



EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

Level: HL IB in Biology

Subject: Biology

Topic: IB HL Biology

Type: Mark Scheme

2002

XVIII

1583

All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY

HL - IB

Key skills

Answer 1

The correct answer is B because it is the only anabolic reaction. This is the formation of the disaccharide sucrose by condensing two monosaccharides together. A large molecule is built from smaller ones, hence is an example of anabolism.

A, C and D are all catabolic.

A is a breakdown of excess polypeptide to form urea, the main nitrogen-containing waste product excreted from the body.

C is when fats are hydrolysed to form fatty acids and glycerol and are in turn respired to release energy.

D is catabolic because anaerobic respiration is still a form of respiration, which is exergonic (releases energy).

Answer 2

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).

Answer 3

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.

Answer 4

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

Answer 5

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.

Answer 6

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).

Answer 7

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.

Answer 8

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

Answer 9

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.

Answer 10

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)

Answer 11

The correct answer is C because it uses the method of serial dilution. 2 successive $10 \times$ dilutions achieves an overall $100 \times$ 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 $100 \times$ 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.

Answer 12

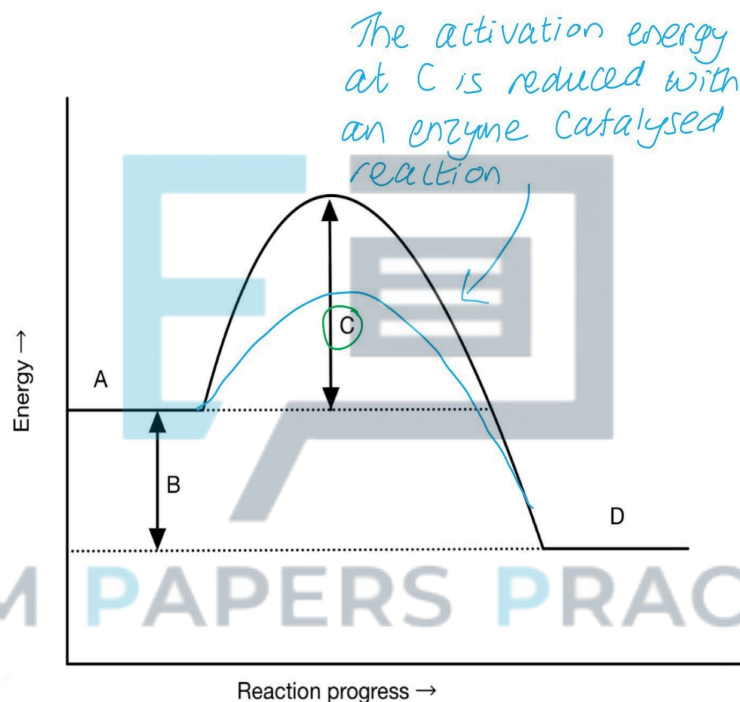
The correct answer is D.

Metabolism can involve the breakdown molecules but also the formation of new ones.

Answer 13

The correct answer is C.

An enzyme lowers the activation energy required for a reaction (C). The energy of the reactants (A) and products (D) remain unchanged, so the difference in energy between A and D (B) would



also remain the same.

Answer 14

The correct answer is A.

A competitive inhibitor changes or blocks the active site so a substrate is competing with the inhibitor, while a non-competitive inhibitor binds to an alternative site on the enzyme and causes the active site to change shape, preventing the substrate from binding.

Inhibitors only change the enzyme and do not alter the substrate.

Answer 15

The correct answer is B

An allosteric inhibitor is a non-competitive inhibitor that binds to an alternative/allosteric site away from the active site and not to the active site itself.

Answer 16

The correct answer is D

Isoleucine is the end product of a reaction in which the enzyme threonine deaminase has a role in converting the amino acid threonine into the amino acid isoleucine. Isoleucine is a non-competitive inhibitor to threonine deaminase, binding to an allosteric site in order to alter its active site.

Answer 17

The correct answer is B

You can tell that this is a competitive inhibitor because the rate of reaction eventually reaches the same rate as the enzyme in the absence of an inhibitor once the substrate concentration exceeds that of the inhibitor.

Answer 18

The correct answer is D.

$$3.7 \times 10^7 = 37\,000\,000$$

Answers A, B and C give smaller numbers when you convert from standard form.

Converting from standard form

Move the decimal to the right
the same number of times as the
power

$$\begin{aligned} & 5.2 \times 10^3 \\ = & 5.2 \quad \text{Step 1: Move the decimal.} \\ = & 5.200 \quad \text{Step 2: Add in zeros in the gaps.} \\ = & \underline{5200} \quad \text{Step 3: Remove the decimals.} \end{aligned}$$

Extra tip - if it was a negative power, you'd move the decimal to the left!

Answer 19

The correct answer is A.

A tangent drawn through the origin that matches the gradient of the initial part of the curve will enable calculation of the initial rate of reaction while a tangent that matches the gradient part way along the curve will give the rate at a later stage in the reaction.

Note that rate is calculated by dividing volume by time, and not the other way around; a rate is an amount of something per unit time.