1 Enzymes act as biological catalysts.

Amylase is an enzyme present in saliva that catalyses the hydrolysis of starch into maltose.

*(a) Describe the structure of starch.

(5)

(b) Explain the meaning of the following terms.

(i) Catalyst

(2)

(ii) Hydrolysis

(2)

(c) Bread contains a high proportion of starch. If bread is chewed for a long period of time it begins to taste sweet.

Suggest why bread tastes sweet after chewing for a long period of time.

(1)

(Total for Question 1 = 10 marks)

2 Photosynthesis can be divided into two main stages, the light-dependent stage and the light-independent stage.

(a) Explain why the light-independent stage cannot take place without the light-dependent stage.

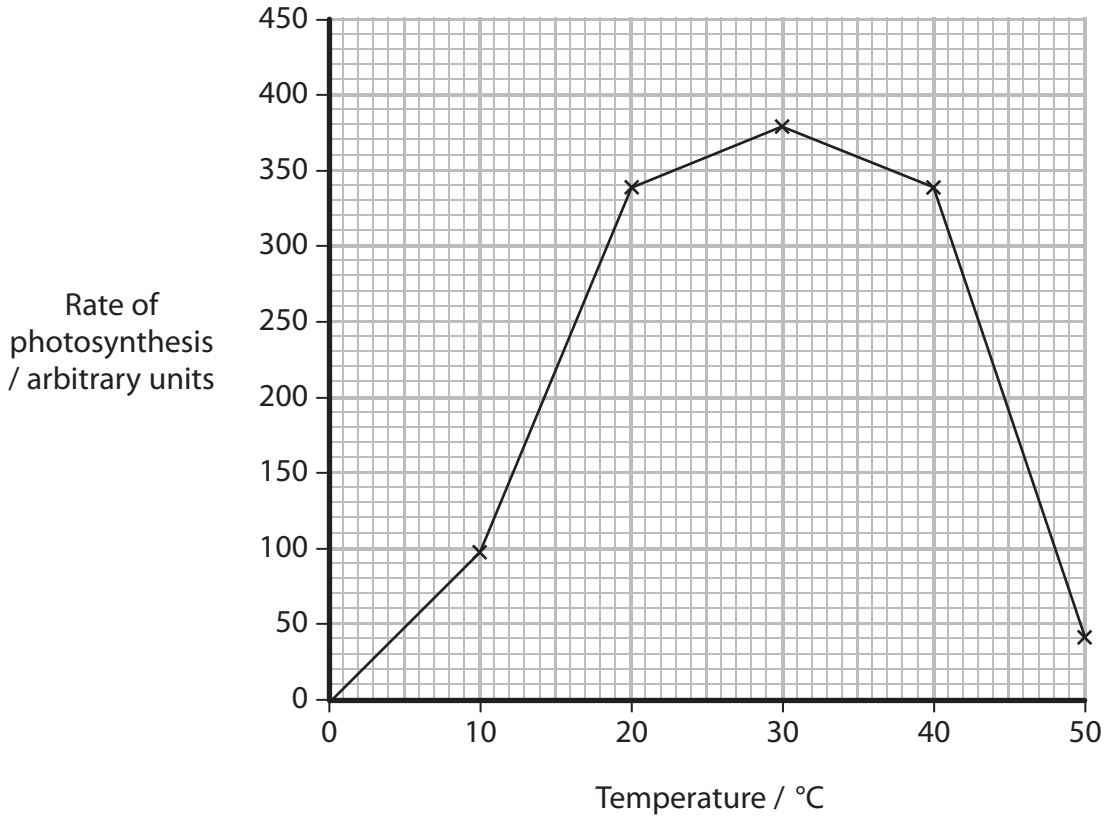
(3)

(b) An investigation was carried out by a student, to find the effect of temperature on the rate of photosynthesis in *Elodea canadensis* (Canadian pondweed).

The rate of photosynthesis was measured over a period of two hours at a fixed temperature. This was repeated at different temperatures.

All other abiotic factors were controlled.

The results of this investigation are shown in the graph below.



(i) Place a cross (☒) in the box next to the statement that describes what could be measured to find the rate of photosynthesis in this investigation.

(1)

☒ **A** increase in mass of *Elodea*

☒ **B** mass of nitrate absorbed

☒ **C** volume of carbon dioxide produced

☒ **D** volume of oxygen produced

(ii) The temperatures used in this investigation were 0 °C, 10 °C, 20 °C, 30 °C, 40 °C and 50 °C.

Suggest what the results of the investigation show about the minimum temperature required for photosynthesis in *Elodea*.
Give a reason for your answer.

(2)

(iii) Explain the meaning of the following statement.

"All other abiotic factors were controlled."

(2)

(iv) The student, who carried out this investigation, wrote the following as part of her conclusion.

Enzymes control the rate of photosynthesis in *Elodea*.

Discuss how far the results of this investigation support her conclusion.

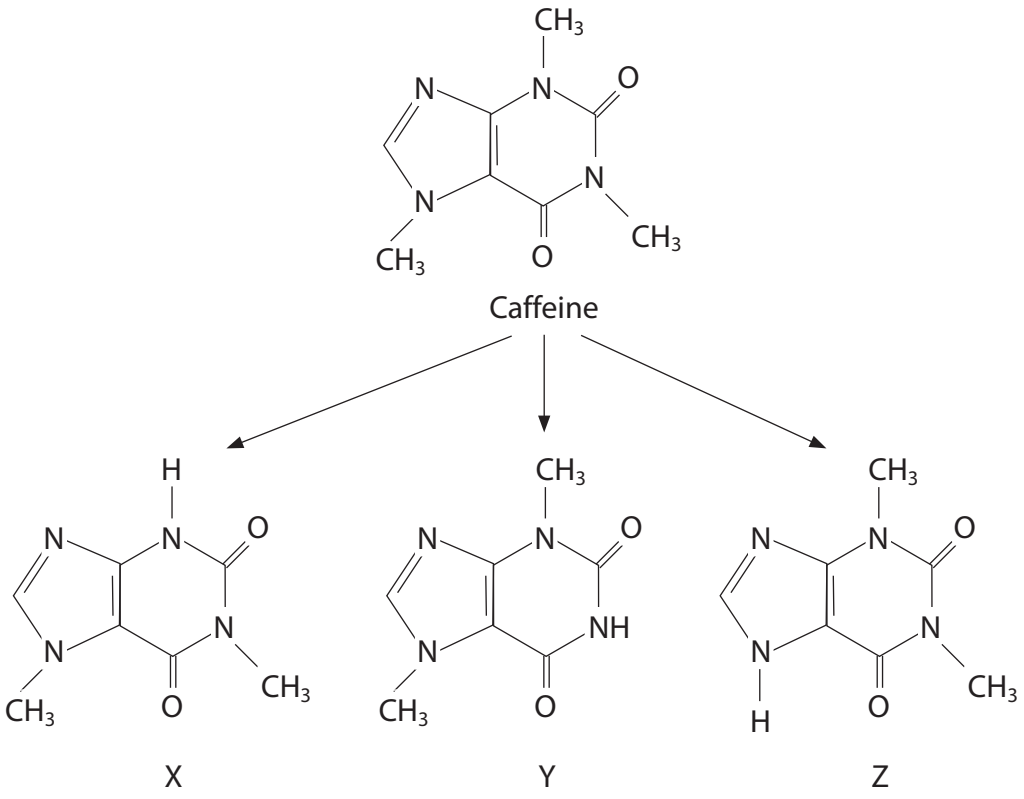
(4)

(Total for Question 2 = 12 marks)

3 Caffeine is a drug frequently consumed in a number of drinks such as coffee, cola, hot chocolate and tea.

Caffeine is broken down in the liver by a group of enzymes called cytochrome P450 oxidase.

(a) The diagram below shows the structure of caffeine and its three breakdown products, X, Y and Z.



(i) Using the information in the diagram, give **two** reasons why caffeine is **not** an amino acid.

(2)

1 .....

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2 .....

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(ii) Using the information in the diagram, state **two** differences between the breakdown products.

(2)

1 .....

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2 .....

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(iii) Using the information in the diagram and your own knowledge of enzyme action, suggest why cytochrome P450 oxidase consists of more than one type of enzyme.

(3)

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(b) A student decided to investigate the concentration of caffeine in four drinks: coffee, cola, hot chocolate and tea.

The student's results are shown in the table below.

Drink	Volume of drink	Caffeine content / mg
coffee	200 cm^3	135
cola	1 can	80
hot chocolate	200 cm^3	10
tea	1 cup	50

The student made two conclusions from these results.

Conclusion 1 "Different drinks have different concentrations of caffeine."

Conclusion 2 "Coffee has the highest concentration of caffeine."

Comment on the validity of these conclusions. Give reasons for your answer.

(3)

Conclusion 1 .....

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Conclusion 2 .....

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(Total for Question 3 = 10 marks)