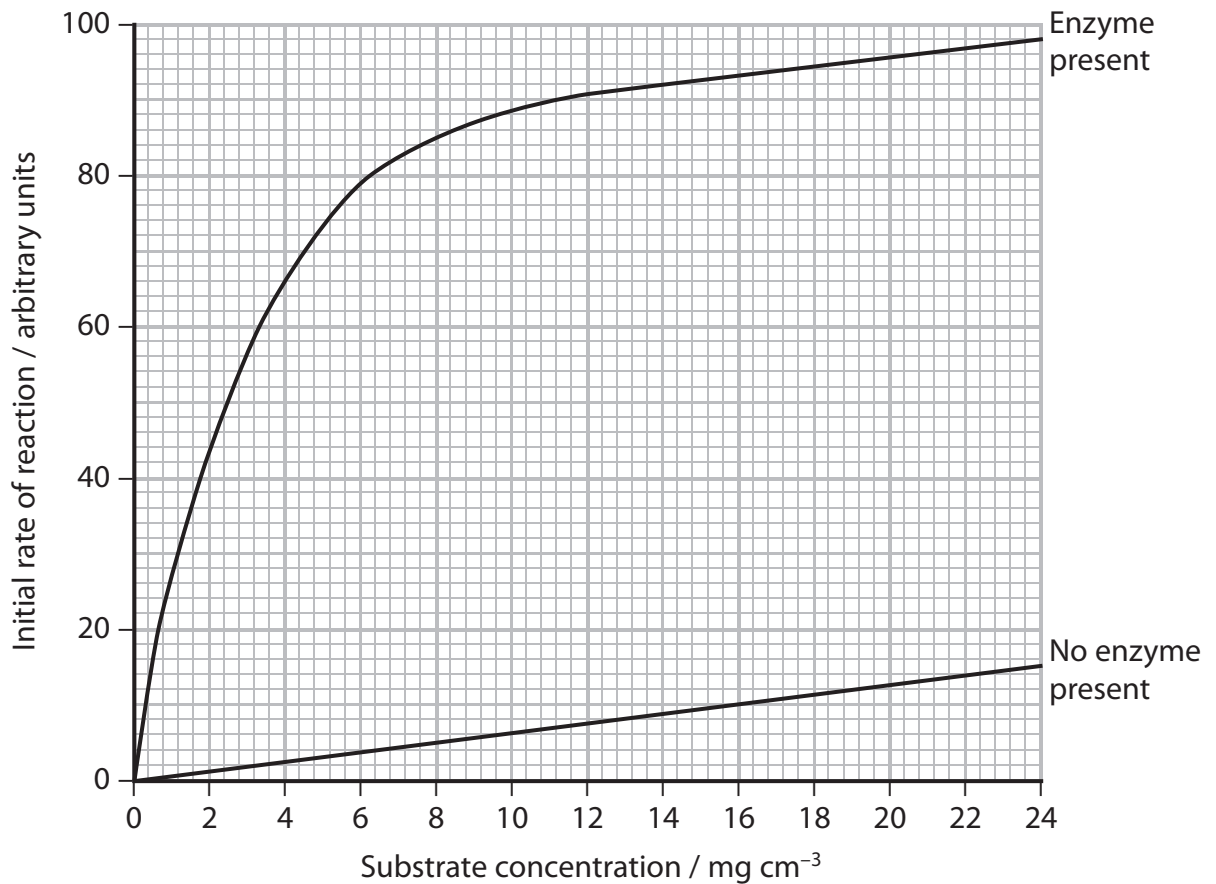


1 Enzymes are biological catalysts. They are involved in many chemical reactions in the body, including the digestion of lipids.

(a) The graph below shows the effect of an enzyme on the initial rate of reaction at different concentrations of the substrate.



Describe the effects that the enzyme had on this reaction.

(2)

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(b) Lipases are enzymes that are involved in the breakdown of lipids, such as triglycerides.

(i) Name the bond broken by lipases.

(1)

(ii) Name **two** products formed from the breakdown of triglycerides by lipases.

(2)

1

2

(iii) Suggest what effect the breakdown of triglycerides could have on the pH of a reaction mixture.

(1)

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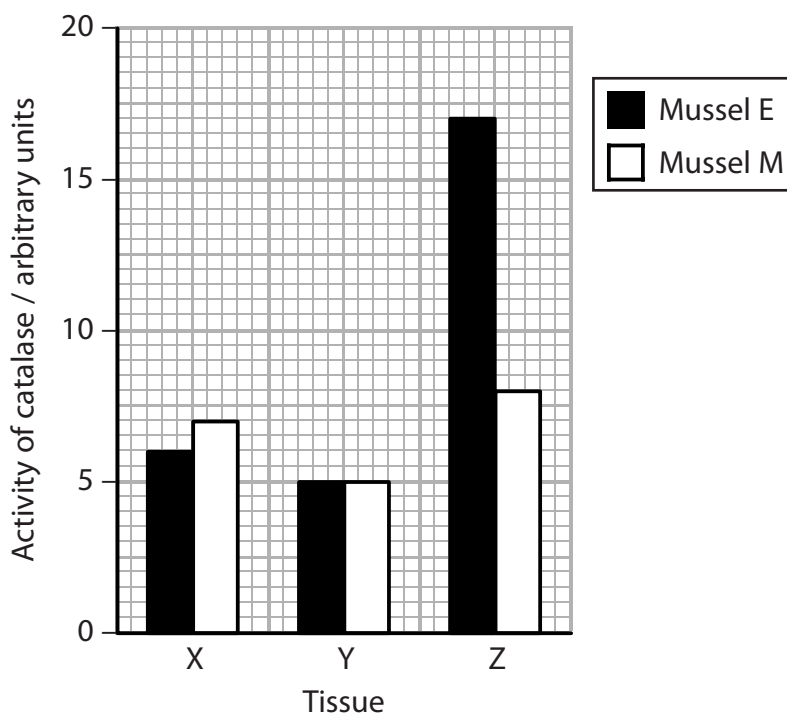
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2 Catalase is an enzyme present in many tissues of most living organisms. Its role is to break hydrogen peroxide down into oxygen and water. Hydrogen peroxide is produced by cells and is very harmful if it is not broken down.

(a) A study compared the activity of catalase in the tissues of freshwater mussels. Mussels from two different rivers: mussel E from the river Eo and mussel M from the river Masma were studied.

The catalase activity was measured in three tissues, X, Y and Z, taken from each type of mussel.

The graph below shows the results of this study.



(i) Use the information in the graph to state the conclusions that can be made about the activity of catalase in the tissues of mussel E.

(3)

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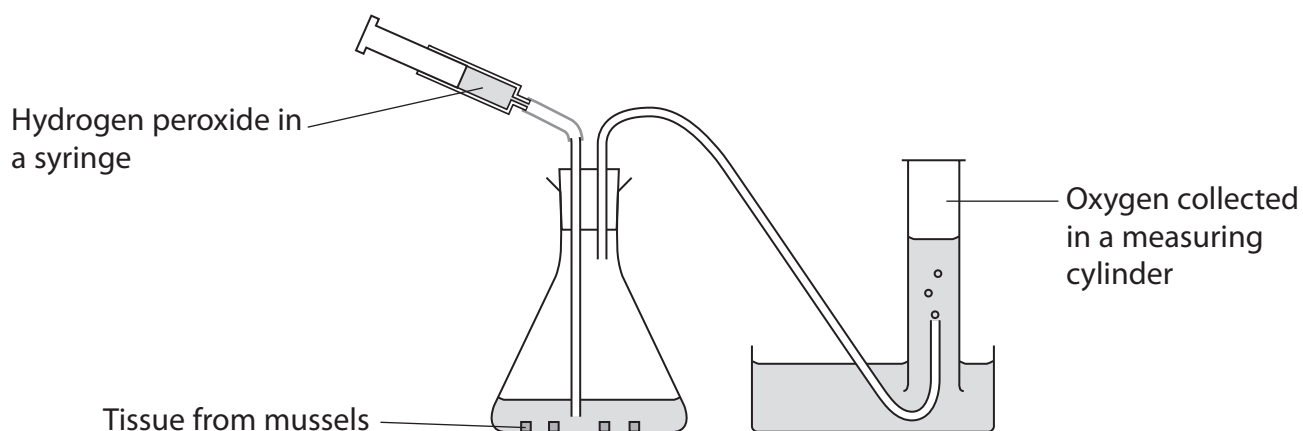
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(ii) Using the information in the graph, compare the activity of catalase in mussel E and mussel M.

(2)

(b) Catalase activity in tissue from mussels can be studied using the apparatus shown below.

Tissue from mussels is placed in the flask and hydrogen peroxide is added using the syringe. The oxygen produced from the breakdown of hydrogen peroxide is collected in the measuring cylinder.



Describe how this apparatus could be used to compare the catalase activity in two different types of mussel.

(4)

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(Total for Question 2 = 9 marks)

3 Enzymes are biological catalysts that change the activation energy of chemical reactions.

(a) Explain the meaning of the terms **biological catalyst** and **activation energy**.

(4)

Biological catalyst

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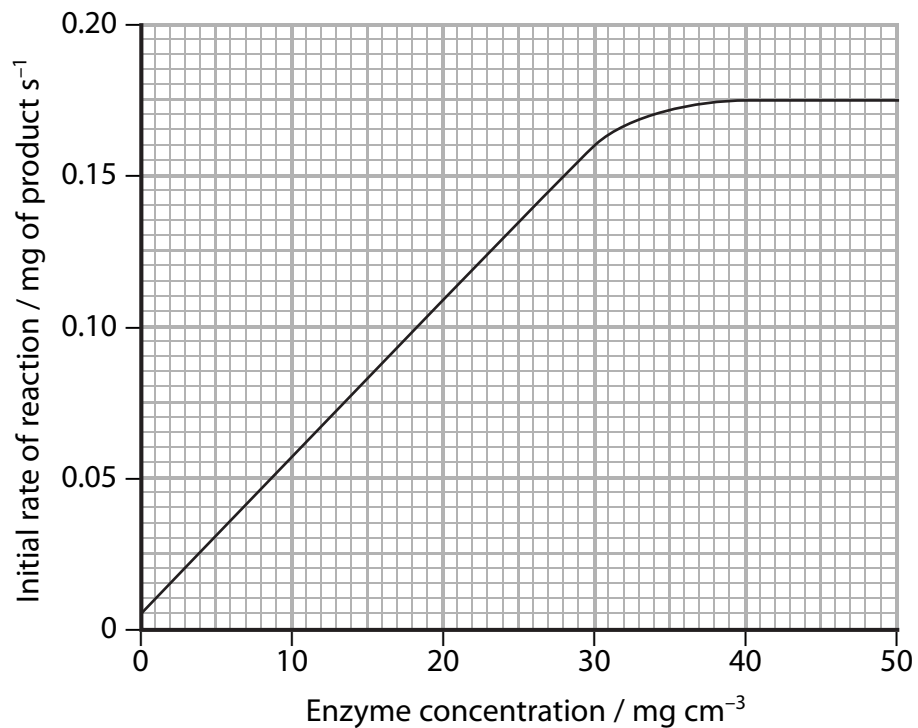
Activation energy

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(b) The graph below shows the results of an investigation into the effect of enzyme concentration on the initial rate of this reaction.



Explain why it is necessary to measure the **initial rate** of reaction when investigating the effect of enzyme concentration on the rate of reaction.

(2)

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(c) In this investigation, the substrate concentration was a factor that was kept constant.
Suggest **two** other factors that should be kept constant. For each factor, state how it can be kept constant.

(4)

Factor 1

How the factor can be kept constant

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Factor 2

How the factor can be kept constant

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(Total for Question 3 = 10 marks)

- 4 The photograph below shows packaging pellets made from thermoplastic starch, which is produced from corn starch. These pellets can be produced from a sustainable resource.



Magnification $\times 0.5$

- (a) (i) Explain what is meant by the term **sustainable**.

(2)

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- (ii) Other packaging pellets contain polystyrene made from crude oil.

Explain why packaging pellets made from thermoplastic starch are sustainable but polystyrene pellets are not sustainable.

(2)

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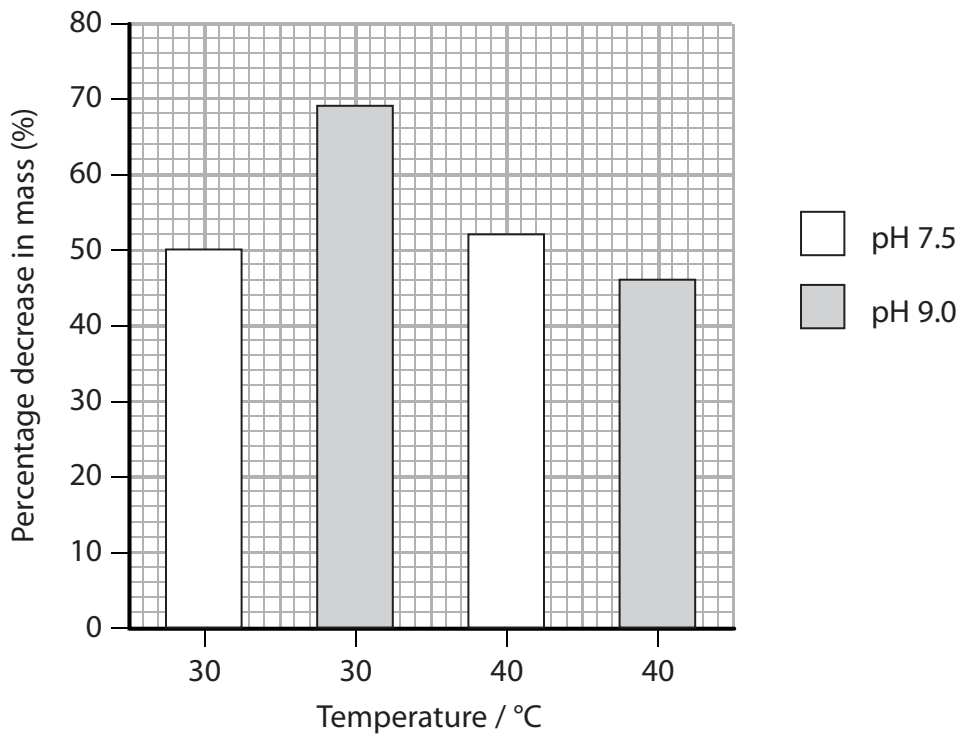
(b) Scientists investigated various factors that affect the breakdown of a starch-based plastic. They tested plastic sheets made from a starch-based plastic.

Pieces of the plastic sheet were placed in beakers containing a solution of an enzyme that breaks down starch.

In one beaker, the enzyme solution had a pH of 7.5 and in the other it had a pH of 9.0. These beakers were then incubated at 30 °C for 10 days. The percentage decrease in mass of the plastic sheet was recorded.

The investigation was then repeated at 40 °C.

The results are shown in the graph below.



(i) Using information from the graph, suggest which conditions were best for the breakdown of the plastic.

(1)

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(ii) Using information from the graph, describe the effect of temperature on the breakdown of the plastic.

(3)

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(iii) Suggest **two** factors that would have been kept constant to make this a valid investigation.

(2)

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(iv) Suggest why it would not be valid to use these data to predict what would happen at a temperature of 30°C and a pH of 11.0.

(1)

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(Total for Question 4 = 11 marks)

5 The pigment melanin affects fur colour in mammals, such as rabbits.

As a result of polygenic inheritance, some breeds of rabbit may have fur that ranges in colour from light brown to black.

(a) Explain what is meant by the term **polygenic inheritance**.

(2)

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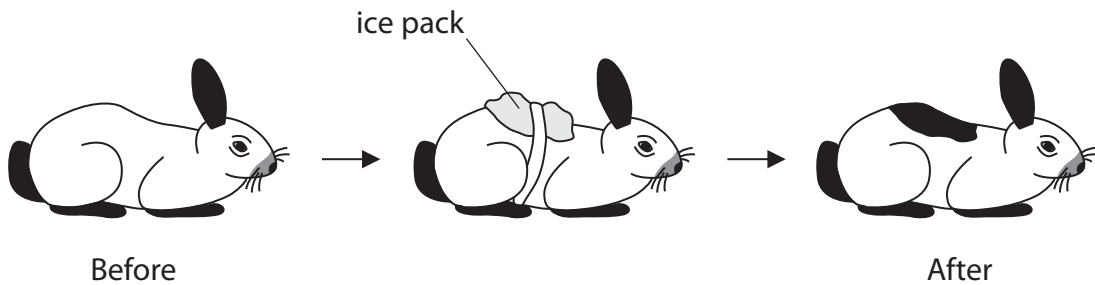
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(b) Himalayan rabbits are white with black fur on their ears, tails and feet.

An experiment was carried out to investigate the effect of temperature on the fur colour in Himalayan rabbits. An area of fur was shaved from the back of a rabbit and an ice pack taped to the area until the fur grew back.

The fur that grew back was black.



(i) Suggest a control for this experiment.

(1)

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