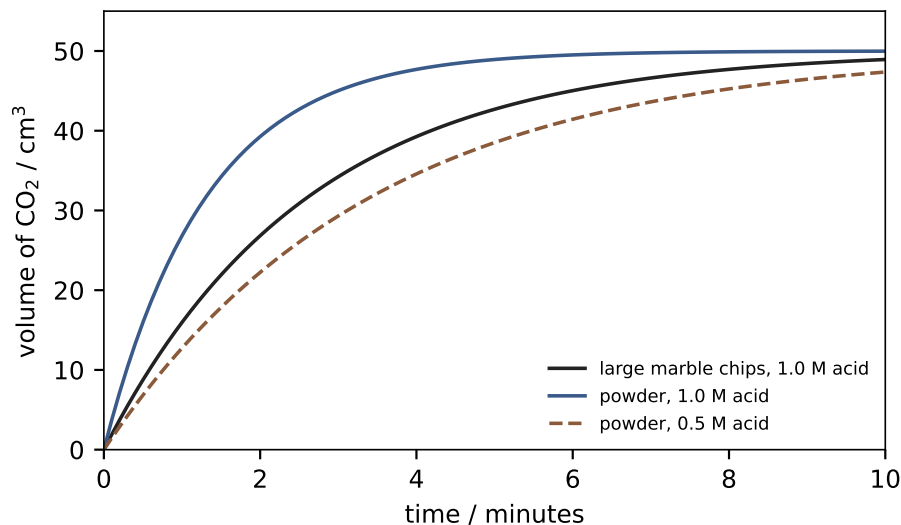
The method

Method — 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.

Method — Four levers, one explanation

Surface area, concentration, pressure and temperature all work through collisions : more frequent (area,...



Rate curves: powder beats chips; weaker acid slows the reaction.

Exercises 2.1·2.3

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]

Exercises 2.1·2.3

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

2.1 Surface area of a solid; concentration of solution; pressure of gas; temperature; (catalyst).

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

2.2 More particles of reactant in the same volume → more frequent collisions per second, so more successful collisions per second.

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

2.3 Temperature.

Exercises 2.4·3.1

2.4 Define a catalyst. [2]

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

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

Exercises 2.4·3.1

2.4 Define a catalyst. [2]

2.4 A substance that increases the rate of a reaction but is chemically unchanged at the end.

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

2.5 (C) The forward and reverse reactions occur at the same rate; the concentrations of reactants and products remain constant.

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

3.1 Temperature raises the energy of particles, so a greater fraction of collisions exceeds the activation energy; a catalyst provides an alternative pathway of lower activation energy without changing the particles' energy – and unlike temperature it does not shift an equilibrium position.

Exercises 3.2·3.3

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]

Exercises 3.2·3.3

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]

3.2 Doubled concentration: faster rate – twice as many acid particles in the same volume, so more frequent collisions. Crushed chips: faster rate – a larger exposed surface area, so more collisions at the solid surface per second.

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]

3.3 (C) (a) Pressure up shifts equilibrium to the right – 3 moles of gas on the left, 2 on the right – so the SO_3 yield rises. (b) Temperature up shifts equilibrium in the endothermic direction – to the left – so the SO_3 yield falls.