

GCSE Biology (9 – 1)

Enzymes

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/8
2	/9
3	/8
4	/13
5	/10
6	/5
7	/6
8	/8
Total	/67
%	
Grade	

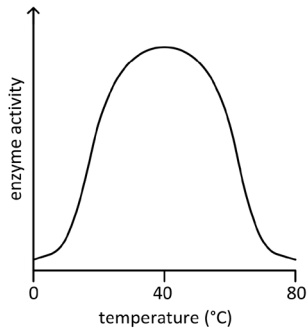
Information

- The maximum mark for this paper is 67 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.

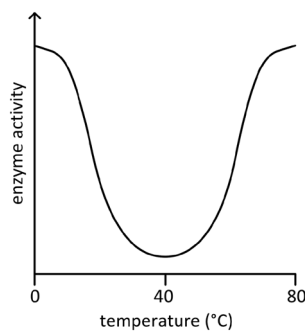


1. Enzymes are biological molecules that are essential for life. Answer each of the following multiple-choice questions relating to cell transport processes. Circle the letter of the correct answer for each.

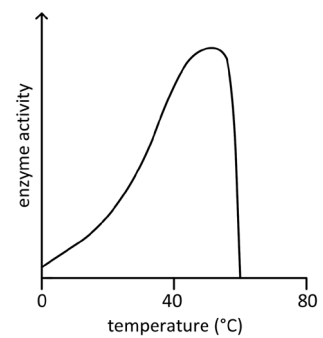
a) Which graph shows the effect of temperature on the activity of an enzyme?



A



B



C

(1 mark)

b) A piece of bread begins to taste sweet when it is mixed with saliva and chewed for several minutes. Which substance in saliva causes this change?

Hydrochloric acid

A

Amylase

B

Protease

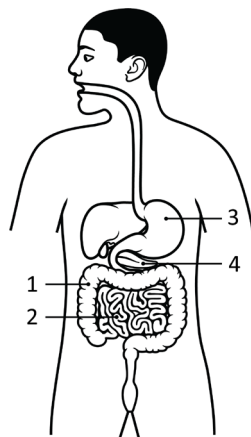
C

Lipase

D

(1 mark)

c) The diagram shows the human digestive system. Which structure does **not** secrete digestive enzymes?



1

A

2

B

3

C

4

D

(1 mark)

d) Enzymes are biological molecules. What type of biological molecules are enzymes?

Carbohydrates

A

Lipids

B

Nucleic acids

C

Proteins

D

(1 mark)

e) Amylase is a carbohydrase enzyme. What would be the products when amylase breaks down its substrate.

Carbohydrates

A

Lipids

B

Nucleic acids

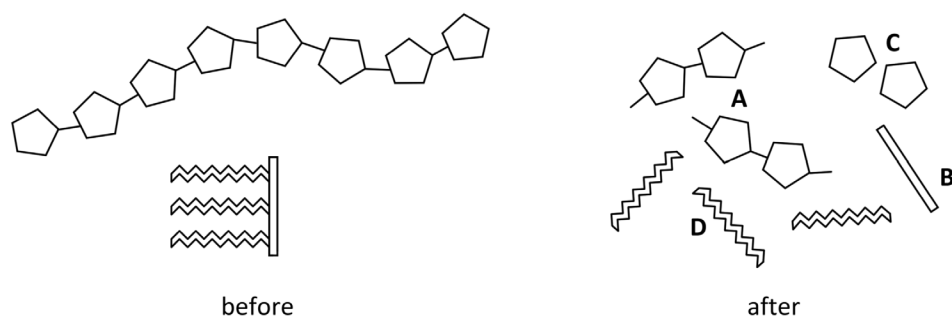
C

Proteins

D

(1 mark)

- f) The figure below shows two different food molecules before and after they have been digested by enzymes in the ileum.



Which **two** structures show the products of lipid digestion.
Circle the **number** of the correct answer.

1 – A and B

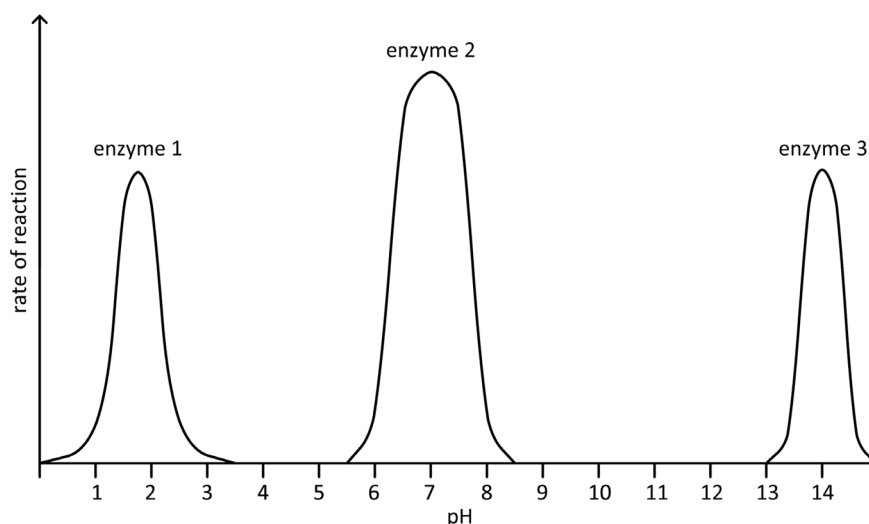
2 – A and C

3 – B and D

4 – C and D

(1 mark)

- g) The figure of the graph below shows the effect of different pH values on the rate of reaction of three different enzymes.



What does the figure of the graph show?

Circle the letter of the correct answer.

- A All enzymes have acidic optimum pH's.
- B All enzymes have alkali optimum pH's.
- C Each enzyme has a different optimum pH.
- D Each enzyme has a different optimum temperature.

(1 mark)

- h) What is the main substrate broken down by the enzyme lipase?

Circle the letter of the correct answer.

Carbohydrates

Lipids

Nucleic acids

Proteins

A

B

C

D

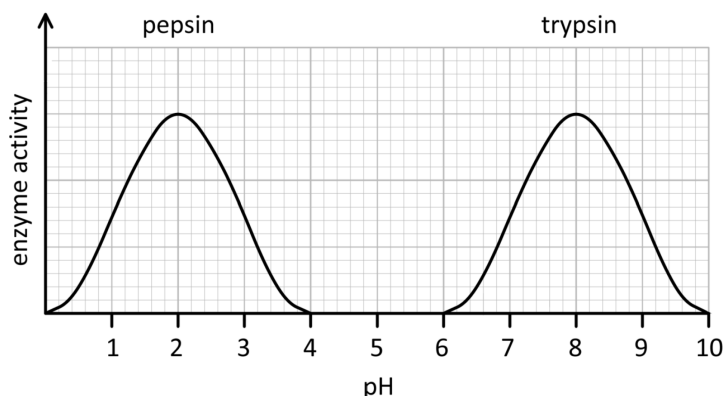
(1 mark)

(Total for Question 1 is 8 marks)

2. The enzymes trypsin and pepsin are protease enzymes.

A student conducted an experiment to examine how enzyme activity is affected by pH.

The results of their investigation is shown in the figure below.



a) Enzymes are biologically molecules. What are enzymes?

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(2 marks)

b) Describe the trend in the figure above for the enzyme trypsin.
Use information from the figure to support your answer.

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(3 marks)

c) Identify the optimum pH for pepsin.

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(1 mark)

d) Explain why there is no pepsin activity at pH 5.

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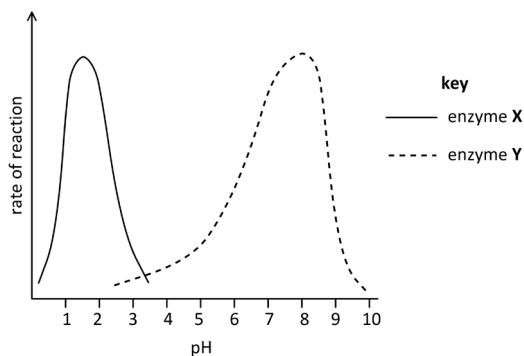
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(3 marks)

(Total for Question 2 is 9 marks)

3. A group of students investigated two enzymes, enzyme X and Y which are found in the digestive system. The figure below shows the rate of reaction of enzyme X and enzyme Y in different pH conditions.



- a) Enzyme X is a protease enzyme.
State the substrate and produced of a protease enzyme.

Substrate:

Product:

(2 marks)

The table below shows the pH in various parts of the digestive system.

Part of the digestive system	pH
mouth	7.5
stomach	1.5
small intestine	8.0
large intestine	7.5

The students say that their results show enzyme X is a protease enzyme and is found in the stomach.

- b) Explain whether the students results back up their claim?

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(2 marks)

- c) Enzymes which are present in the mouth are denatured when they are swallowed into the stomach.
i. State what is meant by the term “denatured”.

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(2 marks)

- ii. Explain why a denatured enzyme does not function.

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(2 marks)

(Total for Question 3 is 8 marks)

4. Maltase is an enzyme that breaks down carbohydrates.

a) State the substrate and product of maltase.

Substrate:

Product:

(2 marks)

b) Identify where maltase is produced in the digestive system.

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(1 mark)

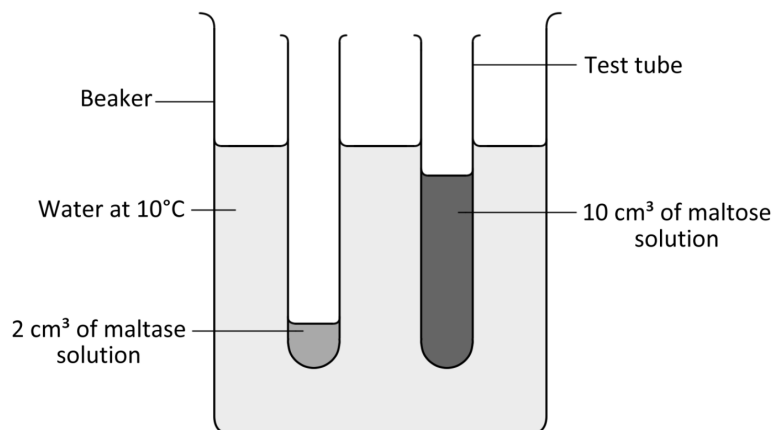
c) Explain how maltase breaks down carbohydrates, your answer should include correct references to the 'lock and key' model of enzyme action.

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(3 marks)

A student investigated the effect of temperature on the activity of maltase.

The figure below shows the apparatus used.



The student used the following method:

- Set up the apparatus as shown in the figure above.
- After 5 minutes, pour the maltose solution into the maltase solution and mix well.
- Remove some of the maltose-maltase mixture and add it to some Benedict's solution in a water bath.
- Record the colour of the maltose-maltase mixture after it has been added to the Benedict's solution.
- Repeat steps 3 and 4 every 2 minutes until the Benedict's solution remains a blue colour.
- Repeat steps 1 to 5 using water at different temperatures.

d) Identify **two** control variables the student used in the investigation.

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(2 marks)

The table below shows the results of the students investigation.

Temperature (°C)	Time taken for colour change (min)
10	No colour change
20	20
30	10
40	2
50	10
60	20
70	No colour change

e) What conclusion could the student make about the effect of increasing temperature on maltase activity between 20 °C and 60 °C?

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(1 mark)

f) Explain why there was no colour change when the temperature of the mixture was 10 °C.

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(2 marks)

g) Explain why there was no colour change when the temperature of the mixture was 70 °C.

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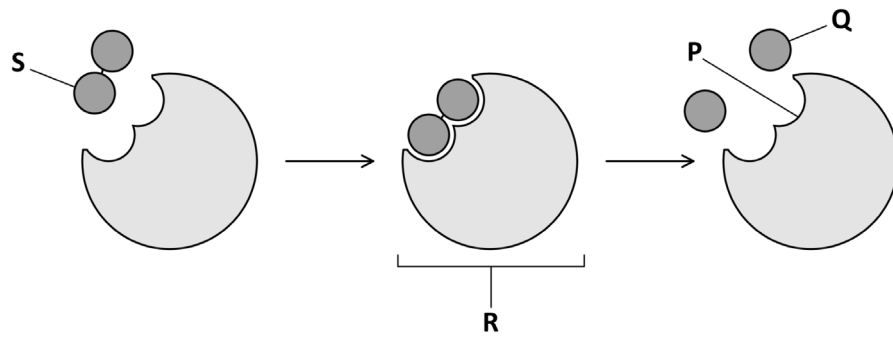
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(2 marks)

(Total for Question 4 is 13 marks)

5. The figure below shows the different stages of the action of an enzyme.



a) Identify structures S, P, Q and R in the figure above.

S = ...

P = ...

Q = ...

R = ...

(4 marks)

b) State the **three** conditions that will cause an enzyme to be denatured.

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(3 marks)

c) Lipase is an enzyme involved in digestion. Explain **how** lipase breaks down lipids during digestion.

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(3 marks)

(Total for Question 5 is 10 marks)

6. The digestive system has a number of different enzymes.

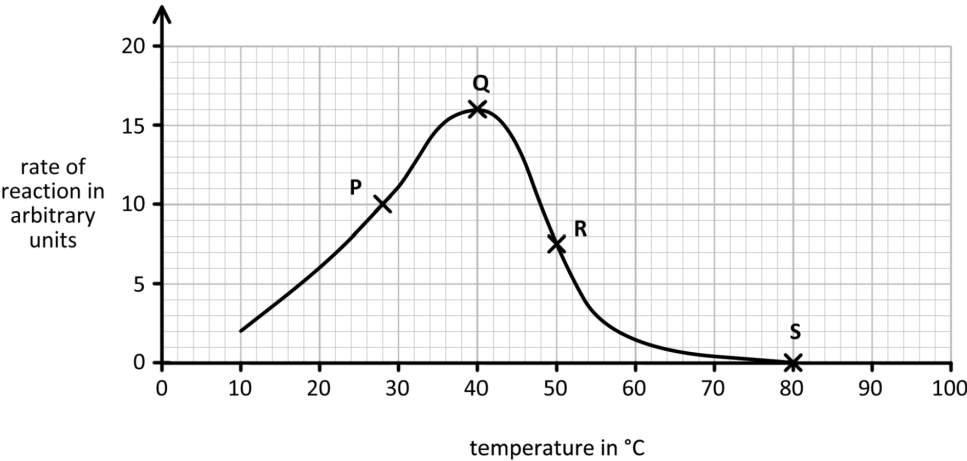
The table below shows some of the different enzymes of the digestive system. As well as their substrates and their products. Complete the table below.

Food sample	Enzyme	Products
.....	Amylase	
Protein		Amino acids
.....	Lipase	

(5 marks)

(Total for Question 6 is 5 marks)

7. The figure below shows the rate of reaction for the enzyme lipase at different temperatures.



Explain why the rate of reaction is different at points P, Q, R and S.

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(6 marks)

(Total for Question 7 is 6 marks)

8. A student conducted an experiment to investigate the rate of reaction of a carbohydrase enzyme. The student measured the production of maltose over a period of time.

The table below shows the students results.

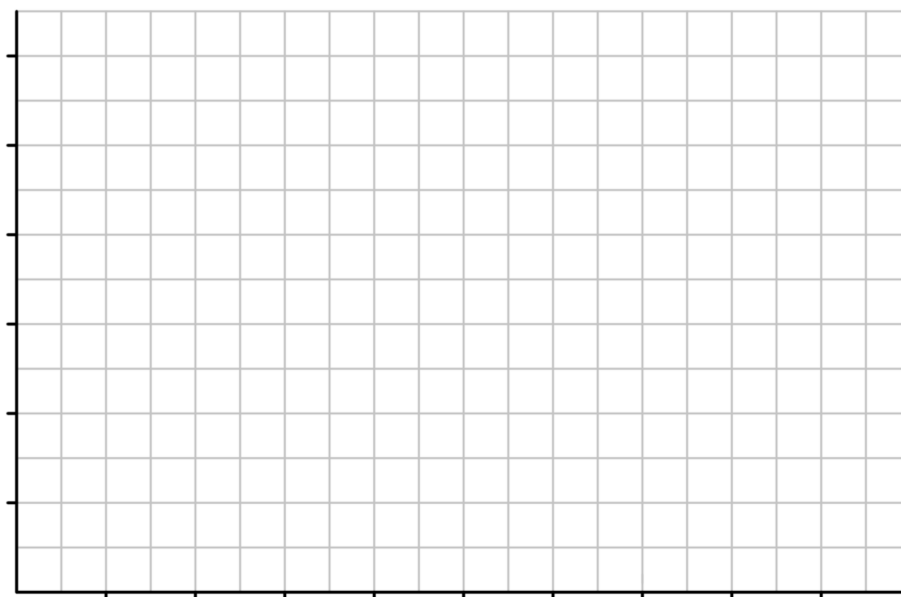
Time (s)	Maltose Concentration (mol/dm ³)
0	0.0
5	3.0
10	6.0
15	8.0
20	9.0
25	10.0
30	10.5
35	11.0
40	11.0
45	11.0
50	11.0

- a) What enzyme did the student use in their investigation?

.....

(1 mark)

- b) Plot the students results on the graph.



(2 marks)

- c) Use the completed graph to determine the rate of the reaction at 15 seconds.

Rate = ...

(2 marks)

d) In terms of substrate molecules, explain why the graph plateaus.

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(3 marks)

(Total for Question 8 is 8 marks)