5. Enzymes

5.1 Enzymes

Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 Which type of biological molecule are enzymes made of?

A carbohydrate

B fat

C oil

D protein

2 The diagrams show molecules involved in the action of a digestive enzyme.

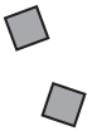
What is the substrate?

A

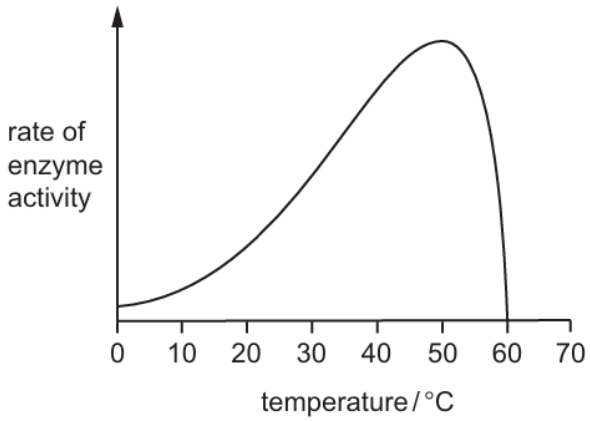
B

C

D



3 The graph shows how the activity of an enzyme varies with temperature.



What is the optimum temperature for this enzyme, and at which temperature is the enzyme completely denatured?

	temperature / °C	
	optimum	completely denatured
A	30	0
B	30	60
C	50	0
D	50	60

4 Which statements about enzymes are correct?

1 Enzymes are biological catalysts.

2 Enzymes are carbohydrates.

3 Enzymes have an active site.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

5 What is a correct statement about enzymes?

A The pH has no effect on the rate of reaction.

B They are denatured at low temperatures.

C They are made of carbohydrates which have specific shapes.

D They speed up chemical reactions.

6 Which statement about enzyme action is correct?

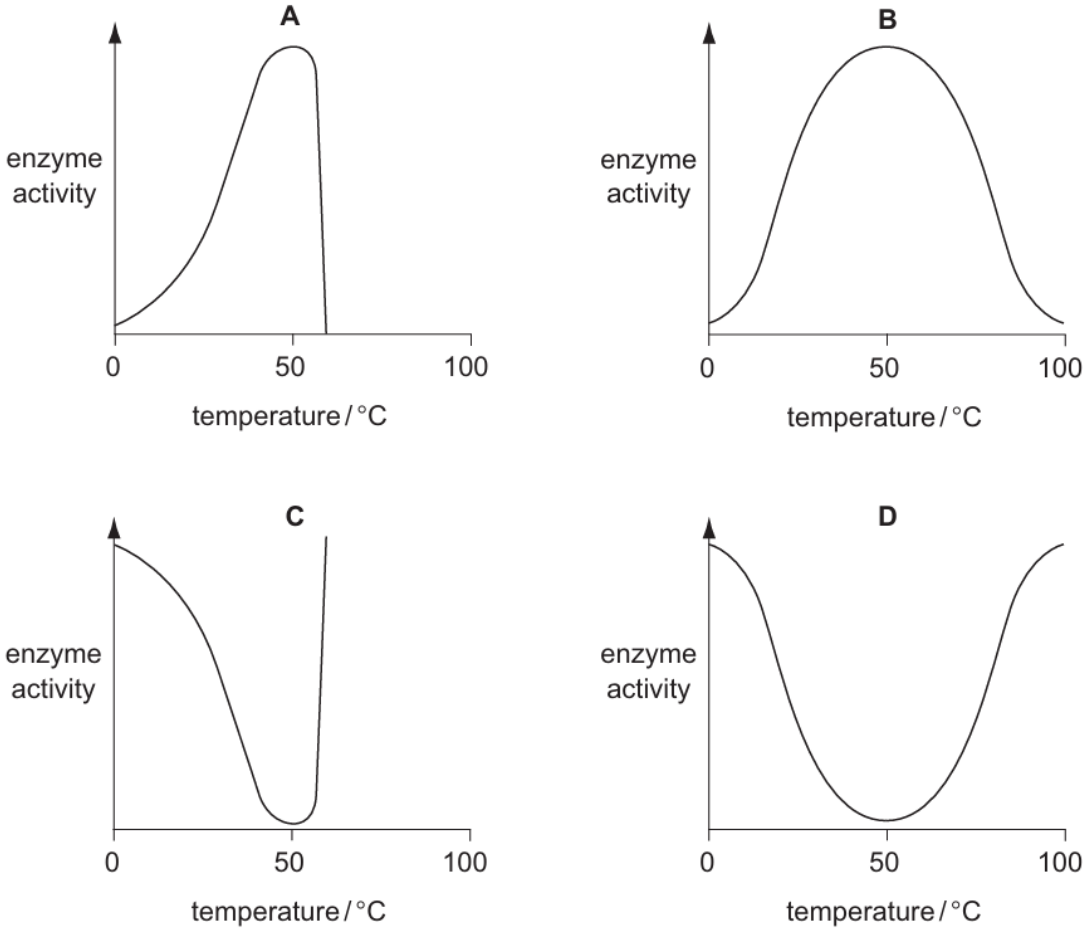
A The shape of the enzyme's active site is complementary to all proteins.

B The shape of the enzyme's active site is complementary to the substrate.

C The shape of the substrate's active site is complementary to the product.

D The shape of the substrate's active site is complementary to the enzyme.

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



8 Which of these statements about enzymes are correct?

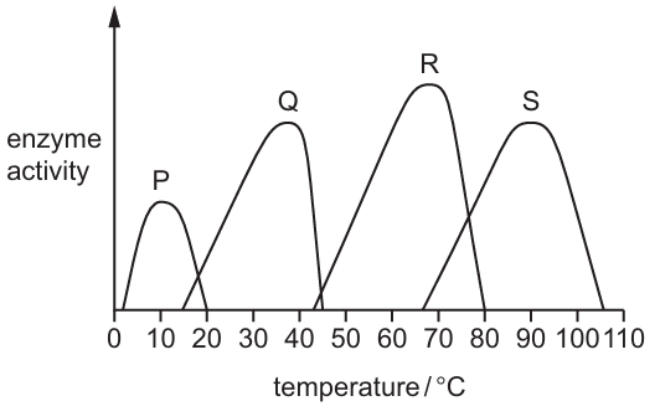
1 enzymes are proteins

2 enzymes are used up during chemical reactions

3 enzymes speed up metabolic reactions

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

9 The graph shows the effect of temperature on the activity of four different enzymes.



Which conclusion about the data in the graph is correct?

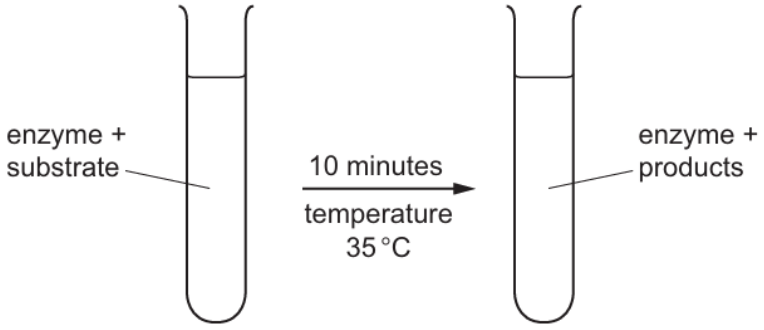
A Enzyme P and enzyme Q are both active at 25 °C.

B Enzyme R and enzyme S are both active at 75 °C.

C Enzyme P has an optimum temperature of 0 °C.

D Enzyme S has an optimum temperature above 100 °C.

10 The diagram shows a test-tube at the start and at the end of an enzyme experiment.



At the end of the experiment, the mixture in the test-tube contains glycerol.

Which row correctly identifies the enzyme and the substrate it acts on?

	enzyme	substrate it acts on
A	amylase	fat
B	amylase	glucose
C	lipase	fat
D	lipase	glucose

11 Which changes could cause an enzyme to denature?

1 change in pH

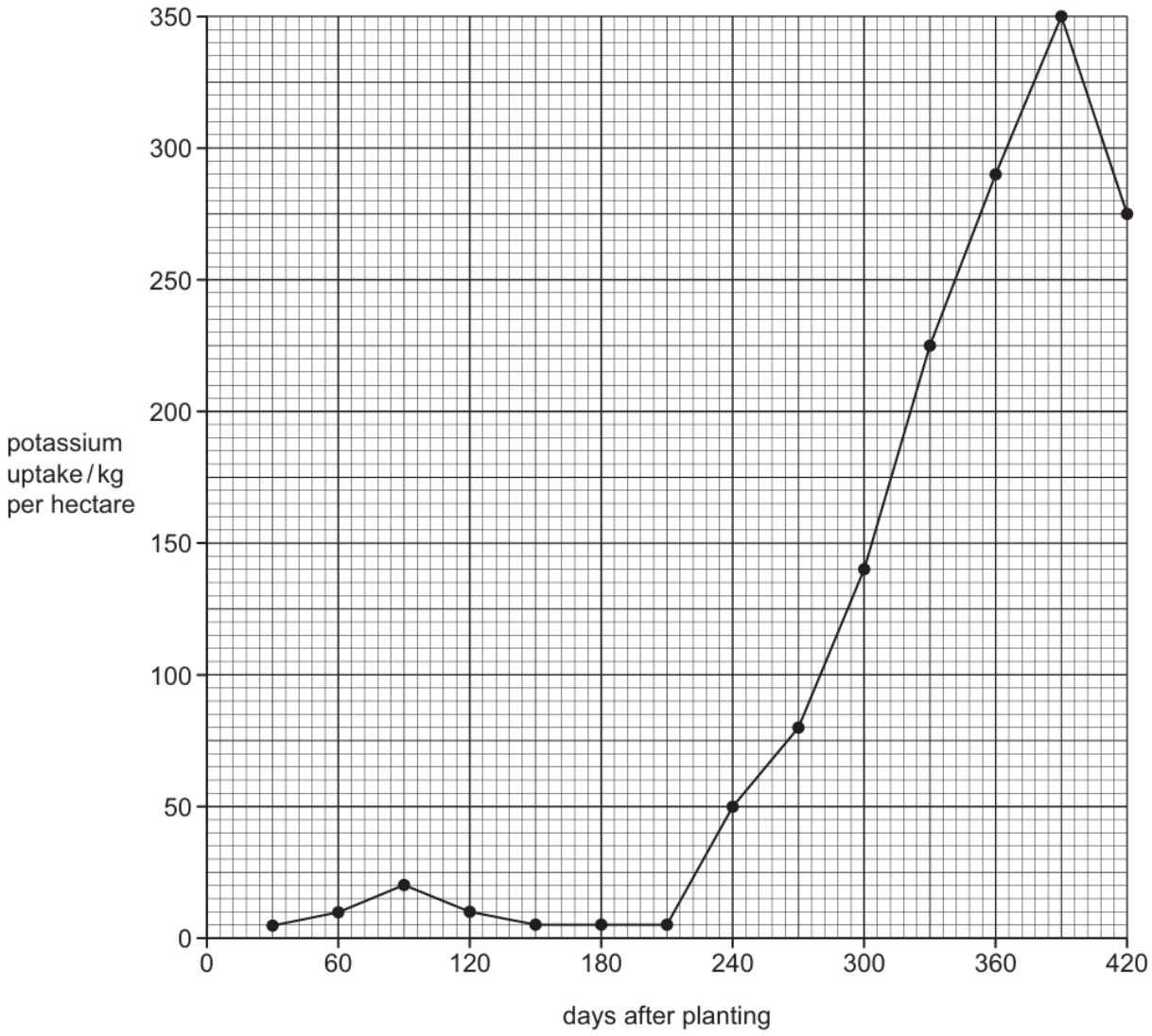
2 change in temperature

3 change in substrate concentration

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

12 Scientists studied the uptake of potassium ions from chemical fertilisers by wheat plants.

The results are shown.



What is the difference in the uptake of potassium ions at 360 days after planting compared to 30 days after planting?

A 295 kg per hectare

B 290 kg per hectare

C 285 kg per hectare

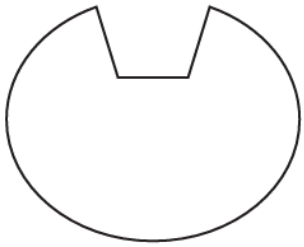
D 280 kg per hectare

13 What is true of **all** enzymes?

	they are sugars	they are most effective at pH 7
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

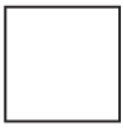
key
✓ = yes
✗ = no

14 What is the substrate for enzyme X?



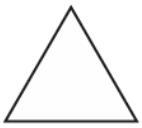
enzyme X

A



B

C



D

15 Which processes depend on the action of enzymes?

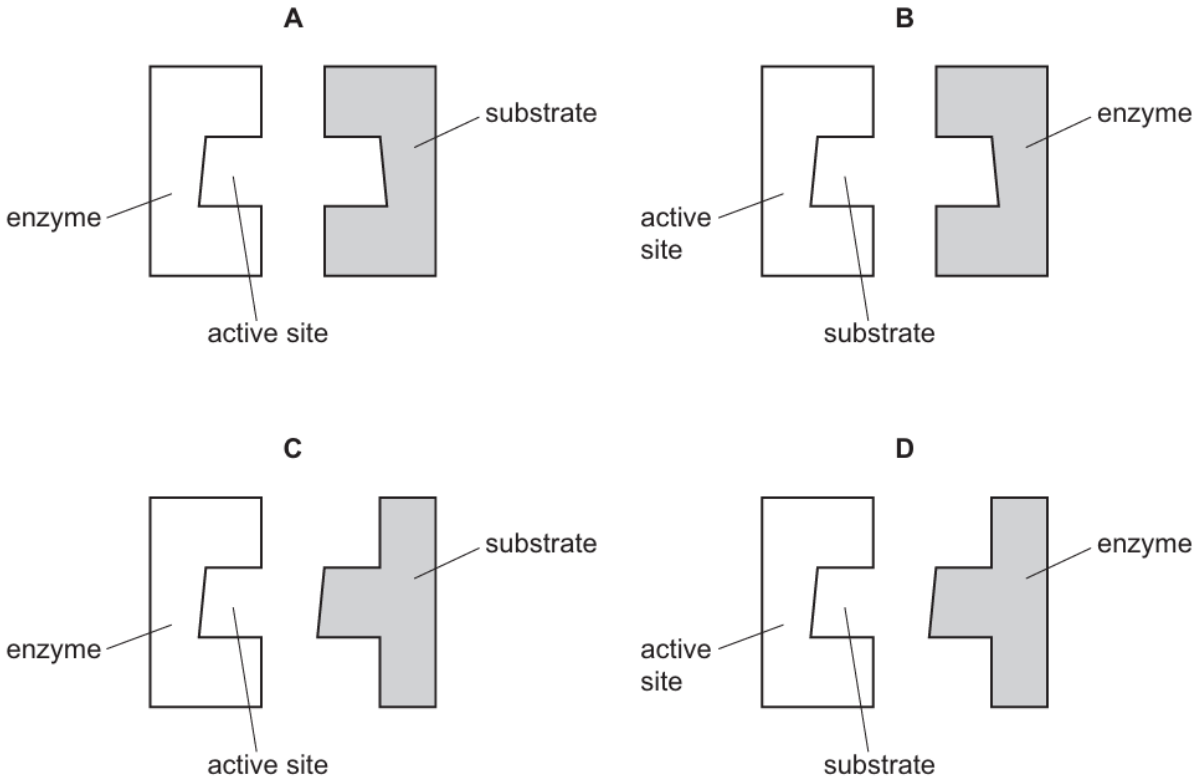
1 digestion

2 osmosis

3 respiration

A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

16 Which diagram of an enzyme, active site and substrate is correct?



17 Which description of an enzyme-catalysed reaction is correct?

A The substrate binds to an enzyme with the same shape and a product is formed.

B The product binds to an enzyme with the same shape and a substrate is formed.

C The product binds to an enzyme with a complementary shape and a substrate is formed.

D The substrate binds to an enzyme with a complementary shape and a product is formed.

18 Which statement about enzymes is correct?

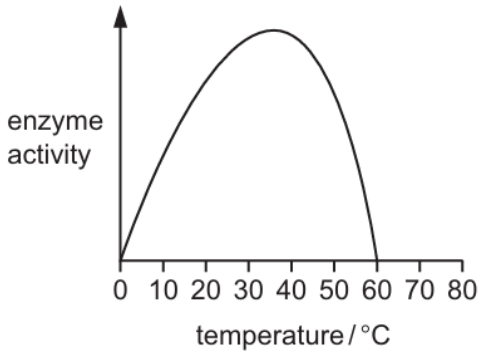
A They are made of carbohydrates.

B Their activity is unaffected by pH.

C They are used up during the reaction.

D They have a complementary shape to their substrate.

19 The graph shows the effect of temperature on the activity of an enzyme.



At which temperature is the enzyme most active?

A 15 °C **B** 25 °C **C** 35 °C **D** 60 °C

20 Some terms used to describe enzyme-controlled reactions are listed.

1 catalyst

2 product

3 protein

4 substrate

Which terms describe an enzyme?

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

21 Which type of molecule are enzymes made of?

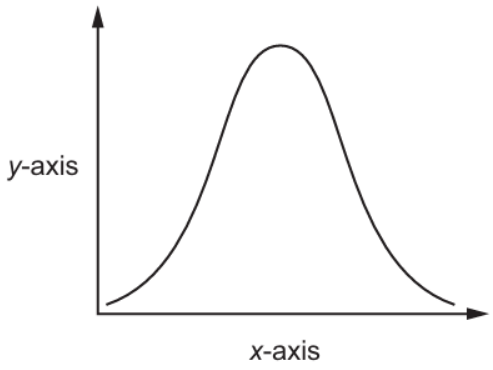
A carbohydrates

B fats

C proteins

D vitamins

22 An experiment was carried out to investigate the effect of pH on enzyme action. The graph shows the results.



What are the labels for the *x*-axis and the *y*-axis?

	x-axis	*y*-axis
A	pH	rate of reaction
B	pH	time
C	rate of reaction	pH
D	time	pH

23 Which statement describes a catalyst?

A a substance that decreases the rate of a chemical reaction and is not changed by the reaction

B a substance that decreases the rate of a chemical reaction and is changed by the reaction

C a substance that increases the rate of a chemical reaction and is changed by the reaction

D a substance that increases the rate of a chemical reaction and is not changed by the reaction

24 Starch is digested by amylase in the mouth, but it is not digested in the stomach.

What is the reason for this?

A All starch digestion is completed in the mouth.

B The pH in the stomach is not suitable for the amylase to work.

C The starch does not stay in the stomach long enough to be digested.

D The temperature in the stomach is not suitable for the amylase to work.

25 Which statement about an enzyme-controlled reaction is correct?

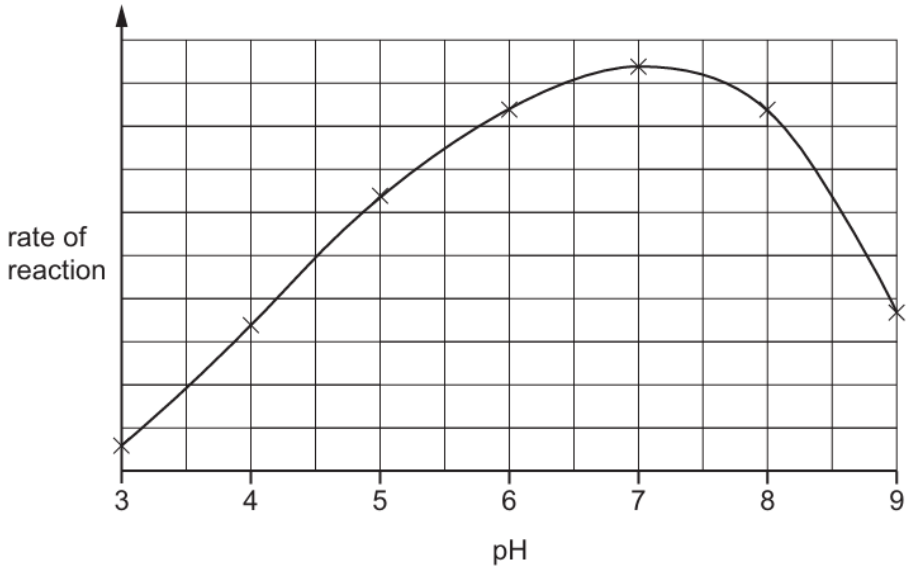
A During the reaction, the substrate changes into products.

B The enzyme is gradually used up during the reaction.

C The enzyme is slowly broken down during the reaction.

D The higher the temperature, the slower the reaction.

26 The graph shows the effect of pH on the rate of reaction of an enzyme.



What does the graph show?

A The enzyme is destroyed at pH 9.

B The enzyme works best at pH 6.

C The rate of reaction halves as the pH changes from pH 5 to pH 7.

D The rate of reaction is the same at pH 5 and pH 8.5.

27 What kind of molecule is an enzyme?

A fat

B glucose

C protein

D starch

28 What is the definition of an enzyme?

A a carbohydrate that acts as a catalyst

B a DNA molecule that acts as a catalyst

C a fat that acts as a catalyst

D a protein that acts as a catalyst

29 The activity of amylase is measured in four parts of the alimentary canal.

Which two parts have the most amylase activity?

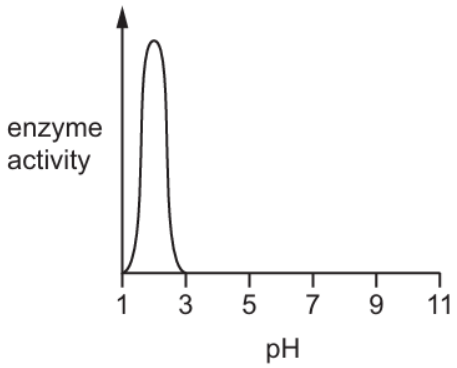
A colon and duodenum

B colon and stomach

C mouth and duodenum

D stomach and mouth

30 The graph shows the effect of pH on the activity of an enzyme.



In which part of the alimentary canal would this enzyme be **most** active?

A large intestine

B mouth

C small intestine

D stomach

31 What is the correct definition of the term *enzyme*?

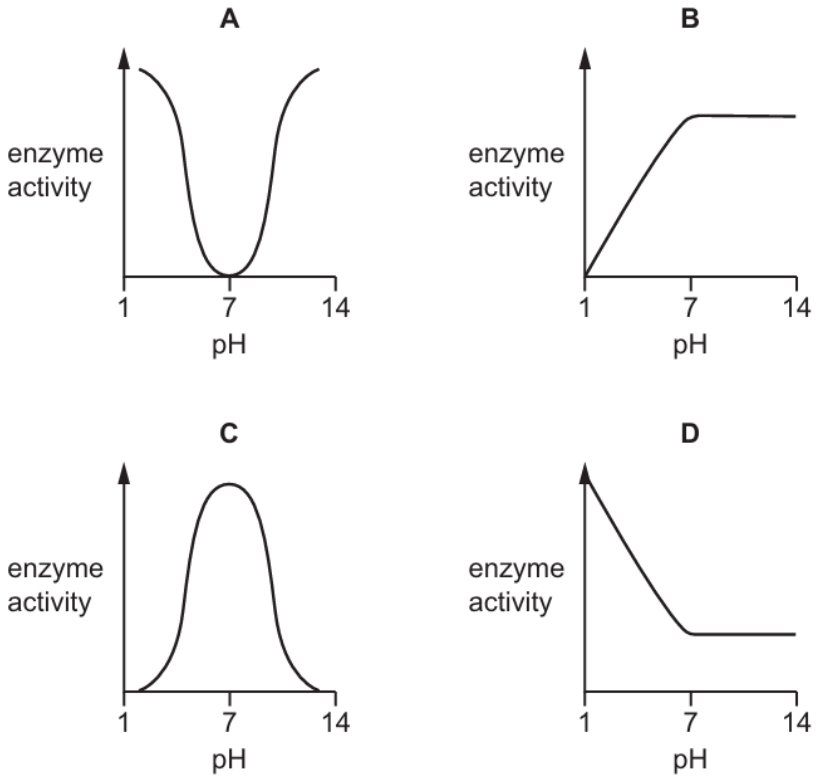
A carbohydrates that act as biological catalysts

B carbohydrates that act as substrates

C proteins that act as biological catalysts

D proteins that act as substrates

32 Which graph shows the effect of pH on enzyme activity?



33 The following statements are about enzymes.

1 enzymes are catalysts

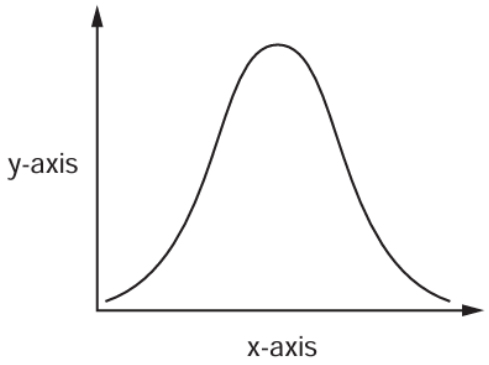
2 enzyme are proteins

3 enzymes are used up during chemical reactions

Which statements are correct?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

34 An experiment was carried out to investigate the effect of pH on enzyme action. The graph shows the results.



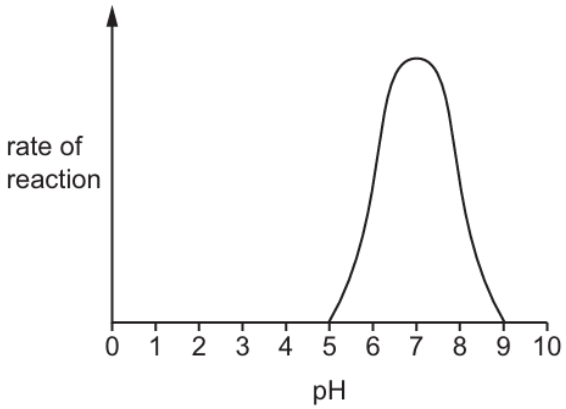
What are the labels for the x-axis and the y-axis?

	x-axis	y-axis
A	pH	rate of reaction
B	pH	time
C	rate of reaction	pH
D	time	pH

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

35 The graph shows the effect of pH on the rate of an enzyme-catalysed reaction.



What explains the effect of pH on the reaction rate? **(extended only)**

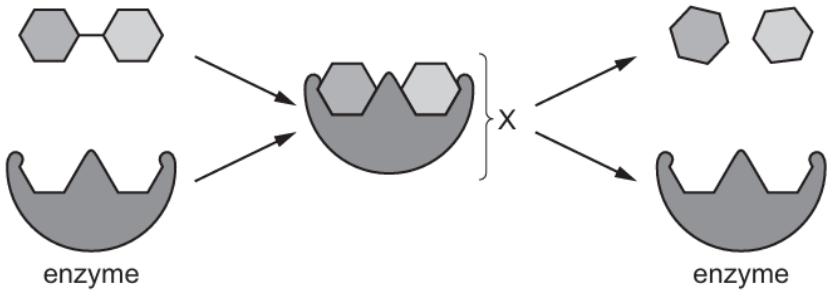
A As the pH increases from 5 to 7, the kinetic energy increases.

B As the pH increases from 7 to 9, the frequency of enzyme and substrate collisions increases.

C The shape of the enzyme's active site changes as the pH increases from 7 to 9.

D The substrate denatures at pH 7.

36 The diagram shows the steps in an enzyme-controlled reaction.



What describes the part labelled X? **(extended only)**

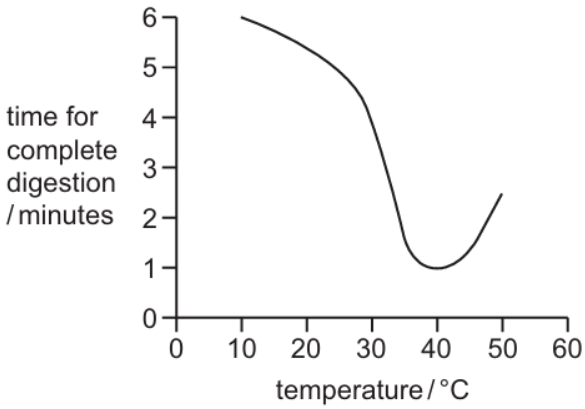
A active site

B enzyme–substrate complex

C product

D substrate

37 The graph shows the effect of temperature on the time taken for the complete digestion of starch.

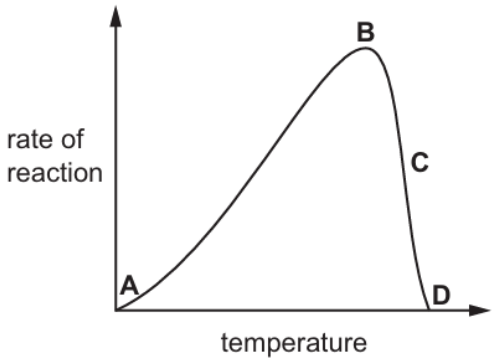


At which temperature is the rate of digestion of starch the greatest?

A 10 °C **B** 30 °C **C** 40 °C **D** 50 °C

38 The graph shows how temperature affects an enzyme-controlled reaction.

Where on the graph do the enzyme and substrate molecules have the most kinetic energy? **(extended only)**



39 Which statement is correct? **(extended only)**

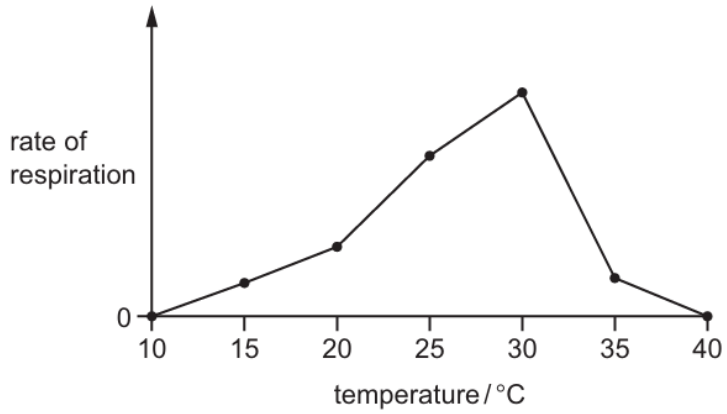
A The active site of an enzyme has the same shape as the substrate.

B The active site is not affected by changes in temperature.

C The shape of the active site of an enzyme is complementary to its substrate.

D The substrate and product combine at the active site.

40 The graph shows the results of an experiment to investigate the rate of respiration in an organism in different environmental temperatures.



What explains the increase in the rate of respiration between 10 °C and 30 °C? **(extended only)**

A The enzymes are denaturing.

B There are more frequent effective collisions between enzyme and substrate molecules.

C There are fewer enzyme-substrate complexes formed.

D There is less kinetic energy.

41 What is true of **all** enzymes?

	they are sugars	they are most effective at pH 7
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key
✓ = yes
✗ = no

42 Which statement about human enzymes is correct when they are at temperatures above 80 °C?

A The enzyme molecules are denatured. **(extended only)**

B The shape of the active site is stable.

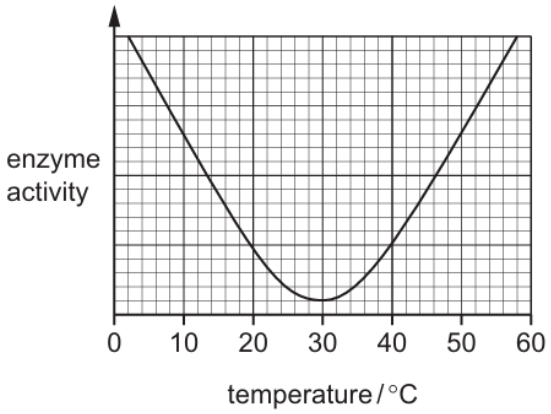
C More enzyme-substrate complexes form.

D More product is formed by the enzyme.

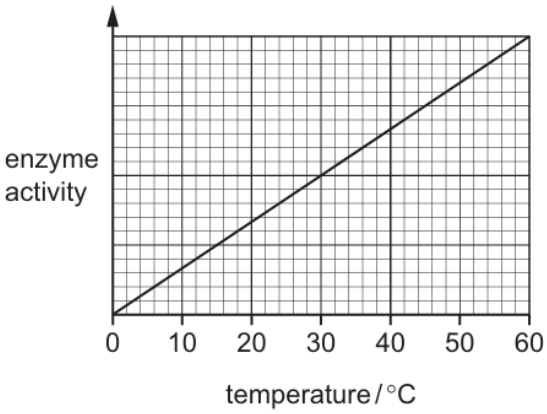
43 The graphs show the effect of temperature on enzyme activity. This enzyme has an optimum temperature of 30 °C.

Which graph shows the effect of temperature on the activity of this enzyme?

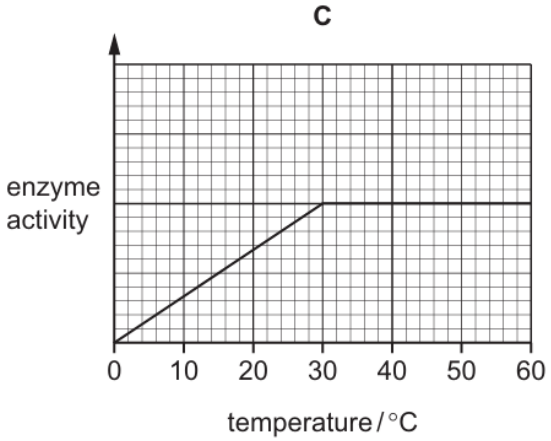
A



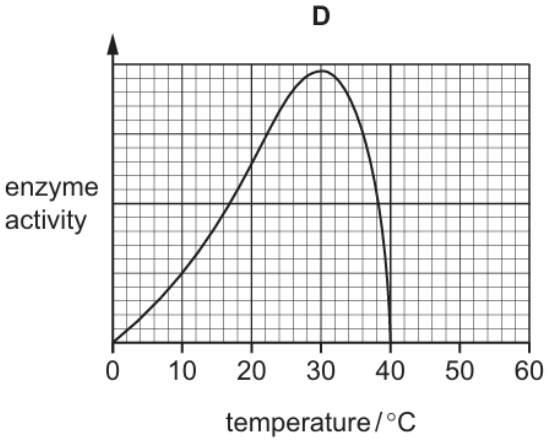
B



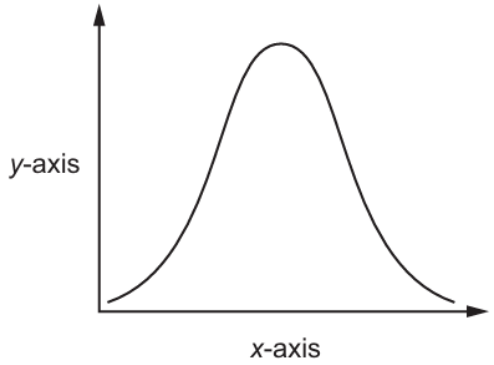
C



D



44 An experiment was carried out to investigate the effect of pH on enzyme action. The graph shows the results.

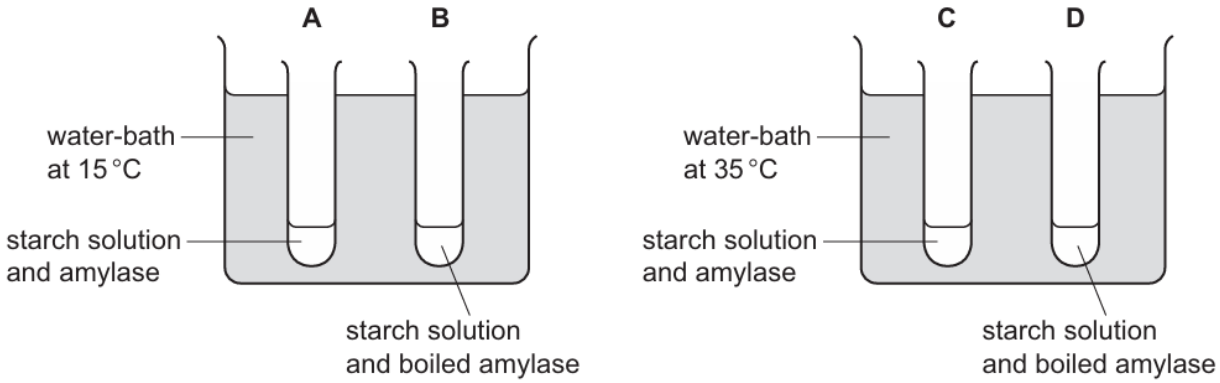


What are the labels for the *x*-axis and the *y*-axis?

	x-axis	*y*-axis
A	pH	rate of reaction
B	pH	time
C	rate of reaction	pH
D	time	pH

45 Four test-tubes were set up as shown in the diagram.

In which test-tube is the starch digested most quickly?



46 Starch is digested by amylase in the mouth, but it is not digested in the stomach.

What is the reason for this?

A All starch digestion is completed in the mouth.

B The pH in the stomach is not suitable for the amylase to work.

C The starch does not stay in the stomach long enough to be digested.

D The temperature in the stomach is not suitable for the amylase to work.

47 Which statement about an enzyme-controlled reaction is correct?

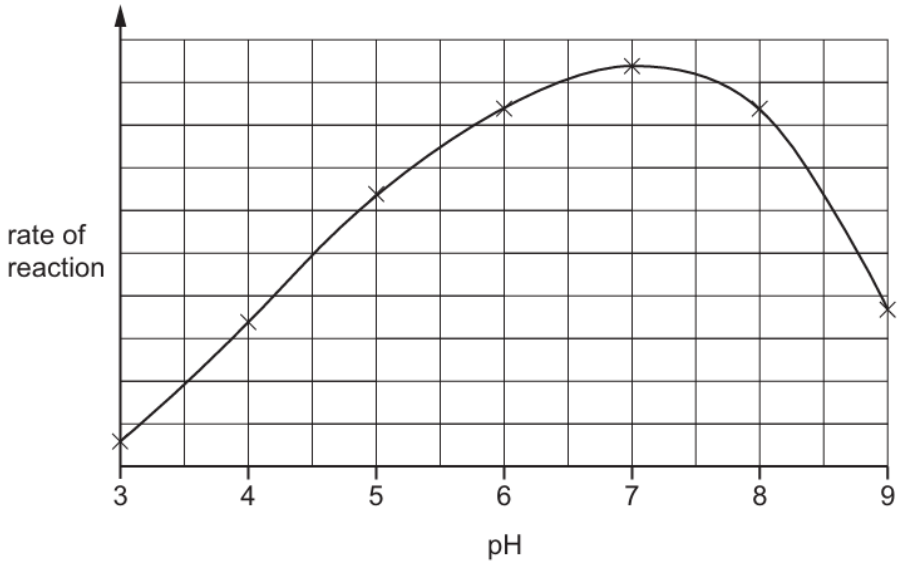
A During the reaction, the substrate changes into products.

B The enzyme is gradually used up during the reaction.

C The enzyme is slowly broken down during the reaction.

D The higher the temperature, the slower the reaction.

48 The graph shows the effect of pH on the rate of reaction of an enzyme.



What does the graph show?

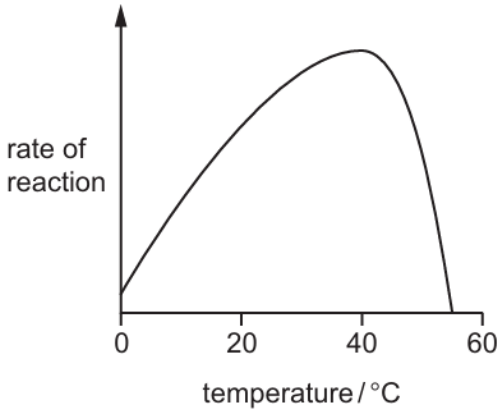
A The enzyme is destroyed at pH 9.

B The enzyme works best at pH 6.

C The rate of reaction halves as the pH changes from pH 5 to pH 7.

D The rate of reaction is the same at pH 5 and pH 8.5.

49 The graph shows how enzyme activity is affected by temperature.



How can the change in activity between 40 °C and 55 °C be explained? **(extended only)**

A Heat has killed the enzyme.

B The enzyme has been used up.

C The reactants are moving faster.

D The substrate is less likely to fit into the active site.

50 What is the definition of an enzyme?

A a carbohydrate that acts as a catalyst

B a DNA molecule that acts as a catalyst

C a fat that acts as a catalyst

D a protein that acts as a catalyst

51 Biological washing powder can be used to remove stains on clothing.

Which enzymes will remove stains caused by starch, fat and protein?

	amylase	lipase	trypsin
A	✓	✗	✗
B	✓	✓	✓
C	✗	✗	✓
D	✗	✓	✓

key

✓ = removes stain

✗ = does not remove stain

52 Enzymes function best at their optimum temperature.

Which statement describes the effect on an enzyme of increasing the temperature to the enzyme's optimum temperature? **(extended only)**

A There are more frequent successful collisions.

B The kinetic energy of the enzymes decreases.

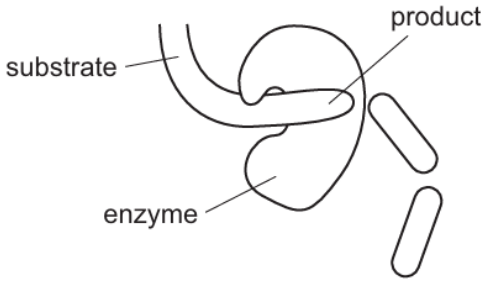
C The enzymes begin to lose their complementary shape.

D The rate at which enzyme-substrate complexes form is reduced.

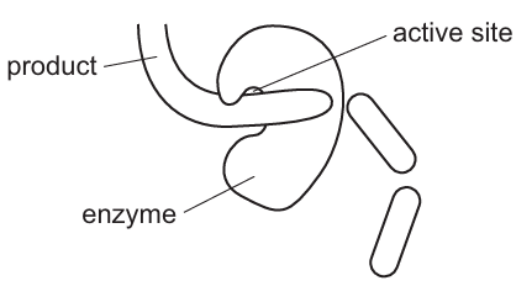
53 The diagrams show a protease enzyme catalysing the breaking of part of a protein molecule into smaller pieces.

Which diagram has three correct labels? **(extended only)**

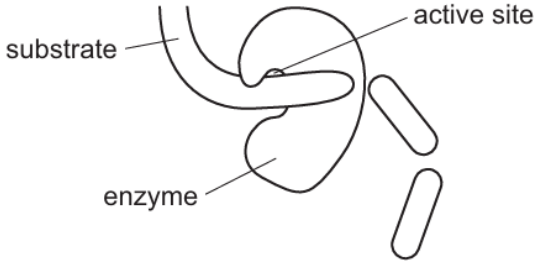
A



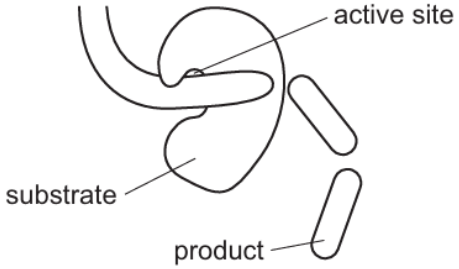
B



C



D



54 What is the correct definition of the term *enzyme*?

A carbohydrates that act as biological catalysts

B carbohydrates that act as substrates

C proteins that act as biological catalysts

D proteins that act as substrates