Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
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Centre Number | Candidate Number

# Pearson Edexcel Level 3 GCE

## Monday 12 May 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **8BI0/01**

# Biology B

## Advanced Subsidiary

## PAPER 1: Core Cellular Biology and Microbiology

**You must have:**
Scientific calculator, HB pencil, ruler

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*

## Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In question(s) marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over*


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P 7 8 6 8 9 A 0 1 3 2

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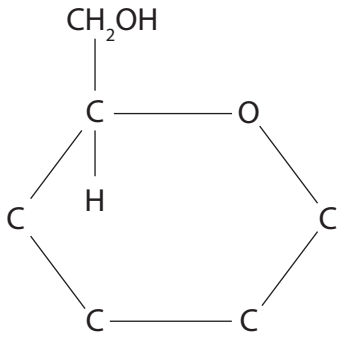
**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** Some carbohydrates are composed of three monosaccharides. These are called trisaccharides.

Raffinose is a trisaccharide composed of glucose, galactose and fructose.

(a) Complete the diagram to show the structure of an **alpha** glucose molecule.

**(2)**




(b) Name the bond that joins monosaccharides together.

**(1)**

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(c) The three monosaccharides present in raffinose each have a molecular mass of 180.

The relative atomic mass of the element hydrogen is 1 and the relative atomic mass of the element oxygen is 16.

Calculate the molecular mass of raffinose.

**(1)**

Answer .....

**(Total for Question 1 = 4 marks)**

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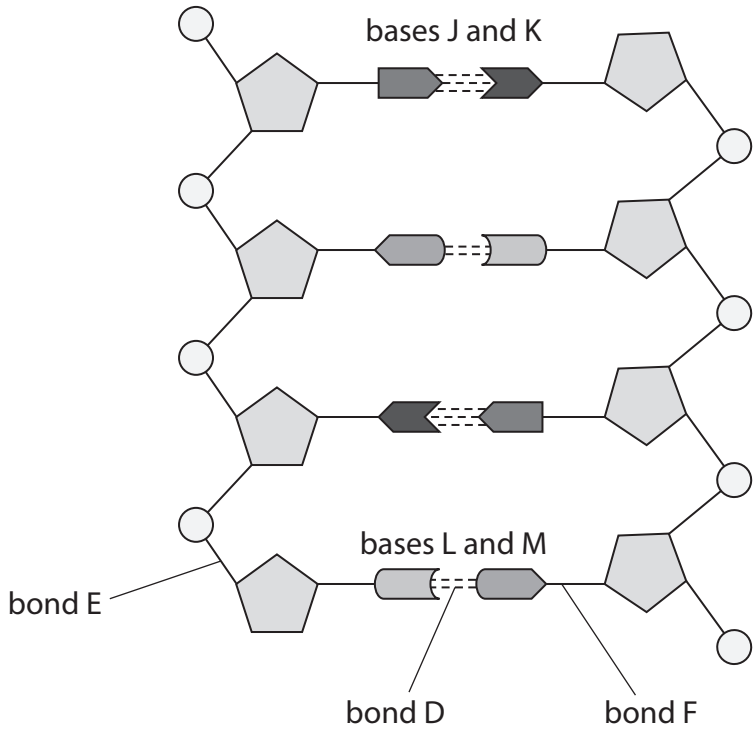
**2** During the S phase of the cell cycle, DNA is synthesised by semi-conservative replication.

The diagram shows part of a DNA molecule.




(a) (i) Name the base pairs labelled J and K, L and M.

**(2)**

J and K .....

L and M .....

(ii) Name the bonds labelled D, E and F.

**(2)**

Bond D .....

Bond E .....

Bond F .....

(iii) Part of a DNA molecule consists of 840 bases. Of these, 136 are base J.

Calculate the percentage of bases that are M in this DNA molecule.

Give your answer to two decimal places.

**(1)**

Answer ..... %

(b) State what is meant by the term **semi-conservative replication**.

**(1)**

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**(Total for Question 2 = 6 marks)**

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**3** Mitochondria are organelles surrounded by a double membrane.

The photograph shows a dividing mitochondrion, as seen using an electron microscope.

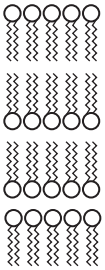
(Source: © DON W. FAWCETT / SCIENCE PHOTO LIBRARY)

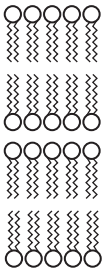
(a) The inner and outer membrane of a mitochondrion each consist of a phospholipid bilayer.

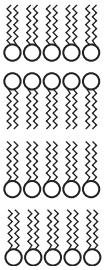
A phospholipid can be represented as

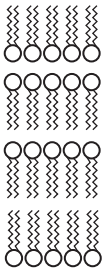
(i) Which of the following shows the arrangement of phospholipids in these two membranes?

**(1)**

☒ **A** 

☒ **C** 

☒ **B** 

☒ **D** 

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(ii) The gap between these two membranes is called the intermembrane space.

The intermembrane space is 200 angstroms wide.

One angstrom = 0.1 nm

Which of the following is the width of the intermembrane space in μm?

**(1)**

☒ **A** 0.002

☒ **B** 0.020

☒ **C** 0.200

☒ **D** 2.000

(iii) Explain why the intermembrane space can be seen in this photograph.

**(2)**

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(iv) Name **one** other organelle with a double membrane.

**(1)**

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(b) (i) Explain why it is necessary for mitochondria to divide during the cell cycle.

**(2)**

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(ii) Describe how mitochondria divide.

Use the information in the photograph and your own knowledge to support your answer.

**(3)**

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**(Total for Question 3 = 10 marks)**

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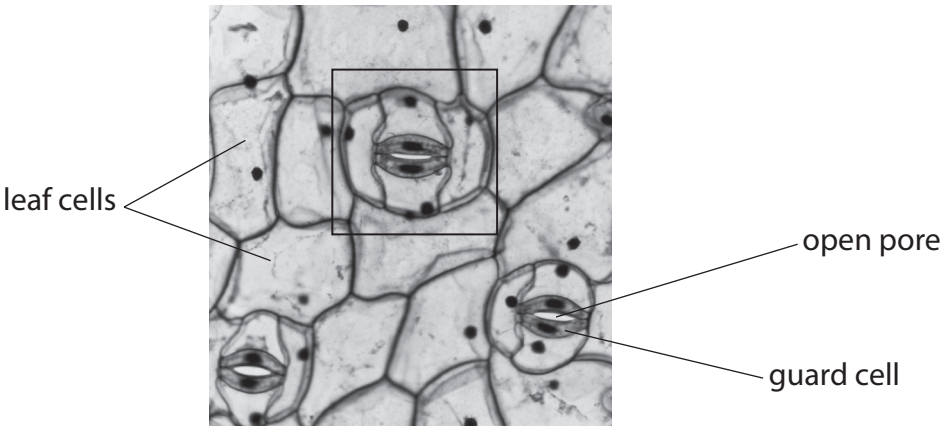
**4** Stomata are pores found on the under-surfaces of leaves. They are surrounded by a pair of guard cells.

The photograph shows three stomata, as seen using a light microscope.




(Source: © Science History Images/Alamy Stock Photo)

(a) Draw the cells in the box on the photograph, at a magnification × 2 of the photograph.

**(3)**

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*(b) The pores are closed in the dark and open in the light.

When the pores are open, the width of the pores increases.

Potassium ions are involved in the opening of the pores.

Devise an investigation to determine the effect of potassium ion concentration on the width of the pores of stomata.

**(6)**

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**(Total for Question 4 = 9 marks)**

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**5** Water has a high surface tension.

(a) Explain how the properties of water molecules result in a high surface tension.

**(3)**

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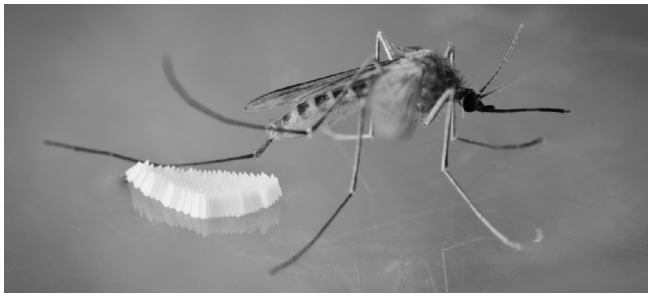
(b) Mosquitoes are insects. They lay their eggs on the surface of water.

The photograph shows a mosquito and eggs on the surface of water.



(Source: © doug4537/Shutterstock)

(i) Analyse the information in the photograph to explain why the mosquito does not sink.

**(2)**

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(ii) Kerosene is a mixture of non-polar organic molecules made of carbon and hydrogen.

When kerosene is sprayed on the water, the floating mosquito eggs sink.

Explain why the eggs sink when kerosene is sprayed on the water.

**(2)**

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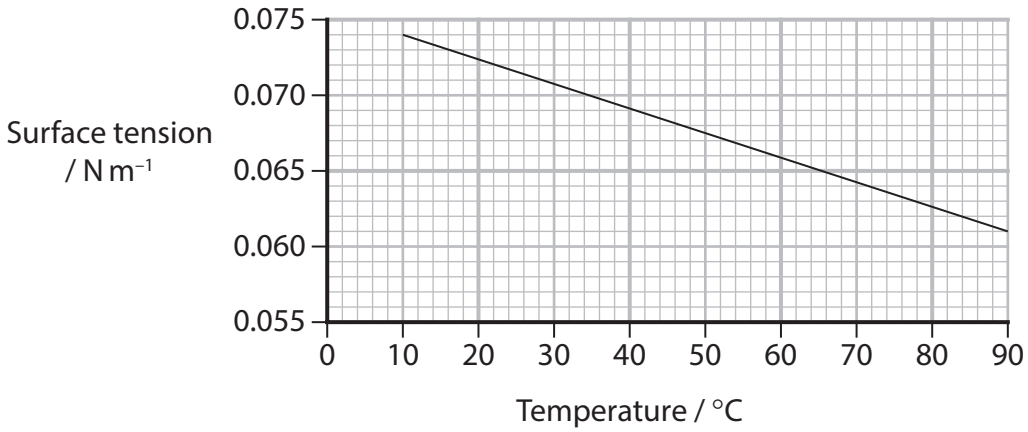
(c) The graph shows the effect of temperature on the surface tension of water.




(i) Calculate the decrease in surface tension per 1 °C rise in temperature.

Give your answer in standard form, to one decimal place.

**(2)**

Answer ..... $N\,m^{-1}$ per °C



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(ii) Explain why a rise in temperature causes a decrease in surface tension.

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**(Total for Question 5 = 11 marks)**

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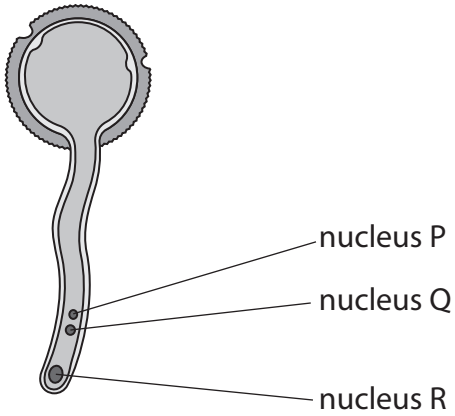
**6** In sexual reproduction in plants, a pollen grain lands on the stigma of a flower. The pollen grain germinates and a pollen tube grows.

(a) The diagram shows a germinated pollen grain.




(i) Which row of the table shows the role of each of these nuclei?

**(1)**

| | | Role of nucleus | | |
|---|---|---|---|---|
| | | **P** | **Q** | **R** |
| ☒ | **A** | control pollen tube growth | fertilise the female nucleus | fertilise the endosperm nucleus |
| ☒ | **B** | control pollen tube growth | fertilise the endosperm nucleus | fertilise the female nucleus |
| ☒ | **C** | fertilise the endosperm nucleus | control pollen tube growth | fertilise the female nucleus |
| ☒ | **D** | fertilise the endosperm nucleus | fertilise the female nucleus | control pollen tube growth |

(ii) Which row of the table shows the number of sets of chromosomes each nucleus contains?

**(1)**

| | | Number of sets of chromosomes | | |
|---|---|---|---|---|
| | | **P** | **Q** | **R** |
| ☒ | **A** | n | n | n |
| ☒ | **B** | n | 2n | 2n |
| ☒ | **C** | 2n | n | 2n |
| ☒ | **D** | 2n | 2n | n |

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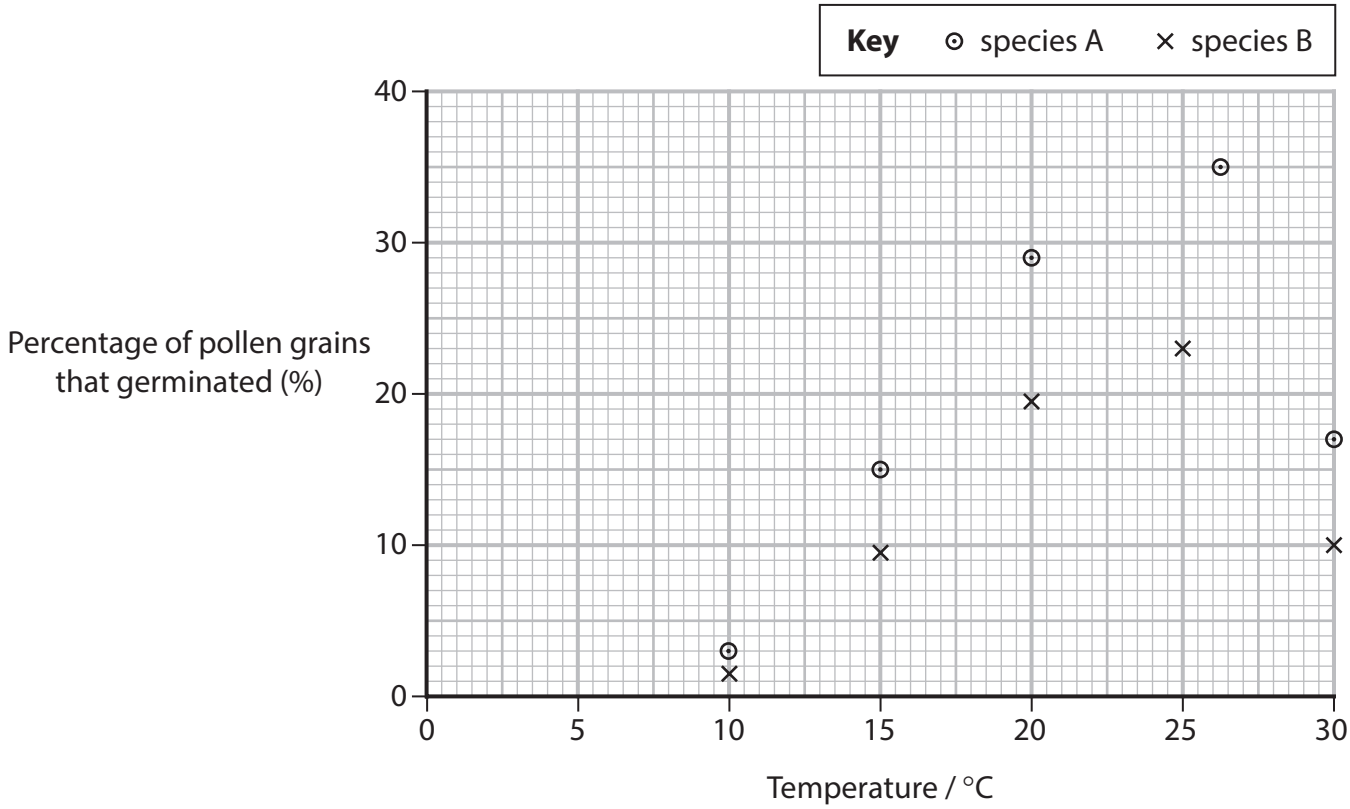
(b) The effect of temperature on the germination of pollen grains from two species of plant was investigated.

The graph shows the results of this investigation.




A student made two conclusions from these results.

(i) Conclusion 1: species A has a wider range of temperatures for pollen grain germination.

Comment on this conclusion.

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(ii) Conclusion 2: species A has a higher optimum temperature for germination than species B.

Devise an investigation to confirm conclusion 2.

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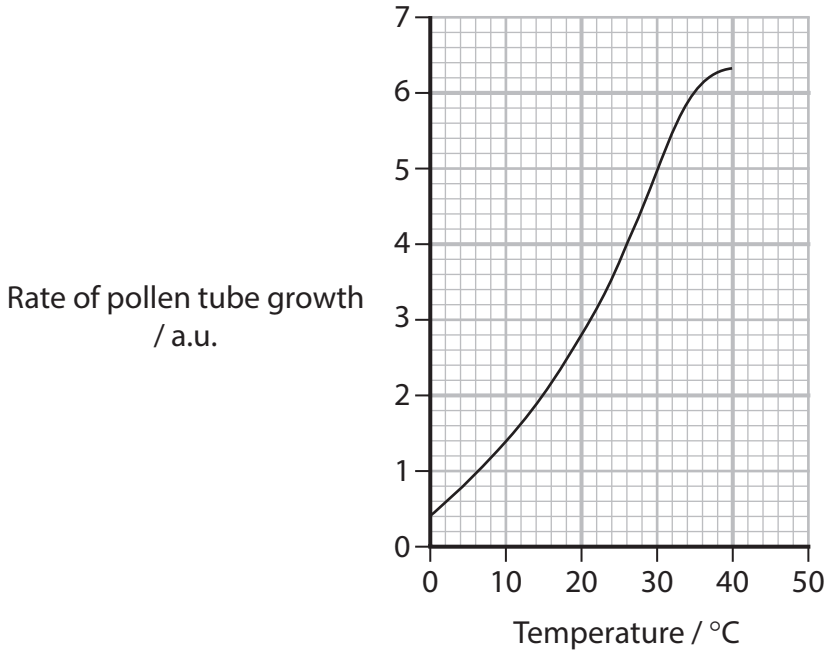
(c) In another investigation, the rate of pollen tube growth at different temperatures was determined.

The graph shows the results of this investigation.




Pollen tube growth is controlled by enzymes.

The temperature coefficient ($Q_{10}$) describes the increase in rate of reaction as a result of increasing the temperature by 10 °C.

Calculate the $Q_{10}$ for a temperature rise from 10 °C to 20 °C.

Use the formula:

$$Q_{10} = \frac{R_{(t+10)}}{R_t}$$

where $R_t$ is the rate of reaction at 10 °C.

Give your answer to one decimal place.

**(2)**

Answer .....

**(Total for Question 6 = 11 marks)**

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**7** Diseases caused by viruses, such as Ebola, can be difficult to treat.

(a) Which of the following statements are correct for Ebola?

1. It contains DNA
2. It has an envelope
3. It is a retrovirus

**(1)**

☒ **A** 1 only

☒ **B** 2 only

☒ **C** 1 and 3 only

☒ **D** 2 and 3 only

(b) Explain why diseases caused by viruses are difficult to treat.

**(2)**

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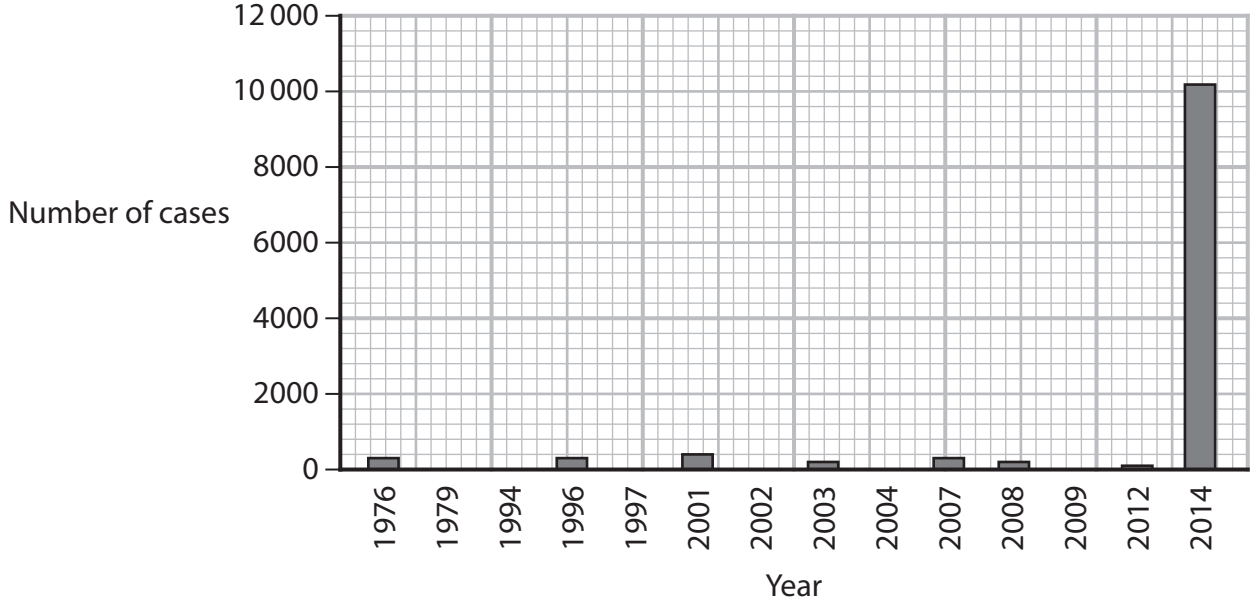
(c) The graph shows the number of cases of Ebola in each outbreak from 1976 to 2014.




(i) State **two** conclusions that can be made about the outbreaks of Ebola in this time period.

**(2)**

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(ii) Give **two** reasons why the figures presented in this graph are likely to be an underestimate.

**(2)**

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(iii) In October 2014, 10 141 cases and 4 922 deaths were reported.

Calculate the ratio of cases to deaths.

Give your answer in whole numbers.

**(1)**

Answer .....

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*(d) The Ebola virus can spread between animals and humans and between humans.

The virus is present in bodily fluids of both infected animals and humans.

It can be passed on by contact with contaminated fluids, through open wounds, or by eating contaminated meat and fruits.

The spread of the disease is also affected by:

- changes in climate
- changes in land-use
- the economy of the country
- the health of the people.

A model has been developed to predict when and where outbreaks of Ebola could occur.

This model has shown that some countries in Africa are at risk of an outbreak of Ebola even though there have not been any known cases of Ebola there before.

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Analyse the information to discuss the measures that could be used to reduce the risk of an Ebola outbreak in these countries.

**(6)**

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**(Total for Question 7 = 14 marks)**

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**8** Threonine is an amino acid that can be converted into another amino acid, isoleucine.

This conversion takes five steps.

The first step is catalysed by the enzyme threonine deaminase.

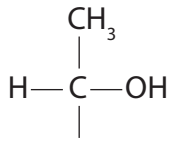
The diagram shows this conversion.

Threonine
↓ Threonine deaminase
Intermediate J
↓ Enzyme 2
Intermediate K
↓ Enzyme 3
Intermediate L
↓ Enzyme 4
Intermediate M
↓ Enzyme 5
Isoleucine

(a) The diagram shows the R group of threonine.

Complete the diagram to show the structure of threonine.

**(3)**

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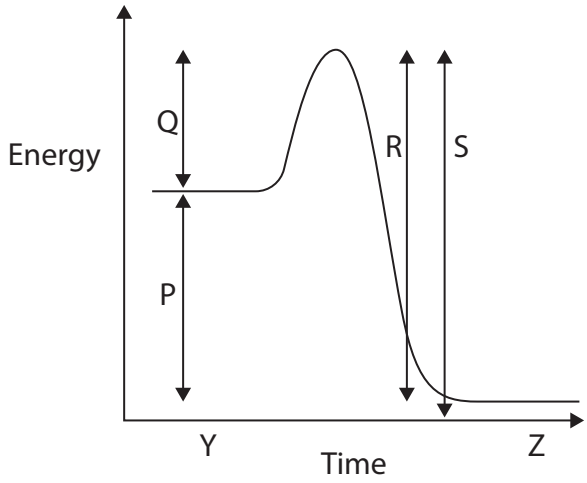
(b) The graph shows the energy changes during the conversion of threonine to intermediate J, in the presence of threonine deaminase.




(i) Which arrow shows the activation energy for this reaction?

**(1)**

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) Which row of the table identifies the molecule present at time Y and the molecule present at time Z on this graph?

**(1)**

| | | Time Y | Time Z |
|---|---|---|---|
| ☒ | **A** | the product threonine | the reactant intermediate J |
| ☒ | **B** | the product threonine | the reactant isoleucine |
| ☒ | **C** | the reactant threonine | the product intermediate J |
| ☒ | **D** | the reactant threonine | the product isoleucine |

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(iii) Which row of the table shows the change in length of the arrows P and Q on this graph in the absence of the enzyme threonine deaminase?

**(1)**

| | | Change in length of arrow | |
|---|---|---|---|
| | | **P** | **Q** |
| ☒ | **A** | increase | increase |
| ☒ | **B** | increase | no change |
| ☒ | **C** | no change | increase |
| ☒ | **D** | no change | no change |

(c) Explain why the conversion of threonine to isoleucine involves several different enzymes.

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(d) This reaction is affected by end-product inhibition.

(i) Explain how end-product inhibition affects this reaction.

**(3)**

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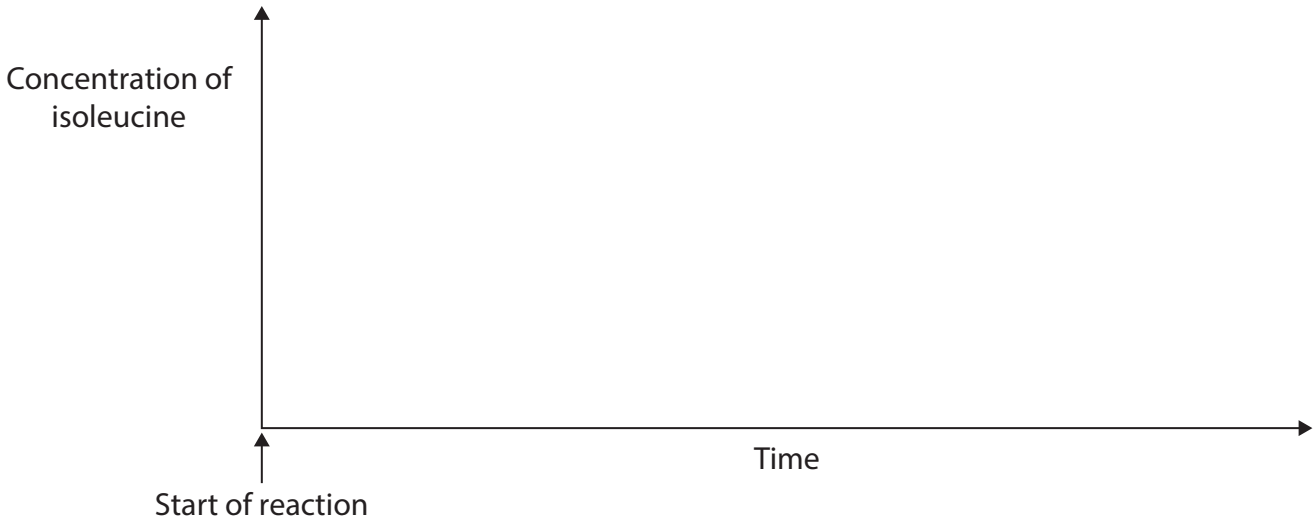
(ii) Complete the graph to show how the concentration of isoleucine would change as a result of end-product inhibition of threonine deaminase.

**(3)**




**(Total for Question 8 = 15 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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