2.4 Enzymes

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Course	DP IB Biology
Section	2. Molecular Biology
Topic	2.4 Enzymes
Difficulty	Medium

Exam Papers Practice

To be used by all students preparing for DP IB Biology SL
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1

The correct answer is **D** as insufficient substrate between Y and Z is what causes the rate of reaction to plateau (i.e. the substrate availability is now the limiting factor). If there was sufficient substrate the rate would continue to increase in a linear relationship.

A is incorrect because between Y and Z, substrate is limiting. **B** is incorrect because between Y and Z, substrate is limiting. **C** is incorrect because between X and Y, enzyme concentration is limiting (hence why an increase in enzyme causes a corresponding increase in rate).

2

The correct answer is **C** because two substrates link temporarily (also referred to as an enzyme-substrate complex). Condensation involves breaking some bonds and forming new ones. The cycle ends when the product diffuses away. Often, the by-product is water.

A question like this can be answered by elimination of the incorrect answers. Anabolic reactions involve building up large molecules from smaller ones. Typically, two substrates are condensed together eg. formation of a polypeptide. Eliminate **B** and **D** as they only mention one substrate.

In all reactions, bonds are broken and reformed - anabolic reactions can't happen without the bonds in the substrates being broken first - Eliminate **A. A** is also wrong because the enzyme returns to its natural state directly after a reaction, ready for the next collision.

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3

The correct answer is **B** as at point X there will be more enzyme/substrate complexes being formed. At Y there is no more product being produced, so the substrate has already all been converted into product (so there will be no more **enzyme/substrate complexes** formed).

A is true as this is early on in the reaction, so most substrate has not yet been converted into product

C is true as at this point the rate of reaction has stopped, therefore no more substrate is available

D is true as at Y the concentration of product plateaus, therefore, there is no more reaction between Y and Z and no enzyme/substrate complexes at either point

4

The correct answer is **B** because this best describes the **complementary** shape of enzyme and substrate.

A is incorrect because while enzymes are always proteins, their substrates can be carbohydrates, lipids, other proteins etc.

C is incorrect because an enzyme's active site is a constant structure and will only fit one type of substrate.

D is incorrect because for complementary fit, a projection on the substrate's surface would have to fit into **an indentation** on the enzyme's surface, not another projection.

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5

The correct answer is **A** because breaking down triglycerides will produce glycerol and three **fatty acids**. The fatty acids will lower the pH of the solution which would denature the lipase if measures weren't taken to maintain a constant pH, usually with a pH buffer solution.

B is incorrect because the fact that acids are produced by lipase does not mean that its optimum pH has to be acidic. In fact lipase operates best at neutral pH or in the slightly alkaline conditions of the small intestine.

C is incorrect because [fatty] acids decrease pH, not increase it.

D is incorrect because water is not produced by hydrolysis, it is used as a reactant. **D** is wrong on two counts because water has no effect on pH as it is itself neutral (pH 7).

6

The correct answer is **B** as the **independent** variable is the factor that is being **changed** in the experiment. The experiment aims to determine how temperature affects the rate of reaction, so it will be the temperature that is being altered.

The **dependent** variable is the factor being **measured** (in this case the dependent variable would be option **D** – the volume of oxygen produced). **Control** variables are factors that need to be kept **constant** in order to give greater validity; any observed effects can be attributed to changes in the independent variable alone, not to some other variable. Option **C** – the mass of liver added at the start - is an example of a control variable. Option **A** is incorrect because this measurement would not indicate anything about the rate of the breakdown of hydrogen peroxide.

7

The correct answer is **C** as there are no ester bonds present in any level of polypeptide structure (and therefore also enzyme structure). Ester bonds are found in lipids (eg. triglycerides and phospholipids).

The bonds within proteins are as follows: peptide bonds, hydrogen bonds, ionic bonds, hydrophobic interactions

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8

The correct answer is **A** because glucose is an isomer of fructose, so both have the same formula ($C_6H_{12}O_6$). Glucose is isomerised into fructose by this enzyme.

Enzymes are conventionally named for their substrates, not for their products. For example, the enzyme that dehydrogenates ethanol is ethanol dehydrogenase.

9

The correct answer is **B** as the effectiveness of the treatment is measured in how much glucose is produced from lactose in the milk.

C is incorrect as the enzyme concentration in the column should remain constant if the enzymes have been adequately immobilised.

A and **D** are both control variables (factors that need to be kept the same in order to ensure a fair test)

10

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The correct answer is **C** because it uses the method of **serial dilution**. 2 successive 10 × dilutions achieves an overall 100 × dilution. There is greater precision in measuring out 1 cm^3 than 0.1 cm^3.

All four methods shown would, in theory, achieve a 100 × dilution factor. They vary in their accuracy and susceptibility to experimental error.

A is too imprecise; measuring just 0.1 cm^3 of starch using standard laboratory equipment would be subject to a large percentage error.

B and **D** only vary in their glassware but neither piece of glassware is graduated accurately enough to measure out the required volumes.