OCR
Oxford Cambridge and RSA

Tuesday 21 May 2019 – Afternoon

AS Level Biology A

H020/01 Breadth in biology

Time allowed: 1 hour 30 minutes

You may use:
- a scientific or graphical calculator
- a ruler (cm/mm)

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **28** pages.

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SECTION A

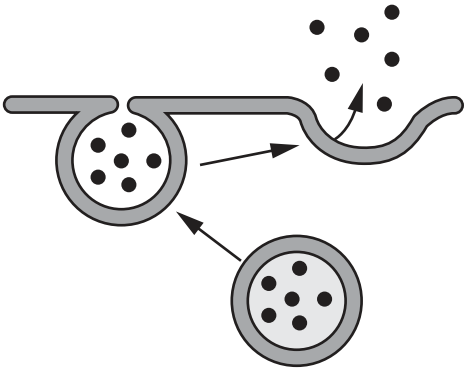
You should spend a maximum of 25 minutes on this section.

Write your answer for each question in the box provided.

Answer **all** the questions.

1 The diagram below shows one method of transport across a cell membrane.

outside cell



inside cell

Which of the following options, **A** to **D**, is the name of this method of transport?

A cytokinesis

B endocytosis

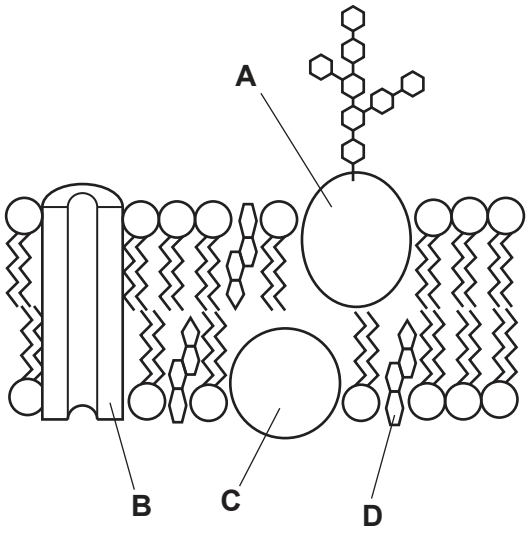
C exocytosis

D phagocytosis

Your answer ☐ **[1]**

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2 The diagram below shows the structure of a plasma membrane.

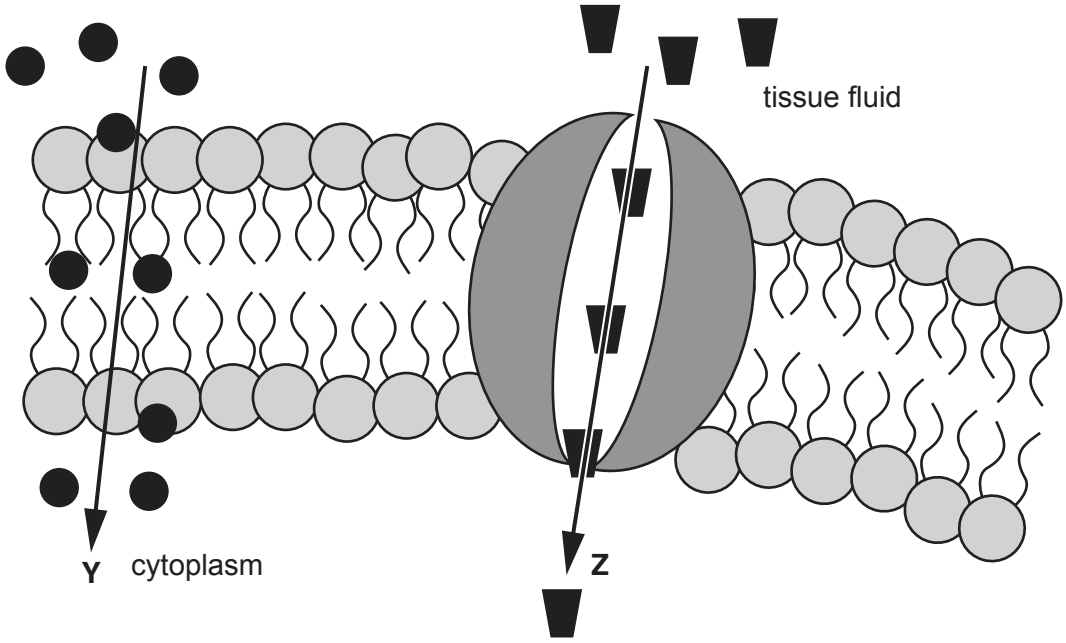


Which label, **A** to **D**, indicates the component of the membrane that can affect its fluidity?

Your answer ☐ **[1]**

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3 This diagram shows the transport of two molecules across a plasma membrane.



Which row, **A** to **D**, correctly identifies the molecule being transported **and** the mechanism of transport across the plasma membrane?

	Y	**Z**
A	glucose by active transport	oxygen by diffusion
B	glucose by diffusion	oxygen by active transport
C	oxygen by active transport	glucose by active transport
D	oxygen by diffusion	glucose by diffusion

Your answer ☐ **[1]**

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4 DNA is made up of two polynucleotide chains.

Which of the bonds, **A** to **D**, forms between two nitrogenous bases holding the two polynucleotide chains together?

A phosphodiester

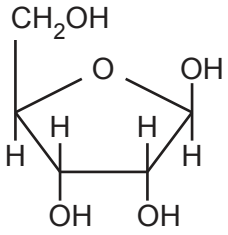
B ionic

C covalent

D hydrogen

Your answer ☐ **[1]**

5 The structure of a biological molecule is shown below.



Which of the following options, **A** to **D**, correctly describes the molecule?

A hexose monosaccharide glucose

B hexose monosaccharide ribose

C pentose monosaccharide glucose

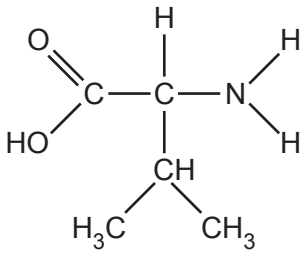
D pentose monosaccharide ribose

Your answer ☐ **[1]**

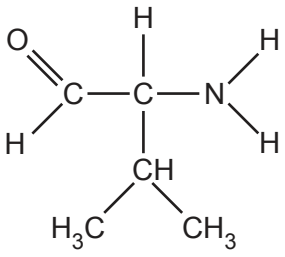
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6 Which of the following molecules, **A** to **D**, could be a product of breaking a peptide bond during a hydrolysis reaction?

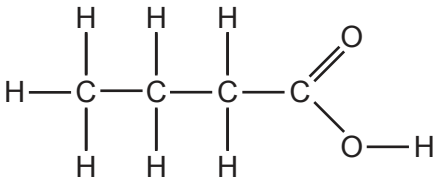
A



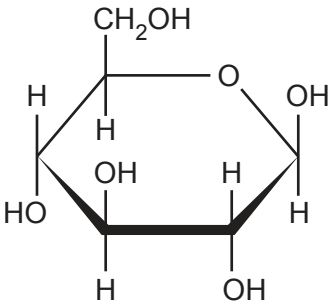
B



C



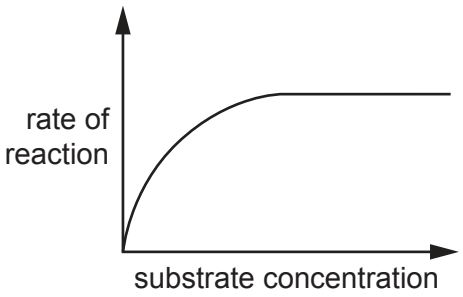
D



Your answer ☐ **[1]**

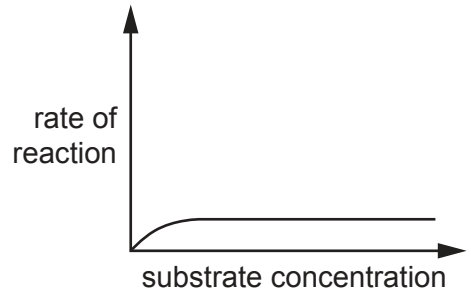
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7 The diagram below shows the effect of changing substrate concentration on the rate of an enzyme-controlled reaction.

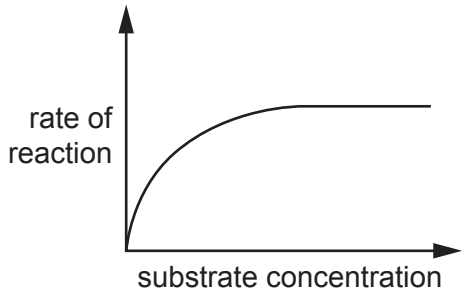


Which of the following graphs, **A** to **D**, shows how a **non-competitive** inhibitor would affect the rate of this reaction?

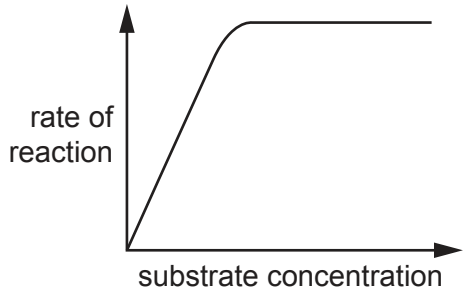
A



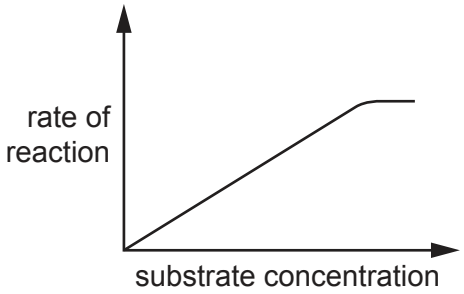
B



C



D



Your answer ☐ **[1]**

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8 Which of the following ions, **A** to **D**, is required for the hydrolysis of starch by an enzyme?

A Cl^-

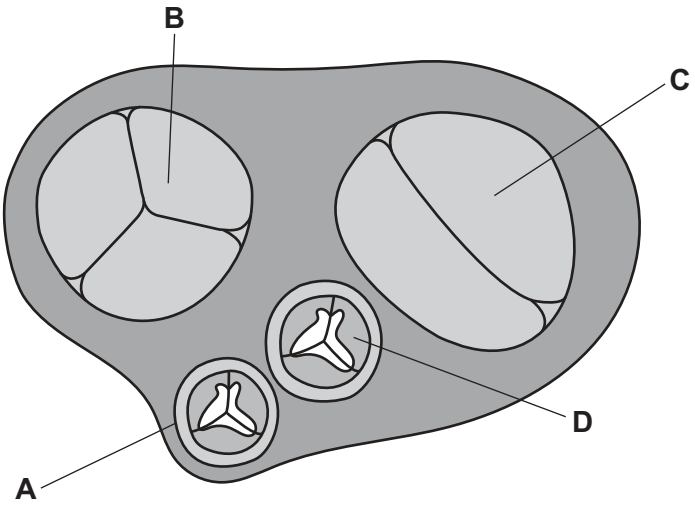
B K^+

C Na^+

D Zn^{2+}

Your answer ☐ **[1]**

9 The diagram below shows an internal view of the mammalian heart with the atria removed so valves can be seen.



Which of the valves, labelled **A** to **D**, is pushed open by oxygenated blood entering a ventricle?

Your answer ☐ **[1]**

10 Which of the following, **A** to **D**, shows the reaction catalysed by carbonic anhydrase?

A $CO_2 + H_2O \longrightarrow H_2CO_3$

B $CO_2 + Hb \longrightarrow HbCO_2$

C $H^+ + Hb \longrightarrow HHb$

D $Hb + 4O_2 \longrightarrow HbO_8$

Your answer ☐ **[1]**

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11 The giant water lily, *Victoria amazonica*, grows in the shallow waters of the Amazon river basin.

Which of the following adaptations, **A** to **D**, enables *Victoria amazonica* to survive in its watery environment?

A thick waxy cuticle

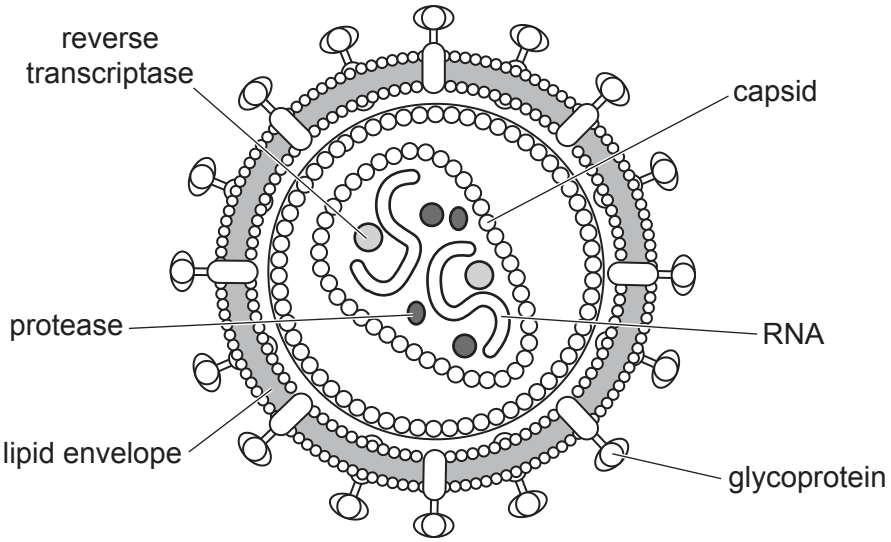
B leaves with stomata on upper surface only

C leaves with sunken stomata

D extensive shallow root system

Your answer ☐ **[1]**

12 The diagram below shows a pathogen.



Which of the options, **A** to **D**, is the disease caused by this pathogen?

A HIV/AIDS

B potato blight

C ringworm

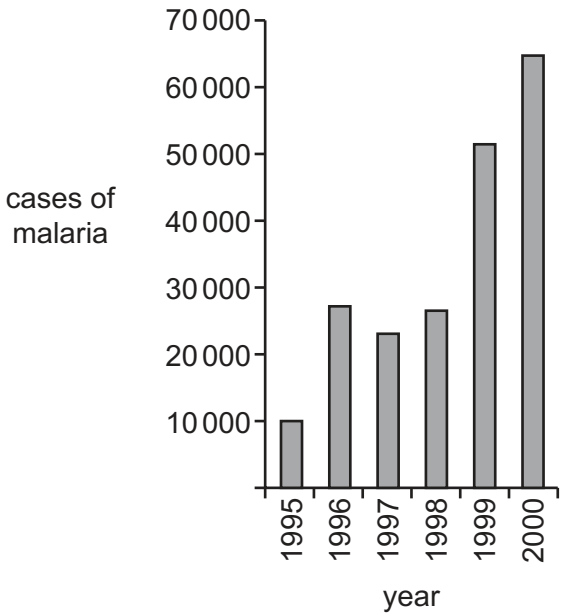
D tuberculosis

Your answer ☐ **[1]**

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The chart shows the number of reported cases of malaria in South Africa between 1995 and 2000.

Questions **13** and **14** refer to this chart.



13 Which of the following, **A** to **D**, is the percentage increase from the number of cases of malaria in 1995 to 2000?

A 85%

B 550%

C 650%

D 55 000%

Your answer ☐ **[1]**

14 Which of the following statements, **A** to **D**, could explain the data shown for 1999–2000?

A the malarial parasite had developed resistance to insecticides

B the vector had developed resistance to antibiotics

C the malarial parasite had developed resistance to antiviral drugs

D the vector had developed resistance to insecticides

Your answer ☐ **[1]**

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15 The sea marigold, *Calendula maritima*, is a rare species that is critically endangered and has been included in an *ex situ* conservation project.

Which of the following options, **A** to **D**, is a disadvantage of conserving the sea marigold *ex situ*?

A it could reduce genetic diversity in sea marigolds

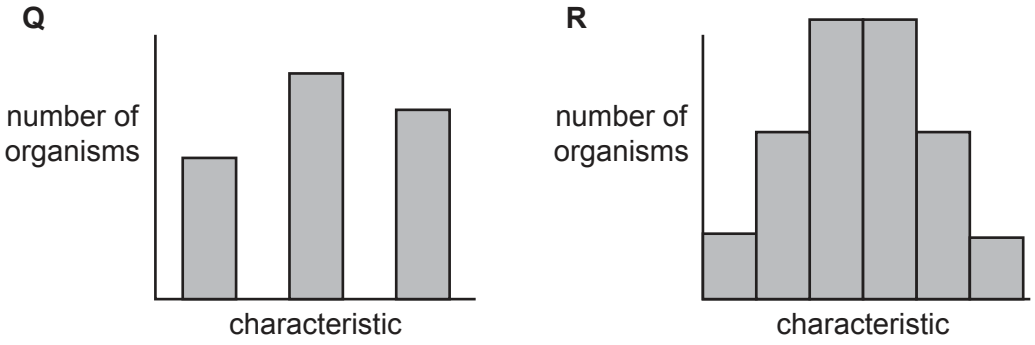
B sea marigolds are collected from the wild as seeds

C sea marigold seeds are stored in large numbers

D sea marigolds will be at risk from grazing by herbivores

Your answer ☐ **[1]**

16 The two histograms represent the frequency distribution for the two different types of variation.



Which of the statements, **A** to **D**, about characteristic **Q** is correct?

A controlled by many genes and unaffected by the environment

B controlled by one or two genes and unaffected by the environment

C controlled by many genes and influenced by the environment

D controlled by one or two genes and influenced by the environment

Your answer ☐ **[1]**

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17 Some of the taxonomic groups for the beach sunflower, *Helianthus debilis*, are shown in the table below.

Kingdom	Plantae
Phylum	Magnoliophyta
W	Magnoliopsida
Order	Asterales
X	Asteraceae
Y	Helianthus

Which of the following rows, **A** to **D**, correctly identifies the missing taxonomic groups from the classification of *Helianthus debilis*?

	W	**X**	**Y**
A	class	genus	species
B	class	family	genus
C	family	genus	species
D	family	class	genus

Your answer ☐ **[1]**

18 Ventilation is a process that involves various parts of the body.

Which of the following options, **A** to **D**, describes **exhalation** in a mammal?

A ribcage moves upwards and outwards; external intercostal muscles relax; diaphragm relaxes

B ribcage moves downwards and inwards; external intercostal muscles relax; diaphragm relaxes

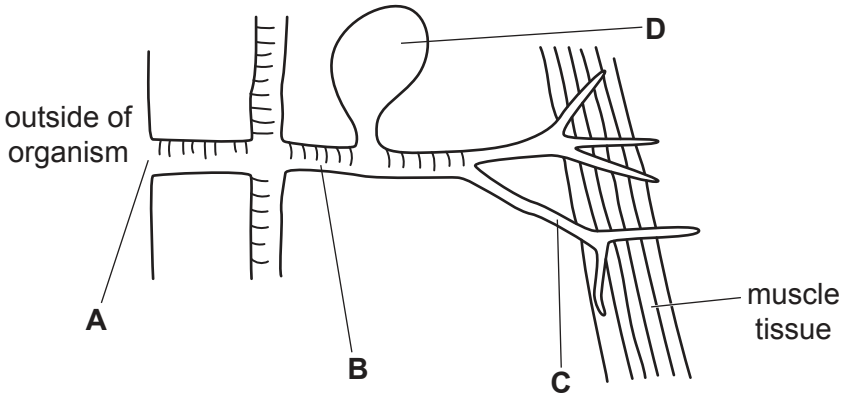
C ribcage moves upwards and outwards; external intercostal muscles contract; diaphragm relaxes

D ribcage moves downwards and inwards; external intercostal muscles contract; diaphragm contracts

Your answer ☐ **[1]**

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19 The diagram shows part of the gas exchange system of an insect.



Which of the labels, **A** to **D**, indicates the trachea?

Your answer ☐ **[1]**

20 The table below shows the stages of the cell cycle.

Which row, **A** to **D**, shows the correct order of the different stages?

	Cytokinesis	**G_1**	**G_2**	**Mitosis**	**S**
A	four	two	three	one	five
B	five	one	three	two	four
C	three	four	one	two	five
D	four	two	five	one	three

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

21 A student investigated the effects of different solutions on pieces of potato tissue. Six potato rods were prepared with a cork borer. The student trimmed them to a length of exactly 5 cm.

After treatment, the six rods were placed in test tubes and submerged in either sucrose solution or distilled water.

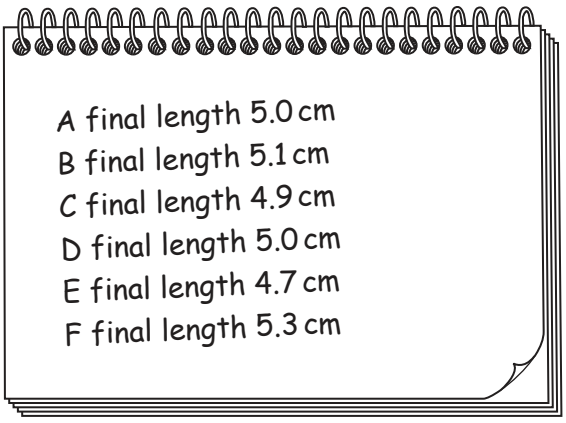
The treatment and liquid added to each potato rod is shown in Table 21 below.

Potato rod	Treatment	Liquid added
A	boiled in water for 5 minutes	1 mol dm^{-3} sucrose solution
B	boiled in water for 5 minutes	distilled water
C	soaked in ethanol for 5 minutes	1 mol dm^{-3} sucrose solution
D	soaked in ethanol for 5 minutes	distilled water
E	untreated	1 mol dm^{-3} sucrose solution
F	untreated	distilled water

Table 21

After 30 minutes, the rods were removed from the tubes and their lengths measured.

The student recorded the results on a piece of scrap paper, shown below.



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(a) In the space below, present the student's results in an appropriate format.

[3]

(b) **(i)** Explain how the treatment results in the difference in the final lengths of rod **A** and rod **E**.

.....

.....

.....

.....

..... **[2]**

(ii) Explain how the treatment results in the difference in the final lengths of rod **D** and rod **F**.

.....

.....

.....

.....

..... **[2]**

(c) State how the student could reduce the uncertainty of their data.

.....

..... **[1]**

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22 Practical apparatus is often used in biological investigations.

(a) Table 22 is a list of practical apparatus used in biological investigations. Each piece of apparatus has been assigned a letter.

Letter	Apparatus
A	calorimeter
B	gridded quadrat
C	biosensor
D	potometer
E	chromatography tank
F	spirometer
G	colorimeter

Table 22

The table below gives five examples of biological investigations.

Using Table 22, write the letter of the correct piece of apparatus that would be used in each investigation.

Biological investigation	Letter of piece of apparatus that would be used
Determining blood glucose concentration over a short time period following a meal	
Determining the distribution of dandelions on a playing field	
Estimating the concentration of pigment that has escaped from plant tissue that had been placed in water baths of different temperatures	
Measuring the vital capacity of a student	
Estimating the rate of transpiration in a plant shoot	

[3]

(b) Before taking readings with a colorimeter it is important to calibrate the apparatus.

(i) Describe how a colorimeter is calibrated.

.....

..... **[1]**

(ii) Why is it important to calibrate a colorimeter?

.....

..... **[1]**

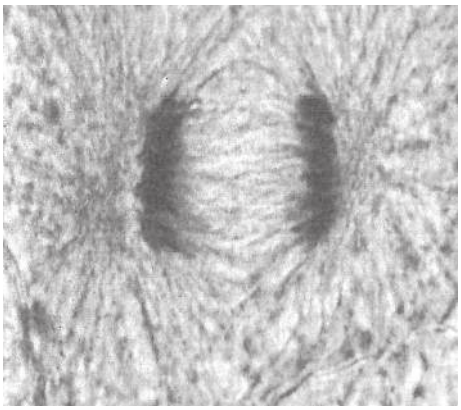
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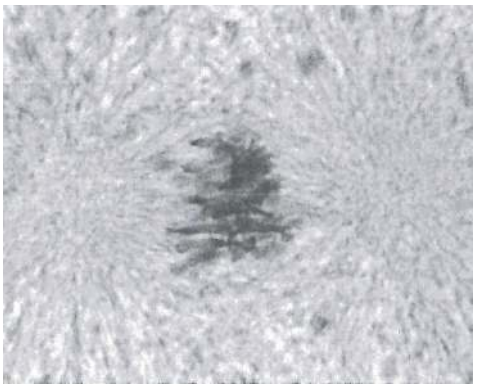
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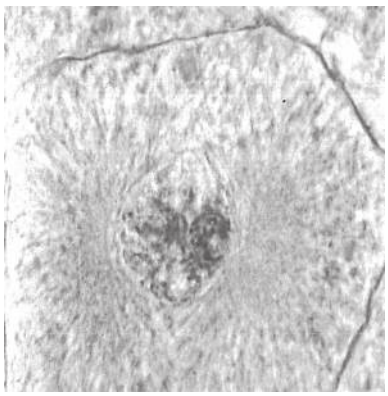
23 The photomicrographs shown in Fig. 23 below are taken from an animal cell undergoing mitosis.



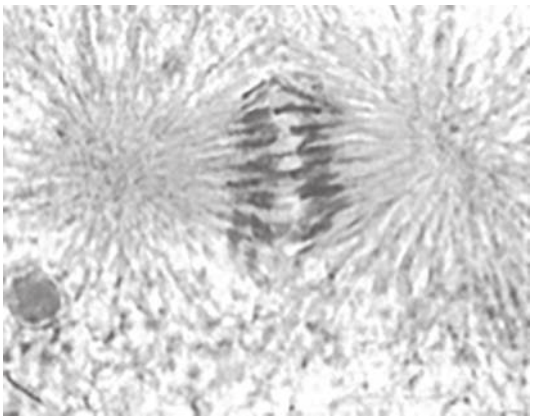
P



Q



R



S

Fig. 23

(a) (i) Write the letters of the images, **P** to **S**, in the correct mitotic sequence.

.... **[1]**

(ii) Describe in detail what is happening in image **Q**.

.....

.....

.....

.....

..... **[2]**

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(b) In the space below produce a **labelled** diagram of the cell in image **S** from Fig. 23.

[3]

(c) A student observed a prepared slide of an onion root tip under a microscope.
The total number of cells in the field of view was 265.

The number of cells at the different stages of the cell cycle are shown in Table 23.

Stage of cell cycle	Number of cells
interphase	207
prophase	42
metaphase	4
anaphase	6
telophase	6

Table 23

The cell cycle takes 20 hours. The number of cells visible at each stage is proportional to how long each stage of the cell cycle lasts.

Calculate the time taken for prophase to occur.

Give your answer in minutes to the nearest whole number.

time taken = ... min **[2]**

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24 Plants need water to survive.

(a) Water enters plants through the roots. Most roots are covered in root hairs.

The number of root hairs per mm^2 of root surface is described as the density of root hairs. The density of root hairs can vary between and within species.

A scientist examined a plant root. The plant root had a diameter of 2 mm. In 1 mm of root **length** the scientist counted 440 root hairs.

Calculate the density of root hairs on the root the scientist examined.

Use the formula: Surface area of cylinder = $2\pi r(r+l)$

Give your answer to **2** significant figures.

density = ... **[3]**

(b) A scientist investigated the effect of different mineral solutions on root hair density on cress plants.

Cress plants were grown for seven days in two different mineral solutions, **A** and **B**.

The results are shown in the table below.

Cress plant	Root hair density (hairs mm^{-2})	
	Mineral solution A	**Mineral solution B**
1	42	25
2	53	41
3	60	32
4	52	34
5	38	58
6	48	27
Mean	48.8	
Standard deviation	8.0	

(i) Calculate the standard deviation of root hair density for cress grown in mineral solution **B**.

Use the formula: $s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

[Write your answer in the table] **[3]**

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(ii) The scientist thought that mineral solution **B** might cause a reduction in root hair density.

Suggest an appropriate statistical test that the scientist could carry out in order to confirm their hypothesis.

..... **[1]**

(c) Fig. 24 is a section through xylem tissue from a **stem** of a dicotyledonous plant.

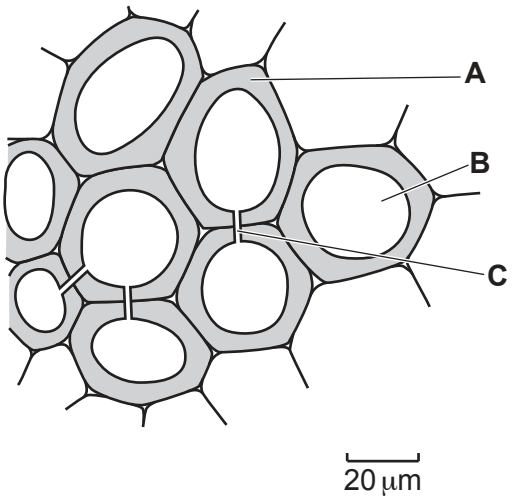


Fig. 24

(i) Identify **A**, **B** and **C** on Fig. 24.

A .....

B .....

C .....

[3]

(ii) Some plants, such as mosses, do not have xylem. Mosses are small plants that rarely grow more than a few cm in height.

Suggest why mosses do not need structures such as roots or xylem to survive.

.....

.....

..... **[1]**

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25 Fig. 25.1 represents the tertiary structure of the enzyme lysozyme.

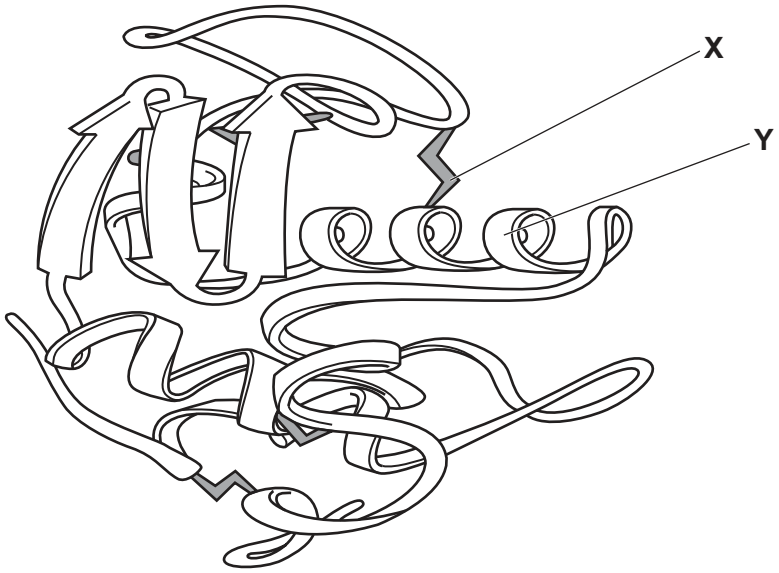


Fig. 25.1

(a) (i) Name the covalent chemical bond labelled **X** which links two cysteine amino acids.

..... **[1]**

(ii) Name the structure labelled **Y** which forms part of the secondary structure of lysozyme.

..... **[1]**

(iii) Lysozyme consists of a single polypeptide chain of 129 amino acids.

State which level of protein structure is **not** shown by lysozyme.

..... **[1]**

(b) The function of lysozyme is to break down the cell walls of bacteria.

(i) Name the molecule that is found in the cell walls of bacterial cells.

..... **[1]**

(ii) Lysozyme is also known as a glycoside hydrolase.

Suggest the type of chemical bond that lysozyme breaks and name the molecule other than the substrate that is needed for this reaction.

Type of bond .....

Other molecule needed for this reaction .....

[2]

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(c) Enzymes are affected by temperature. Fig. 25.2 shows the time course of a mammalian enzyme reaction at different temperatures.

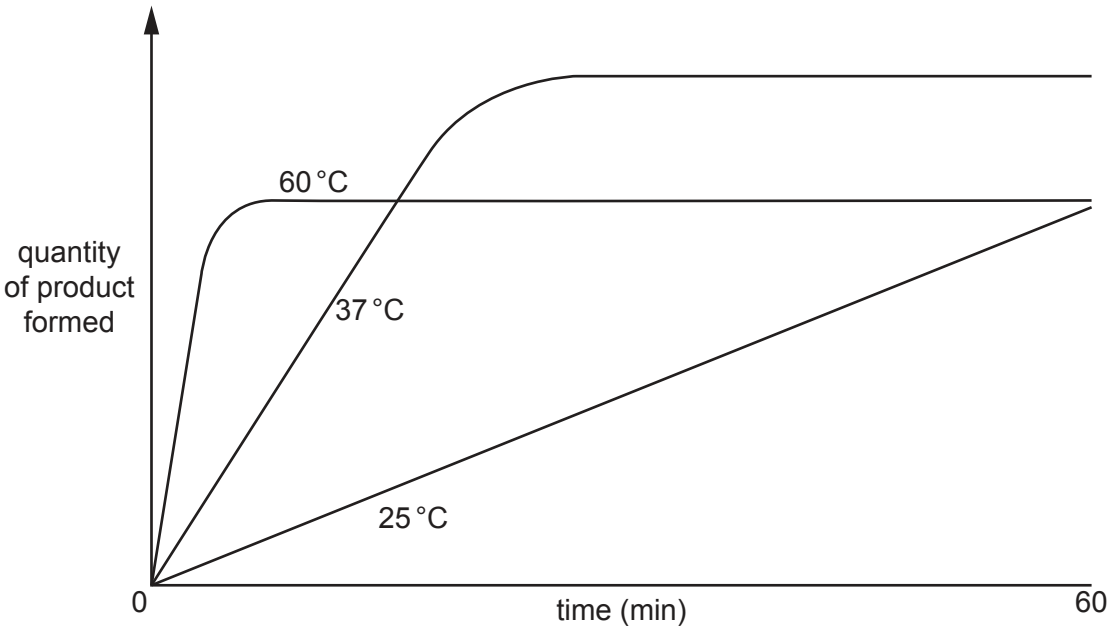


Fig. 25.2

(i) Explain why there is a difference in the shapes of the curves at 37 °C and 60 °C.

.....

.....

.....

.....

.....

..... **[2]**

(ii) Explain why there is a difference in the shapes of the curves at 25 °C and 37 °C.

.....

.....

.....

.....

.....

..... **[2]**

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26 The specific immune system is based on white blood cells called lymphocytes.

(a) Complete the following passage by using the most appropriate terms from the list. You may use terms once, more than once or not at all.

memory **plasma** **killer T cell** **antigens** **antibodies**

interleukins **phagocyte** **meiosis** **mitosis** **hormones**

When a pathogen enters the body it is recognised due to specific molecules on the surface of its cells called ..... . A phagocyte will engulf the pathogen and process these molecules by displaying them on the surface of the phagocyte. This cell will now interact with a special type of T lymphocyte called a T helper cell. The T helper cells produce ..... that will activate the B lymphocytes. They start to divide by ..... . These cells now differentiate into ..... cells, which synthesise and release ..... .

[5]

(b) A student wrote the following passage in an essay on the immune system.

Immunisation programmes involve injecting individuals with a small amount of the safe antibody, known as a vaccine. In the UK, babies are given routine vaccinations against a range of infectious diseases including diphtheria and measles. These injections provide a form of natural passive immunity that may last a year, a few years or a lifetime.

State **three** errors that the student has made in this passage.

.....

.....

.....

.....

.....

..... **[3]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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