

# 2.4 Enzymes

## Question Paper

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

**Time allowed:** 60  
**Score:** /44  
**Percentage:** /100

### Question 1a

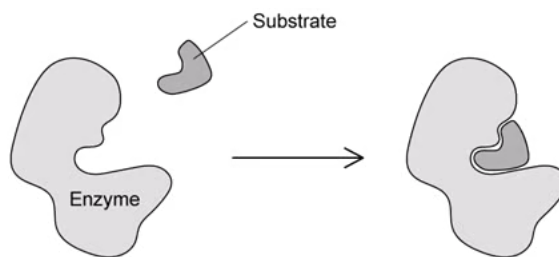
a)  
State the reason why enzymes are referred to as biological catalysts.

[1 mark]

[1 mark]

### Question 1b

b)  
The image below shows a representation of an enzyme-controlled reaction.



Describe the events taking place in the image.

[3 marks]

[3 marks]

### Question 1c

c)  
State what is meant by the term 'enzyme specificity'?

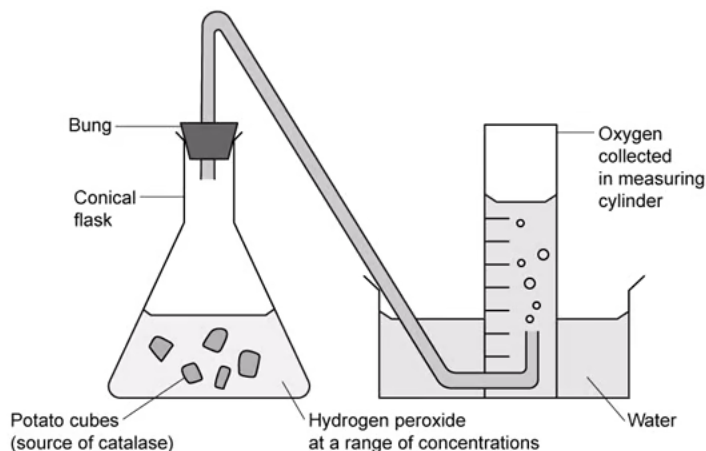
[2 marks]

[2 marks]

### Question 2a

a)

A student wanted to investigate the effect of substrate concentration on the activity of an enzyme called catalase. Catalase is an enzyme that commonly occurs inside living cells where it breaks down toxic hydrogen peroxide into oxygen and water. The image below shows the experimental set up done by the student.



List **two** control variables that the student would need to be aware of in the experiment shown in the image.

[2 marks]

[2 marks]

### Question 2b

b)

The student decided to make up solutions at five different hydrogen peroxide concentrations. Their measurements for these solutions are shown in the table below.

Concentration of hydrogen peroxide solution (%)	Volume of hydrogen peroxide required (cm <sup>3</sup> )	Volume of distilled water required (cm <sup>3</sup> )
10	10	90
8	<b>B</b>	<b>C</b>
6	6	94
<b>A</b>	4	96
2	2	98

Give the measurements needed to fill in gaps **A–C** in the table.

[1 mark]

[1 mark]

### Question 2c

c)

After measuring out the range of hydrogen peroxide concentrations shown in part (b), the student carried out the experiment using the equipment set up in part (a). They recorded the volume of oxygen (the product) produced after one minute, and repeated this measurement three times at each concentration. Their results are shown in the table below.

Hydrogen peroxide concentration / %	Volume of oxygen produced after 1 minute / cm <sup>3</sup>			Mean volume of oxygen / cm <sup>3</sup>
	Repeat 1	Repeat 2	Repeat 3	
10	18	20	21	19.7
8	17	18	18	17.7
6	13	11	13	<b>X</b>
4	9	9	10	9.3
2	5	6	6	5.7

Use the data in the table to calculate the value missing from the square marked **X**.

[1 mark]

[1 mark]

### Question 2d

d)

State the purpose of repeating the experiment three times at each concentration of hydrogen peroxide.

[2 marks]

[2 marks]

### Question 2e

e)

Using the data in part (c), draw a graph of hydrogen peroxide concentration against the mean volume of oxygen.

[4 marks]

[4 marks]

**Question 2f**

f)

Deduce the conclusions that can be drawn from your graph from part (e).

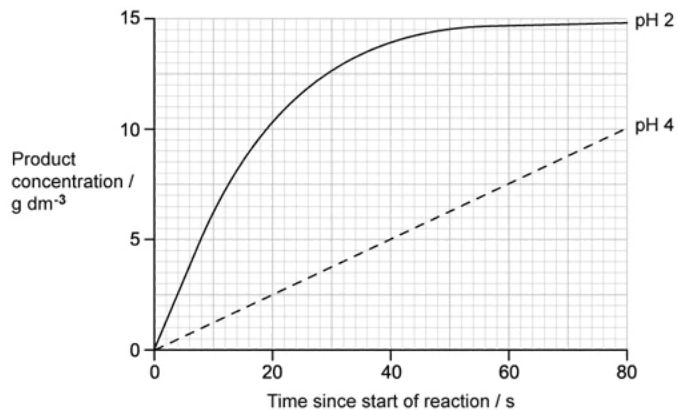
**[2 marks]****[2 marks]**

### Question 3a

a)

A researcher investigated the effect of pH on the activity of stomach enzyme pepsin.

Their results are shown in the image below.



The rate of reaction can be calculated by using the following formula:

$$\text{reaction rate} = \frac{\text{Amount of product produced (g dm}^{-3}\text{)}}{\text{Time (s)}}$$

Calculate the rate of reaction at pH 4. Give your answer with the correct units.

[2 marks]

[2 marks]

### Question 3b

b)

Describe the differences between the curves at pH 2 and pH 4.

[2 marks]

[2 marks]

### Question 3c

c)  
State why product production at pH 2 does not continue indefinitely but reaches a plateau at around 14.75 g.

[1 mark]

[1 mark]

### Question 3d

d)  
i)  
Predict the outcome if the pH were increased to pH 10.

[1 mark]

ii)  
Explain your answer at part i).

[2 marks]

[3 marks]

### Question 4a

a)  
State **two** benefits of using immobilised enzymes in industrial processes.

[2 marks]

[2 marks]

### Question 4b

b)

An example of the use of immobilised enzymes in industry is in the production of lactose-free milk.

i)

Identify the enzyme used in this process.

[1 mark]

ii)

State the substrate and products of the reaction.

[2 marks]

[3 marks]

### Question 4c

c)

When the enzymes are immobilised for this process they are fixed to small alginate beads. The substrate solution is then poured through the beads in order for the substrate to react with the enzyme.

State the benefits of having a large number of small beads for this process, as opposed to a small number of large beads.

[2 marks]

[2 marks]

### Question 5a

*One mark is available for clarity of communication throughout this question.*

a)

Describe the processes that occur during an enzyme-catalysed reaction.

[4 marks]



[4 marks]

**Question 5b**

b)

Outline the events that occur when enzymes are exposed to high temperatures.

[4 marks]

[4 marks]

**Question 5c**

c)

List **three** methods that can be used to immobilise enzymes.

[3 marks]

[3 marks]



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