OXFORD AQA
INTERNATIONAL QUALIFICATIONS

Please write clearly in block capitals.

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I declare this is my own work.

INTERNATIONAL AS
BIOLOGY (9610)

Unit 1 The Diversity of Living Organisms

Monday 13 May 2024 07:00 GMT Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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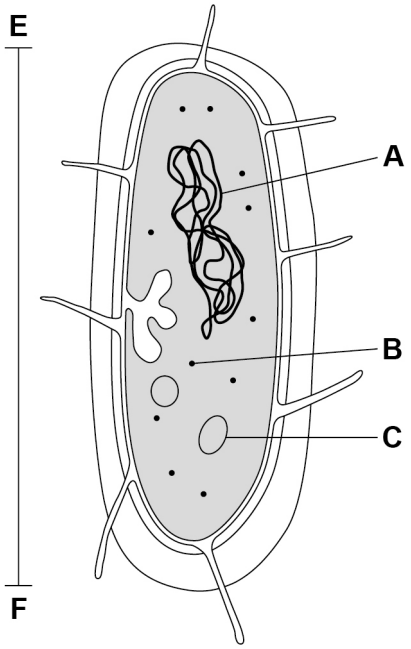
Answer **all** questions in the spaces provided.

0 1 **Figure 1** shows the structure of a prokaryotic cell.

Figure 1



Magnification × 75 000

0 1 . 1 Name the structures labelled **A**, **B** and **C**.

[3 marks]

A _____

B _____

C _____

0 1 . 2 Calculate the actual length of the cell between **E** and **F**.

Give your answer in μm to 2 significant figures.

[2 marks]

_____ μm

Do not write outside the box

0 1 . 3 The antibiotic penicillin causes some prokaryotic cells to die. Penicillin prevents cell wall formation when the cell divides.

Explain why the lack of a cell wall causes cell death.

[3 marks]

0 1 . 4 Why does penicillin **not** cause the death of human cells?

[1 mark]

Question 1 continues on the next page

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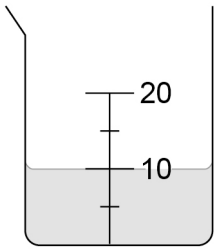
Scientists can culture prokaryotic cells in a Petri dish containing nutrient agar.

A scientist uses a beaker to put 10 cm^3 of nutrient agar into a Petri dish.

Figure 2 shows the beaker containing nutrient agar.

Figure 2



0 1 . 5 Suggest how the scientist can make the measurement of the volume of nutrient agar more accurate.

[1 mark]

0 1 . 6 The scientist then:

- spreads prokaryotic cells evenly over the surface of the nutrient agar in the Petri dish
- adds two antibiotic discs to the surface of the nutrient agar
- incubates the Petri dish at 37 °C for 48 hours to allow the prokaryotic cells to grow.

Explain why the scientist incubates the Petri dish at 37 °C.

[2 marks]

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Question 1 continues on the next page

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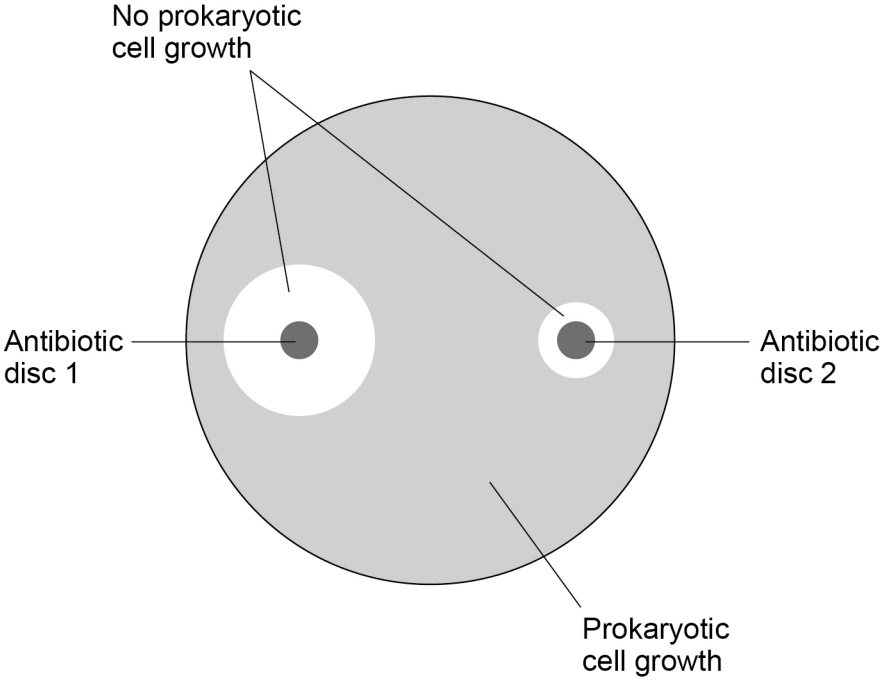
After 48 hours the scientist looks at the Petri dish.

Figure 3 shows the areas where the prokaryotic cells cannot grow on the nutrient agar.

Figure 3



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0 1 . 7 A student looks at the scientist's results and concludes:

> '**Antibiotic 1** is twice as effective as **Antibiotic 2** at preventing the growth of these prokaryotic cells.'

Evaluate the student's conclusion about the effectiveness of the antibiotics.

Include a calculation in your answer.

The area of a circle = πr^2

π = 3.14

[3 marks]

15

Turn over for the next question

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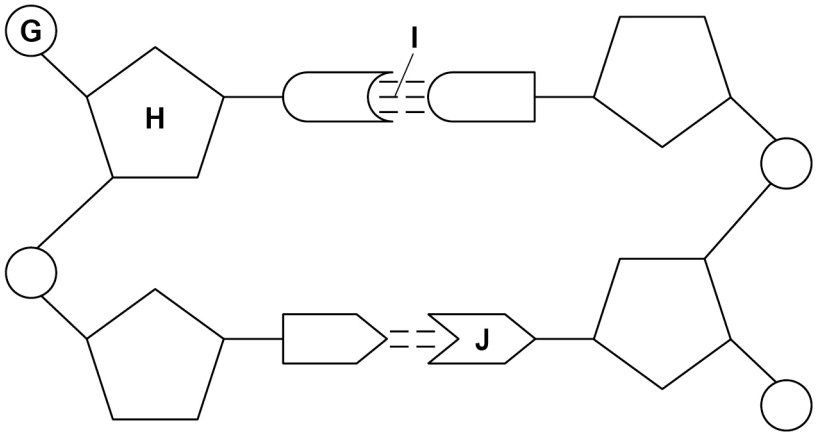
0 2 **Figure 4** shows part of a DNA molecule.

Figure 4



0 2 . 1 Name the structures **G**, **H**, **I** and **J**.

[4 marks]

G _____

H _____

I _____

J _____

0 2 . 2 A section of DNA contains 248 000 000 nucleotides.

Calculate how many nucleotides are in the template strand.

Give your answer in standard form.

[2 marks]

_____

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0 2 . 3 **Figure 5** shows part of an mRNA sequence.

Figure 5

DNA sequence	—	—	—	—	—	—	—	—	—
mRNA sequence	A	A	C	G	U	A	C	C	U
tRNA anti-codons	—	—	—	—	—	—	—	—	—

Complete **Figure 5** to show the DNA sequence and the corresponding tRNA anti-codons.

[2 marks]

0 2 . 4 State how mRNA initially transcribed from eukaryotic DNA differs from mRNA transcribed from prokaryotic DNA.

[1 mark]

_____

_____

_____

0 2 . 5 The code in mRNA is translated by a ribosome into a polypeptide.

Name a biochemical reagent that can be used to test for polypeptides and give the colour seen if polypeptides are present.

[2 marks]

Biochemical reagent _____

Colour seen _____

11

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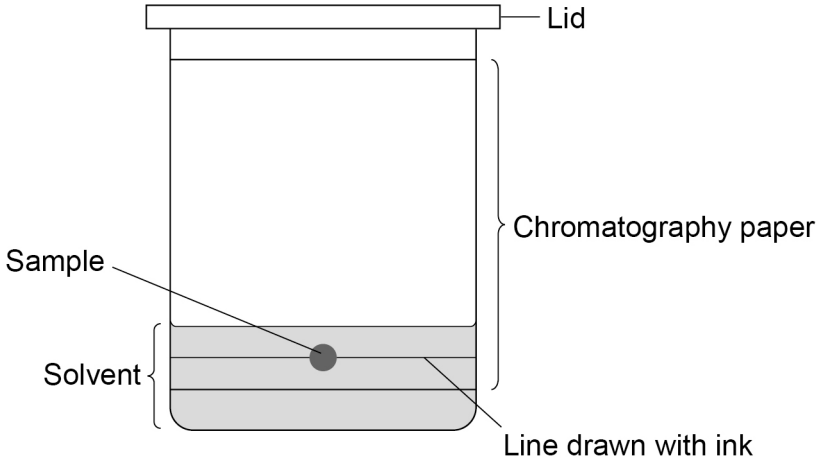
0 3 Students use chromatography to investigate the amino acid content of a sports drink.

The students set up the equipment as shown in **Figure 6**.

Figure 6



0 3 . 1 Identify **two** errors in how the students set up the equipment **and** state how the errors can be corrected.

[4 marks]

Error 1 _____

_____

_____

Correction 1 _____

_____

_____

Error 2 _____

_____

_____

Correction 2 _____

_____

_____

Question 3 continues on the next page

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The teacher repeats the investigation and carries out the chromatography correctly.

Figure 7 shows the results produced by the teacher and **Table 1** shows R_f values for some amino acids.

Figure 7

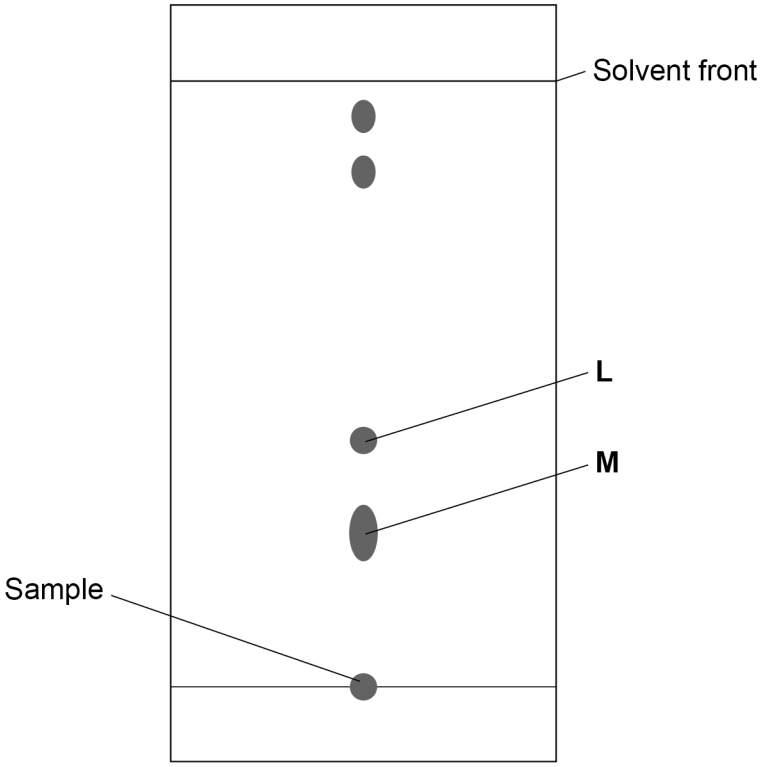

Table 1

Amino acid	R_f value
Alanine	0.38
Asparagine	0.50
Cysteine	0.40
Glycine	0.26
Leucine	0.73

0 3 . 2 Name the amino acid labelled **L**.

Give a reason for your answer.

[2 marks]

Name of amino acid labelled **L** _____

Reason _____

_____

_____

_____

Do not write outside the box

0 3 . 3 The teacher suggests that the spot labelled **M** is actually two different amino acids.

Give **two** methods the teacher could use to find out if **M** is two different amino acids.

[2 marks]

1 _____

_____

2 _____

_____

8

Turn over for the next question

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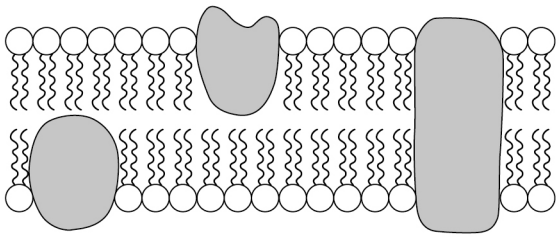
0 4 The cell surface membrane can be described by the fluid mosaic model.

Figure 8 shows the structure of a cell surface membrane.

Figure 8



0 4 . 1 Explain why the following terms are used to describe a membrane.

[2 marks]

Fluid _____

_____

Mosaic _____

_____

0 4 . 2 **Table 2** shows the functions of some molecules found in a cell surface membrane.

Complete **Table 2**.

[3 marks]

Table 2

Molecule	**Function**
	Allows the movement of non-polar molecules through the membrane.
Cholesterol	
	Can be a receptor or a channel.

Do not write outside the box

0 4 . 3 Membranes are also found inside cells.

State **two** functions of membranes **inside** cells.

[2 marks]

1 _____

_____

_____

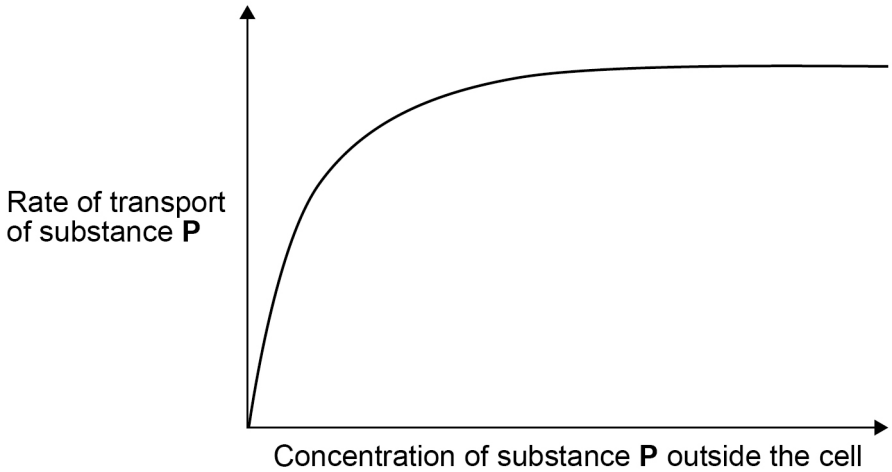
2 _____

_____

_____

Figure 9 shows the rate of transport of substance **P** into a cell at 25 °C

Figure 9



0 4 . 4 Give the method of transport shown in **Figure 9** for substance **P** and suggest why the graph levels off at high concentrations.

[2 marks]

Method of transport _____

Reason why the graph levels off _____

_____

_____

0 4 . 5 Sketch a line on **Figure 9** to show how decreasing the temperature to 15 °C would change the results.

[2 marks]

11

Turn over ►

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0 5 Read the following passage:

Blood vessels in the human circulatory system include arteries, arterioles, capillaries, venules and veins. Blood is transported in blood vessels to and from tissues, including the muscles involved in movement.

The human body contains approximately 5 dm^3 of blood. The blood can be moved around the body to where it is needed the most using a mechanism called the 'vascular shunt'. During exercise, the vascular shunt causes blood to be transported away from the digestive system and towards the working muscles.

The arterioles that supply the capillaries of the digestive system with blood can constrict (narrow) and the arterioles that supply the capillaries of the working muscles with blood can dilate (widen). Blood contains red blood cells that are flexible and have a mean diameter of 7 μm

Red blood cells contain haemoglobin, a protein that has a quaternary structure and contains haem groups. Haemoglobin associates with oxygen in the lungs where the partial pressure of oxygen is high, and dissociates from oxygen at the respiring tissues where the partial pressure of oxygen is lower. When associated with oxygen, haemoglobin is called oxyhaemoglobin.

Use the information from the passage and your own knowledge to answer the questions.

0 5 . 1 Explain the advantage of the vascular shunt to an athlete who is running a long distance (lines 4–8).

[2 marks]

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0 5 . 2 The lumen of a capillary has a radius of approximately 4 μm

Suggest an advantage of the lumen of a capillary being this size (lines 9–12).

[2 marks]

0 5 . 3 Explain how the haem groups in the haemoglobin molecule are involved in the transport of oxygen (lines 14–16).

[2 marks]

Question 5 continues on the next page

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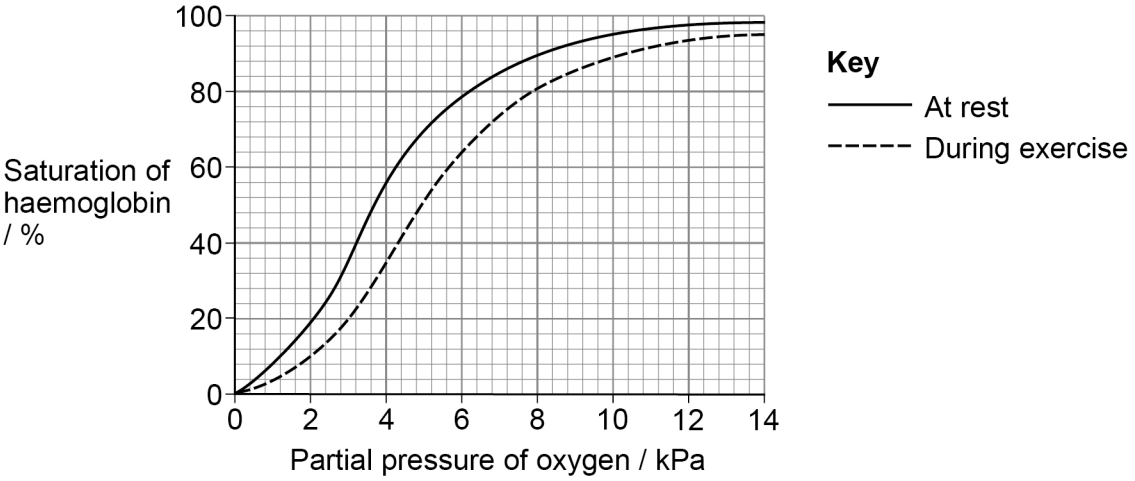
Figure 10 shows an oxygen dissociation curve. This represents the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen. During exercise the position of the dissociation curve shifts to the right.

Figure 10



0 5 . 4 The saturation of haemoglobin is directly affected by the partial pressure of oxygen inside the tissue.

Complete **Table 3** using data from **Figure 10**.

[2 marks]

Table 3

Tissue	Saturation of haemoglobin / %	Partial pressure of oxygen / kPa
At rest		4.0
During exercise	28	

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0 5 . 5 During exercise, the position of the oxygen dissociation curve is to the right of the oxygen dissociation curve at rest.

Use **Figure 10** to suggest the advantage of the position of the curve during exercise.

[2 marks]

_____

_____

_____

_____

_____

_____

10

Turn over for the next question

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0 6 Pike are predatory freshwater fish.

One species of pike is *Esox lucius*.

0 6 . 1 **Table 4** shows the classification of *Esox lucius*.

Table 4 is not complete.

Complete **Table 4**.

[2 marks]

Table 4

Group	**Name**
Domain	Eukaryota
Kingdom	
Phylum	Chordata
	Actinopterygii
	Esociformes
Family	Esocidae
Genus	
Species	*lucius*

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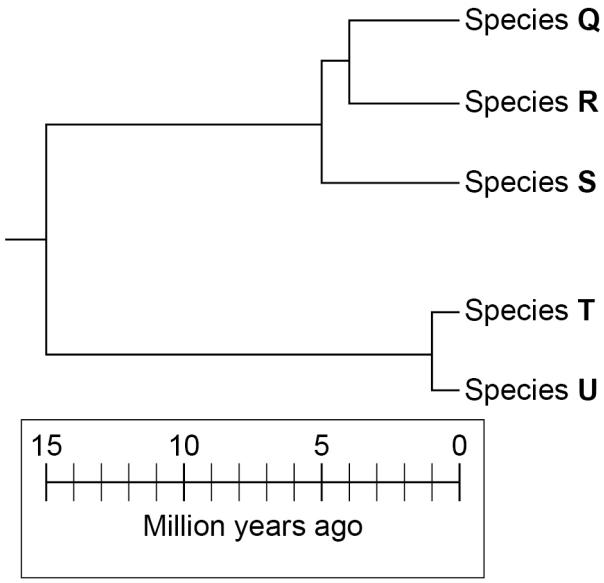
0 6 . 2 **Figure 11** shows the relationship of five species of pike.

Figure 11



Describe the relationship of the five species of pike.

Use information from **Figure 11**.

[3 marks]

Question 6 continues on the next page

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0 6 . 3 Scientists discovered a small population of pike living in a lake in Italy.

In 2011, they classed these pike as a new species and named it *Esox cisalpinus*.

Give **one** method they could have used to identify *Esox cisalpinus* as a new species.

[1 mark]

_____

_____

_____

0 6 . 4 The scientists sampled all the prey species in the lake to see if *Esox cisalpinus* has a variety of different food to eat.

The scientists used the following equation to calculate the index of diversity of the prey species in the lake.

$$d = \frac{N(N-1)}{\sum n(n-1)}$$

Give the meaning of the symbols *N* and *n* used in the equation.

[2 marks]

N = _____

n = _____

0 6 . 5 The scientists took a large number of random samples of the prey species in different areas of the lake.

Explain the importance of:

[2 marks]

taking a large number of samples _____

_____

taking random samples _____

_____

_____

10

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0 7 . 1 One model of enzyme action involves a change in shape of the enzyme's active site to allow the substrate to bind.

Name this model.

[1 mark]

_____

0 7 . 2 When a substrate binds to an enzyme's active site, a chemical bond can be broken in the substrate using a molecule of water.

Name the process of breaking chemical bonds using water.

[1 mark]

_____

0 7 . 3 Endopeptidase and exopeptidase are two different enzymes that can bind and break down the same protein substrate.

Suggest **two** reasons why different enzymes are able to bind to the same substrate.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 7 continues on the next page

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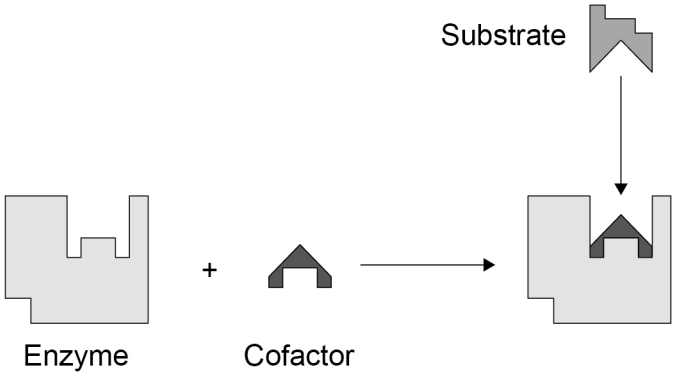
0 7 . 4 **Figure 12** shows an enzyme-controlled reaction involving a type of molecule called a **cofactor**.

Figure 12



Use **Figure 12** to explain how adding a cofactor allows the enzyme–substrate complex to form.

[2 marks]

Question 7 continues on the next page

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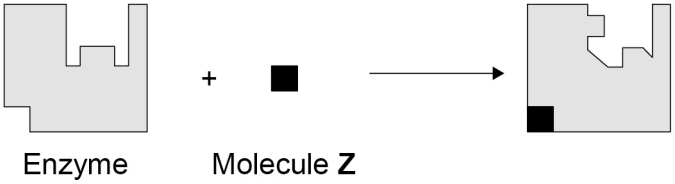
Figure 13 shows the effect of molecule **Z** on the enzyme shown in **Figure 12**.

Figure 13



0 7 . 5 Describe how the action of molecule **Z** results in the changes shown in the diagram.

Use information from **Figure 13**.

[3 marks]

0 7 . 6 Suggest a practical step that a scientist could use to reduce the effect of molecule **Z** on the enzyme-catalysed reaction.

[1 mark]

10

END OF QUESTIONS

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