Enzymes

Question Paper 3

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Foundations in Biology
Topic	Enzymes
Booklet	Question Paper 3

Time allowed: **49 minutes**

Score: **/36**

Percentage: **/100**

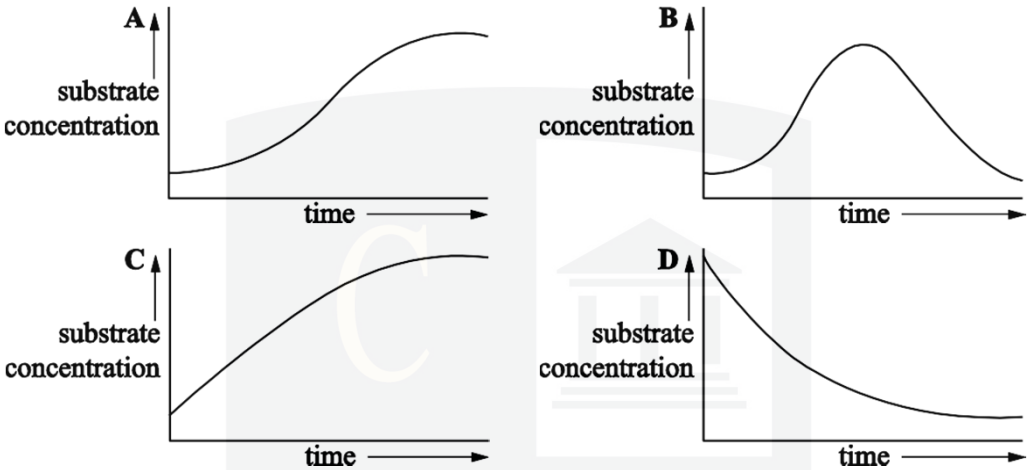
Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

A group of students monitored the **substrate** concentration during an enzyme-controlled reaction.

Select the graph that correctly shows how the substrate concentration changes during the course of the reaction.



[1]

Question 2

A chemical produced by a metabolic pathway binds to the initial enzyme in the pathway. The chemical binds to the enzyme at a site away from the active site and inhibits the enzyme action.

Which of the following statements about the mode of action of the chemical is/are correct?

Statement 1: It is an end product inhibitor.

Statement 2: It is a competitive inhibitor.

Statement 3: It binds to the allosteric site of the enzyme.

A. 1, 2 and 3

B. Only 1 and 2

C. Only 1 and 3

D. Only 1

[1]

Question 3

(a) Alcohol dehydrogenase is a protein molecule that is present in the liver. The molecule breaks down alcohols and other chemicals that would otherwise be toxic to the body.

Name the group of biological molecules to which alcohol dehydrogenase belongs. **[1]**

(b) In 1985, health concerns were raised when the compound diethylene glycol (DEG) was detected in samples of wine. The DEG had been added, illegally, to make the wine taste sweeter.

In the liver, DEG is broken down by alcohol dehydrogenase to form a toxic product. Alcohol dehydrogenase also breaks down ethanol, the key ingredient in alcoholic drinks such as wine, to form a non-toxic product.

Fig. 2.1 shows the structures of DEG and ethanol.

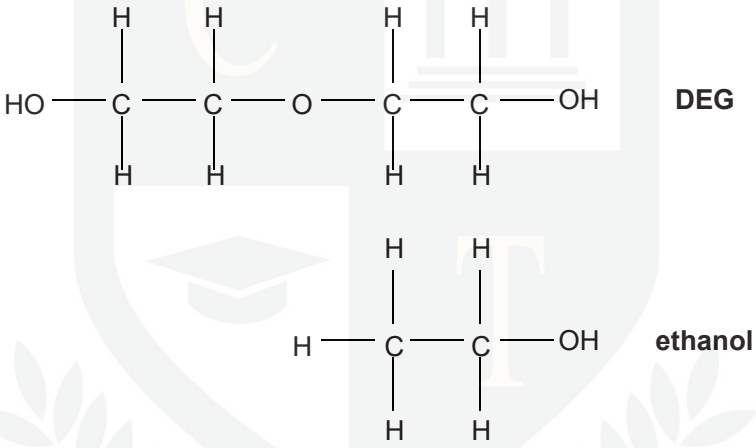


Fig. 2.1

(i) Using the information in Fig. 2.1, explain why alcohol dehydrogenase is able to break down **both** ethanol and DEG. **[3]**

(ii) Suggest why DEG-contaminated wines with a high ethanol content may result in less DEG poisoning than contaminated wines with a low ethanol content. **[3]**

[Total: 7]

Question 4

(a) Complete the passage below using the most appropriate terms.

Enzymes are ..... proteins and are therefore soluble. They alter the rate of metabolic reactions and are described as biological ..... .

Some enzymes, such as those found in cytoplasm, are described as ..... enzymes. Other enzymes, such as those that digest food in the small intestine, are known as ..... enzymes. Some medicinal drugs reduce enzyme activity. These are called enzyme ..... . **[5]**

(b) Many enzymes are associated with non-protein molecules known as cofactors. Some cofactors are small inorganic ions.

Rennin is an enzyme that is involved in the digestion of milk. It converts soluble caseinogen in milk into insoluble casein. The cofactor Ca^{2+} is associated with this reaction.

A student wished to investigate the effect of Ca^{2+} on the action of rennin.

Describe how the student could carry out this investigation and produce valid results. **[5]**

(c) Enzyme cofactors are often derived from vitamins and minerals in the diet.

Proteins are required in large amounts in the diet whereas vitamins and minerals are required only in small amounts.

Suggest why. **[1]**

[Total: 11]

Question 5

(a) Enzymes are biological catalysts.

Explain the term *biological catalyst*. **[2]**

(b) When the enzyme catalase is added to hydrogen peroxide, the following reaction occurs:

$$\underset{\text{hydrogen peroxide}}{H_2O_{2\,(l)}} \xrightarrow{\text{catalase}} 2\,H_2O_{(l)} + O_{2\,(g)}$$

In an investigation into the effect of temperature on the rate of this reaction, a student set up apparatus as shown in Fig. 2.1, using liquidised celery as a source of catalase.

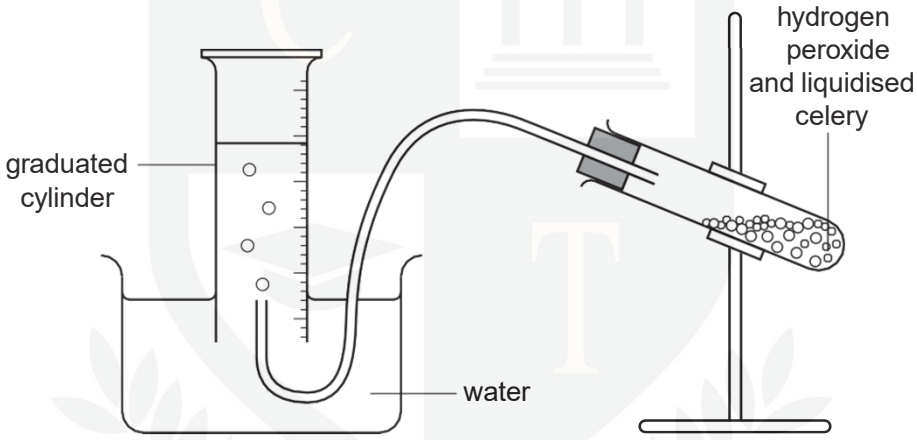


Fig. 2.1

The student measured the volume of oxygen produced at five different temperatures using samples of the liquidised celery.

(i) State the other variable that needs to be measured in order to calculate the **rate** of reaction. **[1]**

(ii) Identify **one** potential problem with using samples of liquidised celery as a source of catalase in this investigation **and** suggest a way to minimise this problem. **[2]**

(iii) The student collected the data shown in Table 2.1.

Table 2.1

temperature (°C)	volume of oxygen (cm^3)
5	4
10	7
12	10
25	28
28	32

Suggest how the student could check the reliability of the data. **[2]**

(c) Another student carried out a similar procedure and presented his results as a graph. The graph that he drew is shown in Fig. 2.2.

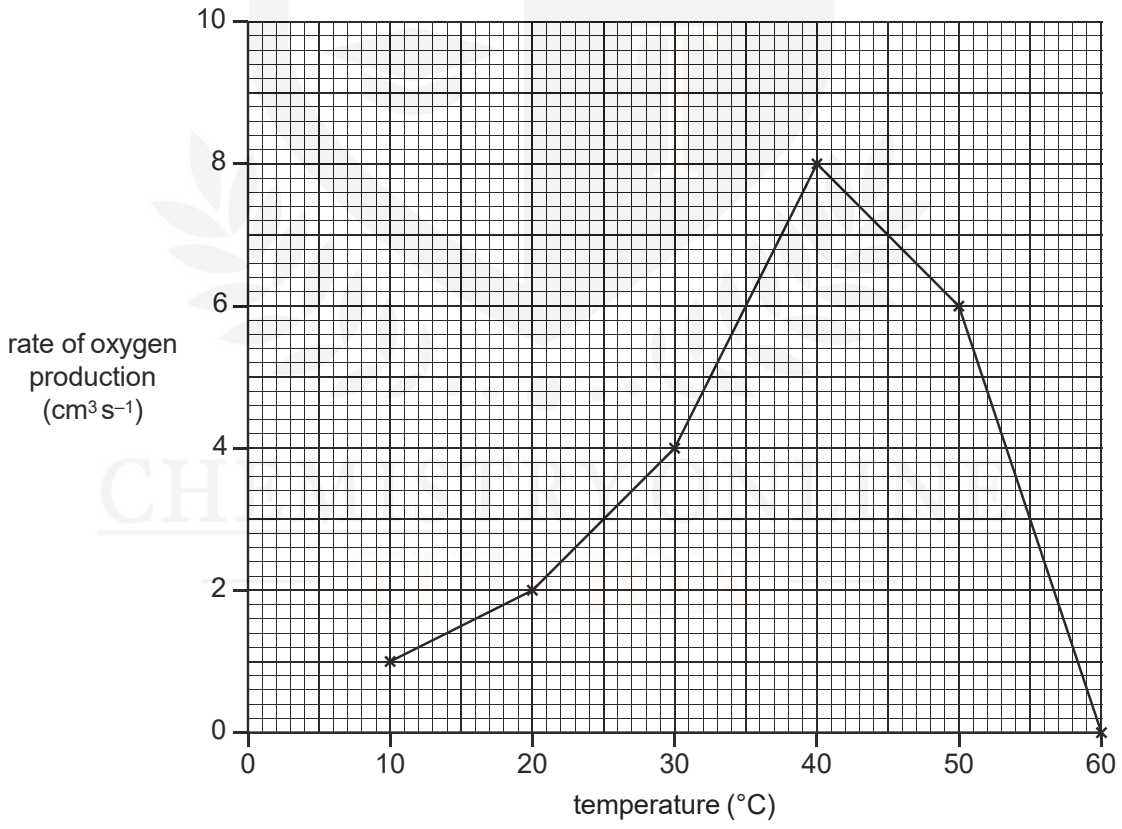


Fig. 2.2

(i) Describe the data shown in Fig. 2.2. **[4]**

(ii) Q_{10} is a measure of the increase in the rate of reaction for a 10 °C rise in temperature.

It is calculated using the following formula:

$$Q_{10} = \frac{\text{rate at } (t + 10°C)}{\text{rate at } t°C}$$

where t + 10 °C = rate at the higher temperature
t = rate at the lower temperature

Using the information in Fig. 2.2, calculate Q_{10} between 15 °C and 25°C.

Show your working. **[1]**

(iii) In the conclusion to this experiment, the student wrote the following:

As the heat increased, the reaction went faster until it got to its highest. After this, the rate of reaction fell. This happened because the enzyme was killed and the hydrogen peroxide could not fit into the enzyme's key site.

Suggest a more appropriate word to replace each of the underlined words.

heat should be replaced with .....

highest should be replaced with .....

killed should be replaced with .....

key should be replaced with ..... **[4]**

[Total: 16]