



ANSWER BOOK

Enzymes: what a catalyst can and cannot do

Enzymes and metabolic control · Unit B03

AQA 3.1.4.2 · OCR A 2.1.4 (a)–(d) · Edexcel A Topic 1.7–1.8 · CAIE 3.1

5 questions · 16 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** an enzyme lowers the activation energy of the reaction. **B1** it does not change the energy of the reactants or of the products, and so does not move the position of equilibrium. [2]
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SECTION B · Standard, 3 to 5 marks

- B1** **B1** the active site is a region formed by the tertiary structure of the enzyme, with a particular shape. **B1** only a substrate whose shape is complementary to the active site can bind to it. **B1** when it binds, an enzyme-substrate complex forms and the reaction is catalysed. **B1** a molecule that is not complementary cannot enter the site, so no complex forms and that reaction is not catalysed. [4]
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- B2** **B1** in lock and key the active site is already exactly complementary to the substrate, whereas in induced fit it is only close to complementary before binding. **B1** in lock and key nothing moves, whereas in induced fit the active site changes shape as the substrate binds. **B1** both models account for specificity, but only induced fit accounts for the rise in rate, because the closing of the site strains the substrate's bonds. **B1** induced fit is supported by enzymes photographed with and without their substrate, such as hexokinase closing around glucose, which lock and key is not. [4]
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- B3** **B1** a globular protein folds with hydrophilic side chains facing outwards, so it dissolves in cytoplasm or plasma where the reaction happens. **B1** its amino acid sequence is irregular, so the surface it presents is irregular and can carry an active site of a particular shape. **B1** a fibrous protein has a repetitive sequence and forms long insoluble strands, so it is neither soluble nor able to present such a pocket. [3]
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- B4** **B1** the active site must be complementary to the strained transition state rather than to the relaxed substrate. **B1** this supports induced fit, in which the site moulds around the substrate and strains the bonds that are about to break. **B1** the molecule occupies the active site, so substrate cannot bind there and fewer enzyme-substrate complexes form. [3]
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