



**Exampro A-level Biology
(7401/7402)**

Name:

Class:

Enzymes Questions

Author:

Date:

Time: 97

Marks: 70

Comments:

These questions mix the different styles of questions. Short answers, practical techniques, experimental data analysis, extended answer and comprehension Work through these, the more you do the better you will become with your exam technique.

Q1. (a) *Induced fit* and *lock and key* are two models used to explain the action of enzymes.

(i) Describe the *induced fit* model of enzyme action.

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(2)

(ii) Describe **one** way that the *lock and key* model is different from the *induced fit* model.

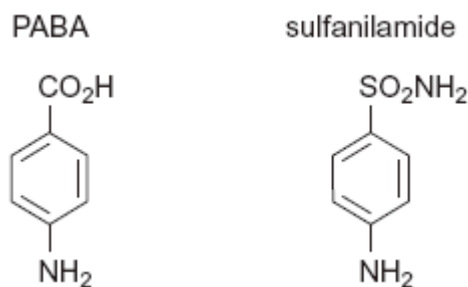
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(1)

(b) Folic acid is a substance required by bacteria for cell growth. Bacteria produce folic acid by the following reaction.



The diagram shows the structure of a molecule of PABA. It also shows the structure of a molecule of a drug called sulfanilamide, which can be used to treat bacterial infections. Sulfanilamide prevents bacteria producing folic acid.



Use the diagram and your knowledge of enzymes to explain how sulphanilamide prevents bacteria producing folic acid.

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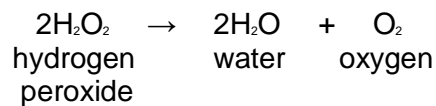
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(3)
(Total 6 marks)

Q2. Catalase is an enzyme. It catalyses the breakdown of hydrogen peroxide in the reaction:



In an investigation, samples of different substances were added to hydrogen peroxide in a series of test tubes. The rate of reaction was measured by recording the rate at which bubbles of oxygen were produced. A scale going from 0 for no bubbles to 5 for the maximum rate of bubbling was used to measure this. The results are shown in the table.

Tube	Substance added	Rate at which bubbles of oxygen were produced
A	Piece of liver	4
B	Ground liver and sand	5
C	Sand	0
D	Piece of cooled, boiled liver	0

(a) Explain the difference between the rate at which bubbles were produced in.

(i) tubes **A** and **B**;

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(2)

(ii) tubes **A** and **D**.

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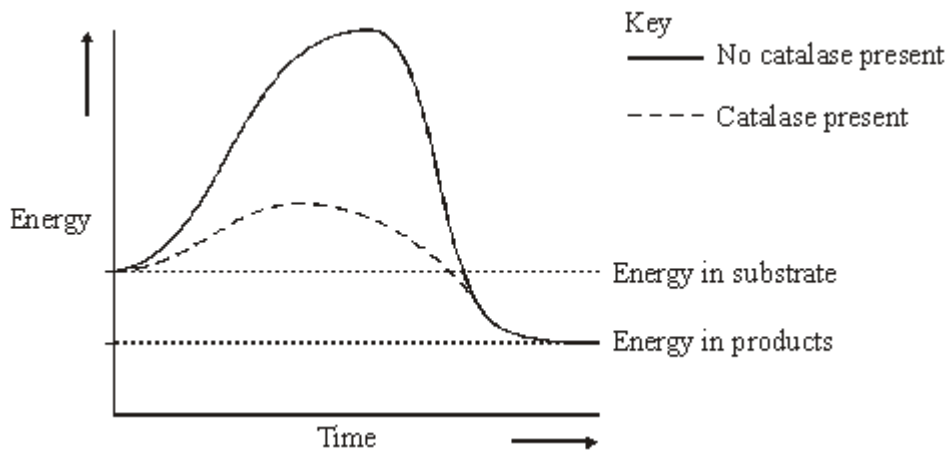
(b) Explain the purpose of tube **C**.

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(1)

(c) The graph shows the energy changes which take place during the reaction in which hydrogen peroxide is converted to water and oxygen.



Use the graph to explain why

- (i) hydrogen peroxide breaks down at a lower temperature when catalase is present than when it is not present;

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(1)

- (ii) test tubes **A** and **B** became warmer when the reaction was taking place.

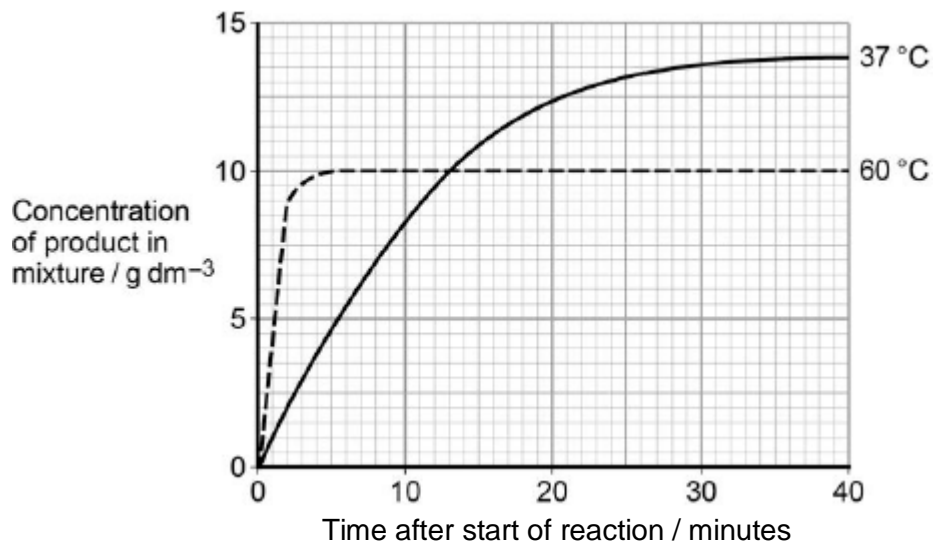
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(2)

(Total 9 marks)

Q3. A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same concentration of substrate.

The following graph shows his results.



- (a) Give **two** other factors the technician would have controlled.

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2

(1)

- (b) Draw a tangent on each curve to find the initial rates of reaction.
Use these values to calculate the ratio of the initial rates of reaction at 60 °C : 37 °C.
Show your working.

Ratio = :1

(2)

- (c) Explain the difference in the initial rate of reaction at 60 °C and 37 °C.

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(2)

- (d) Explain the difference in the rates of reaction at 60 °C and 37 °C between 20 and 40 minutes.

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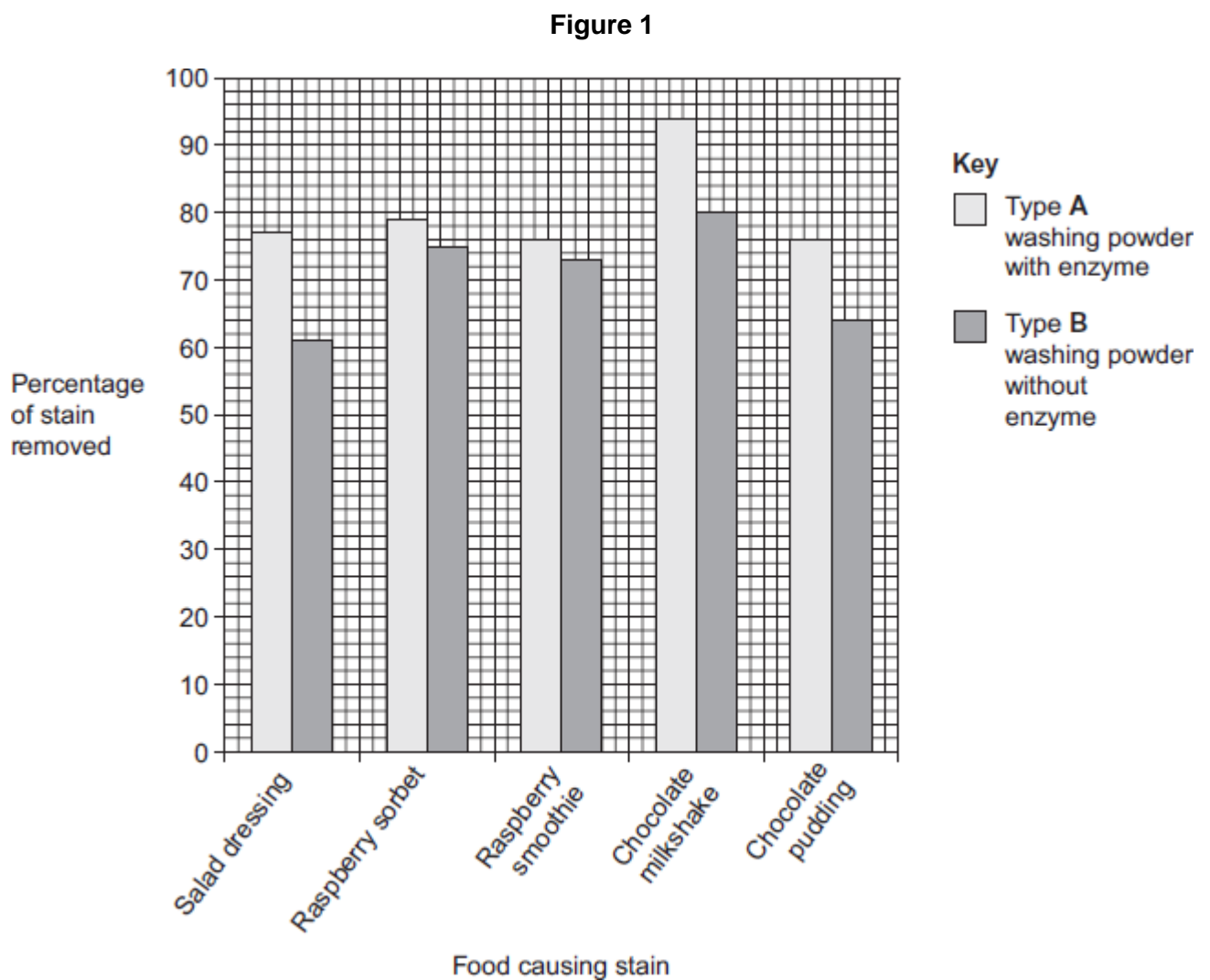
(4)
(Total 9 marks)

Q4. Biological washing powders contain enzymes which hydrolyse substances that cause stains on clothes.

A manufacturer tested the ability of two types of the same brand of washing powder to remove different food substances that stain clothes.

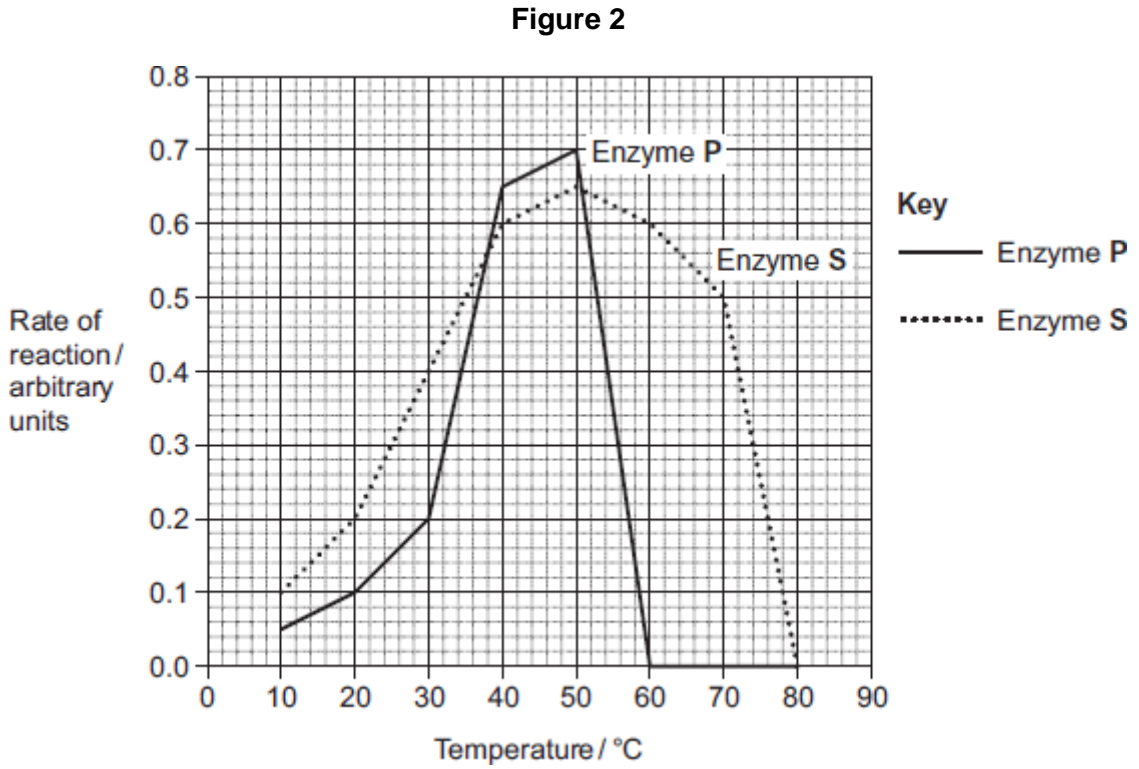
- Type **A** contained an enzyme.
- Type **B** was identical to **A** except it did **not** contain the enzyme.

Figure 1 shows the results.



A scientist worked for a company that wanted to develop a biological washing powder that was effective over a range of temperatures. He investigated the effect of temperature on the rates of the reaction catalysed by two enzymes, **P** and **S** used in biological washing powders.

Figure 2 shows his results.



- (a) Many of the substances causing the food stains are large, insoluble proteins. Suggest how a biological washing powder removes this type of stain.

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(2)

- (b) The manufacturer of type **A** and type **B** washing powder claimed that these results showed that biological washing powders are better at removing stains from clothes.

Use the information in **Figure 1** to evaluate this claim.

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(4)

(c) Most customers want a washing powder which removes stains from clothes over a range of temperatures. After obtaining the results shown in **Figure 2**, which enzyme should the scientist recommend for use in a biological powder?

Give reasons for your answer.

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(3)

(d) Biological washing powders often contain a number of different enzymes. This enables them to remove a wider range of stains from clothes. Explain why a number of enzymes are required to remove a wider range of stains.

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(Extra space)

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(3)
(Total 12 marks)

Q5.(a) In humans, the enzyme maltase breaks down maltose to glucose.
This takes place at normal body temperature.

Explain why maltase:

- only breaks down maltose
- allows this reaction to take place at normal body temperature.

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(5)

- (b) Scientists have investigated the effects of competitive and non-competitive inhibitors of the enzyme maltase.

Describe competitive and non-competitive inhibition of an enzyme.

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(5)
(Total 10 marks)

Q6. Read the following passage.

During the course of a day, we come into contact with many poisonous substances. These include industrial and household chemicals. The skin acts as a barrier and prevents many of these substances entering and harming the body.

5 The skin is one of the largest organs in the body. It is composed of several layers of tissue. The outer layer consists of dead cells packed with keratins. Keratins are a group of proteins that differ from each other in their primary structure. Each keratin molecule consists of several polypeptide chains, each individual chain wound into a spiral or helix. The polypeptide chains include many sulphur-containing amino acids and these help to give the keratin molecules their characteristic strength.

Use information from the passage and your own knowledge to answer the questions.

(a) What is the evidence from the passage that keratin molecules have a quaternary structure?

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(1)

(b) Explain how sulphur-containing amino acids help to give keratin molecules their characteristic strength (lines 8–9).

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(2)

(c) Explain why differences in primary structure result in keratins with different properties (line 6).

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Q7. Read the following passage.

Gluten is a protein found in wheat. When gluten is digested in the small intestine, the products include peptides. Peptides are short chains of amino acids. These peptides cannot be absorbed by facilitated diffusion and leave the gut in faeces

Some people have coeliac disease. The epithelial cells of people with coeliac disease do not absorb the products of digestion very well. In these people, some of the peptides from gluten can pass between the epithelial cells lining the small intestine and enter the intestine wall. Here, the peptides cause an immune response that leads to the destruction of microvilli on the epithelial cells.

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Scientists have identified a drug which might help people with coeliac disease. It reduces the movement of peptides between epithelial cells. They have carried out trials of the drug with patients with coeliac disease.

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Use the information in the passage and your own knowledge to answer the following questions.

(a) Name the type of chemical reaction which produces amino acids from proteins.

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(1)

(b) The peptides released when gluten is digested cannot be absorbed by facilitated diffusion (lines 2 – 3). Suggest why.

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(3)

- (c) The epithelial cells of people with coeliac disease do not absorb the products of digestion very well (lines 4 – 5). Explain why.

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(3)

- (d) Explain why the peptides cause an immune response (lines 7 – 8).

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(1)

- (e) Scientists have carried out trials of a drug to treat coeliac disease (lines 10 – 11). Suggest **two** factors that should be considered before the drug can be used on patients with the disease.

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(2)
(Total 10 marks)