Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5774596970

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2021**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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Answer **all** the questions.

1 **(a)** Fig. 1.1 is a transmission electron micrograph of cells from the leaf of a plant.

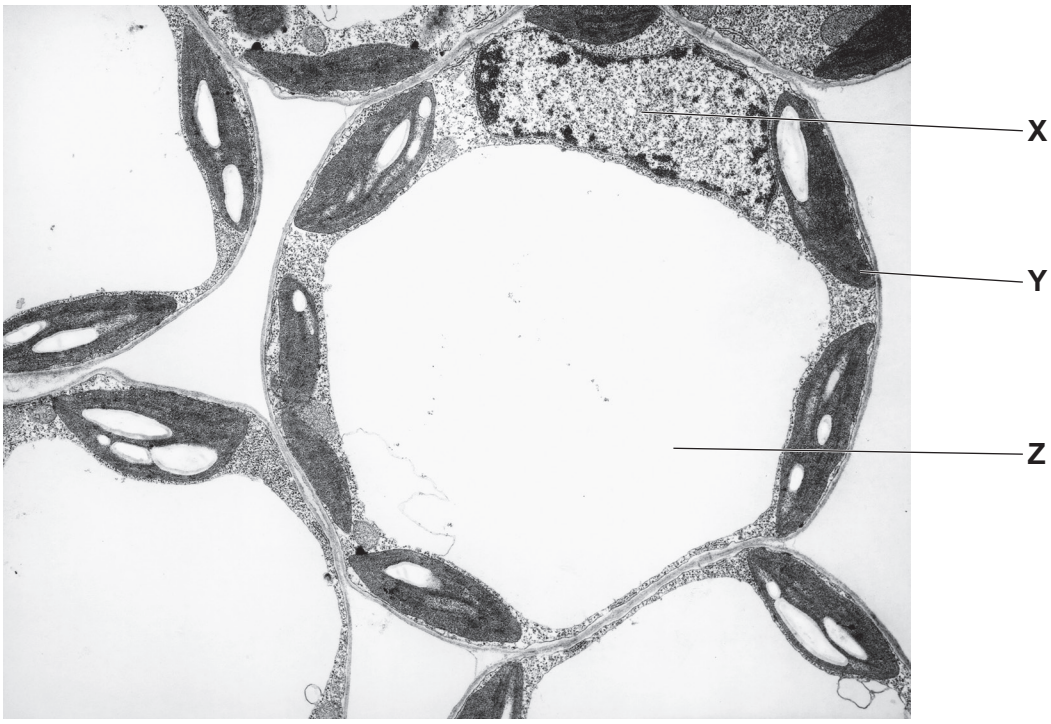


Fig. 1.1

(i) Name the cell structures **X**, **Y**, and **Z**.

X .....

Y .....

Z .....

[3]

(ii) State **two** ways in which the structure of an animal cell differs from plant cells such as those shown in Fig. 1.1.

1 .....

.....

2 .....

.....

[2]

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(b) (i) Cell structure **Y** in Fig. 1.1 contains a large starch granule (grain).

Name the chemical reagent used to test for starch **and** state the colour change that will be seen if starch is present.

reagent .....

colour change ..... [2]

(ii) Starch granules contain amylose and amylopectin.

Describe the similarities **and** differences between the structure of amylose and the structure of amylopectin.

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..... [4]

[Total: 11]

2 **(a)** Fig. 2.1 is a transmission electron micrograph of a transverse section through a blood capillary that is surrounded by actively respiring cells.

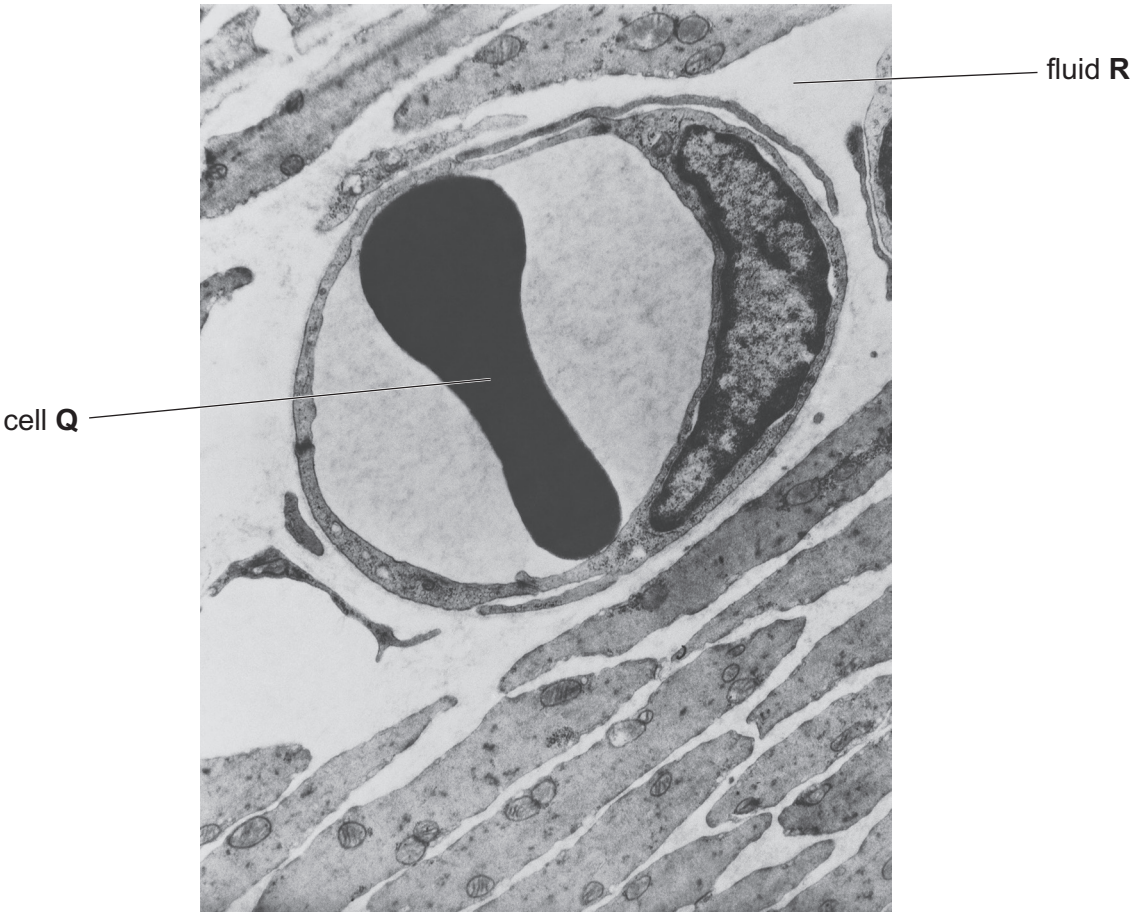


Fig. 2.1

(i) Identify cell **Q** shown in Fig. 2.1.

..... [1]

(ii) Fluid **R** is formed from blood in the blood capillary.

State **and** explain **one** difference between the composition of fluid **R** and the composition of the blood in the capillary.

difference .....

explanation .....

.....

.....

.....

..... [3]

(b) (i) The cell surface membranes of the respiring cells have a role in regulating the exchange of substances between the cells of the body and the blood.

Draw a diagram in the space below to show the arrangement of phospholipid molecules in the cell surface membrane.

[2]

(ii) Cholesterol is a molecule found in the cell surface membrane.

Describe **one** role of cholesterol in the cell surface membrane.

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..... [1]

(c) Nicotine is one of the components of tobacco smoke. Nicotine can cross cell surface membranes and enter the bloodstream.

(i) Describe the short-term effects of nicotine on the cardiovascular system.

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..... [2]

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[Turn over

(ii) Nicotine is absorbed from the blood plasma into the cells of the capillary wall. Scientists have suggested that nicotine is transported from the blood plasma into these cells using a type of co-transporter mechanism.

Fig. 2.2 shows how nicotine may be transported from the blood plasma into a cell.

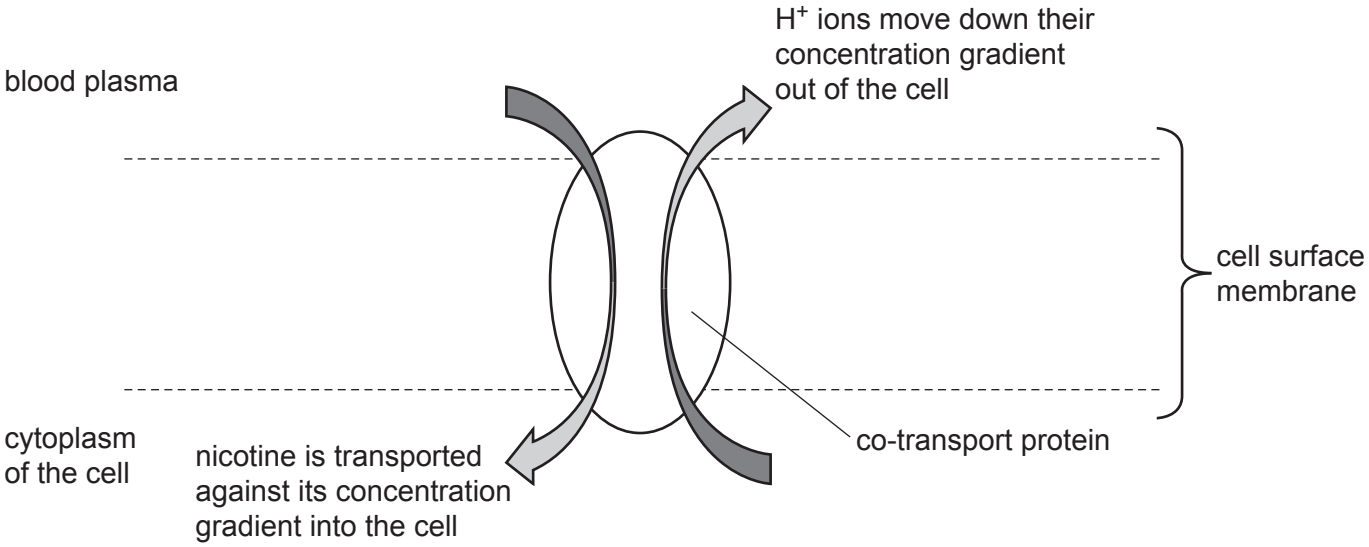


Fig. 2.2

The co-transporter mechanism shown in Fig. 2.2 is different from the co-transporter mechanism that moves sucrose into the cytoplasm of a companion cell in phloem tissue.

Outline the similarities **and** differences between the co-transport of nicotine and the co-transport of sucrose.

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..... [3]

[Total: 12]

Question 3 starts on page 8.

3 Cholera is an infectious disease caused by the bacterial pathogen *Vibrio cholerae*.

(a) Describe how *V. cholerae* is transmitted from an infected person to an uninfected person.

.....

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.....

..... [2]

V. cholerae releases a toxin called choleragen. Choleragen is a protein molecule made up of six polypeptides (subunits).

(b) Fig. 3.1 is a ribbon diagram of a molecule of choleragen.



Fig. 3.1

Describe what is shown by the part of the molecule labelled **T**.

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..... [3]

(c) Vaccination can be used to prevent the spread of cholera. The vaccine used contains part of the choleragen molecule and also contains dead cells of *V. cholerae*.

(i) Phagocytes play an important role in the immune response to a vaccine. Phagocytes contain many lysosomes.

Describe the function of lysosomes in phagocytes.

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..... [2]

(ii) Suggest the advantage of having a vaccine that includes dead cells of *V. cholerae* and part of the choleragen molecule.

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..... [2]

(d) The World Health Organization states that most cases of cholera can be treated with oral rehydration therapy. To reduce the risk of antibiotic resistance developing, antibiotics are only recommended for the most serious cases.

Discuss the consequences of the development of antibiotic resistance in *V. cholerae*.

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..... [4]

[Total: 13]

Question 4 starts on page 12.

4 **(a)** Fig. 4.1 is a drawing made by a student of a plant cell, showing one of the stages of mitosis.

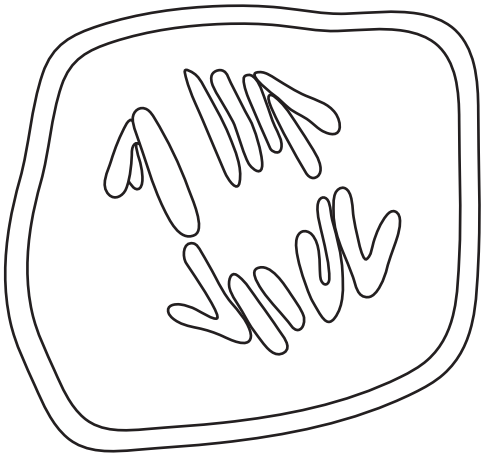


Fig. 4.1

(i) Describe the role of the spindle during this stage of mitosis.

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..... [2]

(ii) The chromosomes are composed of DNA.

Describe the structure of a monomer of a DNA molecule.

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..... [2]

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(b) Telomeres are located at the ends of each chromosome.

Telomeres progressively shorten each time a healthy human cell divides, until the cell is no longer able to divide.

Stem cells have an enzyme called telomerase that prevents the telomeres shortening during the cell cycle.

(i) Suggest why telomerase activity is important in stem cells.

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..... [2]

(ii) Suggest why tumour cells produce high concentrations of telomerase.

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..... [1]

(iii) Scientists have researched the possibility of treating cancer by inhibiting the action of telomerase.

One method that has been studied involves inserting small, single-stranded DNA into cancer cells. These sections of DNA have a base sequence that is complementary to a section of the mRNA transcribed from the gene coding for telomerase.

Explain how inserting small, single-stranded DNA could prevent **translation** of the mRNA to produce telomerase.

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..... [3]

[Total: 10]

5 A student investigated the effects of air movement on the rate of transpiration by using a potometer.

(a) Define the term transpiration.

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..... [2]

The potometer used by the student is shown in Fig. 5.1.

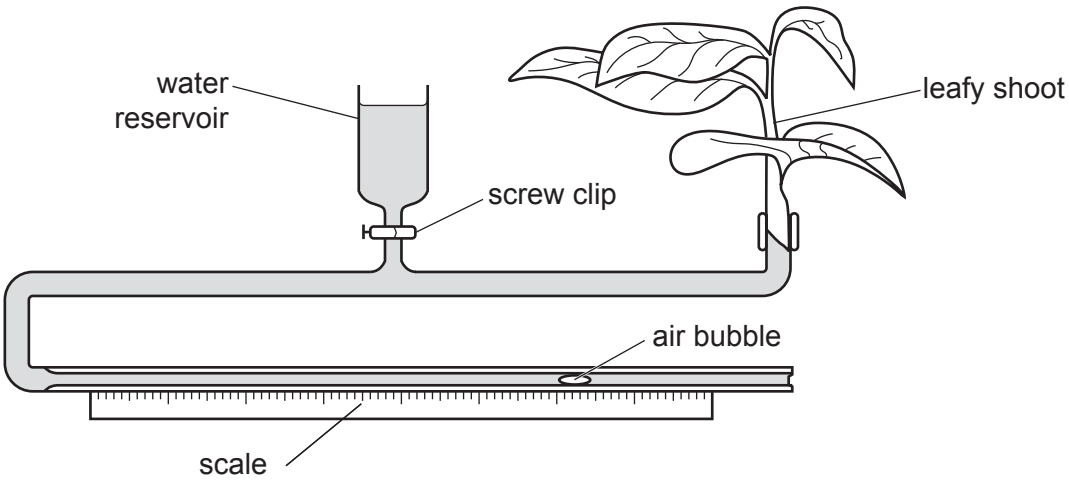


Fig. 5.1

The student recorded the distance the air bubble in the apparatus had moved after ten minutes with no air movement.

The rate of water uptake was used as a measure of the rate of transpiration.

The apparatus was then reset using the reservoir, and the experiment was repeated a further two times. All other variables were standardised during the three experiments.

Table 5.1 shows the results recorded by the student.

Table 5.1

experiment	distance moved by the bubble in 10 minutes / mm
1	12.5
2	12.0
3	11.5

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(b) Use Table 5.1 to calculate the mean rate of movement of the bubble.

..... mm min^{-1} [1]

(c) The student carried out another experiment using the same plant. In this experiment a fan was used to blow air across the leaves of the plant. All other variables were standardised.

The results showed that the bubble moved further in 10 minutes.

The student concluded that air movement increases the rate of transpiration.

Explain why air movement increases the rate of transpiration.

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..... [2]

(d) Explain how water moves up through a xylem vessel in the stem of the plant in the potometer, shown in Fig. 5.1.

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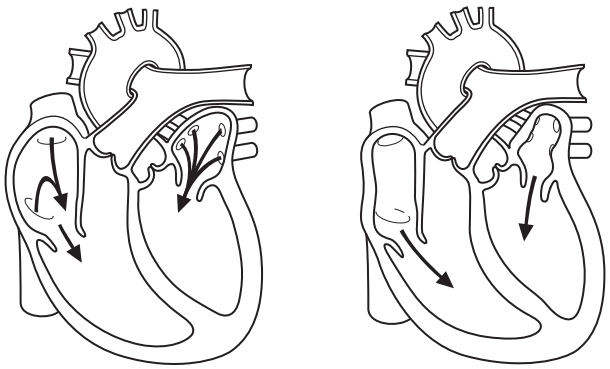
.....

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..... [4]

[Total: 9]

6 Fig. 6.1 is a diagram of sections through the heart showing two stages of the cardiac cycle, **A** and **B**.



Stage A **Stage B**

Fig. 6.1

(a) Name stage **B** in Fig. 6.1 **and** state one piece of evidence from the diagram that supports your answer.

stage **B** .....

evidence .....

.....

.....

.....

..... [2]

(b) **(i)** Draw a label line on Fig. 6.1 to identify **one** semilunar valve. Label the valve **S**. [1]

(ii) Describe the role of the semilunar valves in the cardiac cycle.

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..... [2]

[Total: 5]

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