Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2023**

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. Any blank pages are indicated.

DC (CE/AR) 316055/1

[Turn over

1 The cells in a tissue are often at different stages of the cell cycle.

(a) Fig. 1.1 shows cells at different stages of the cell cycle.

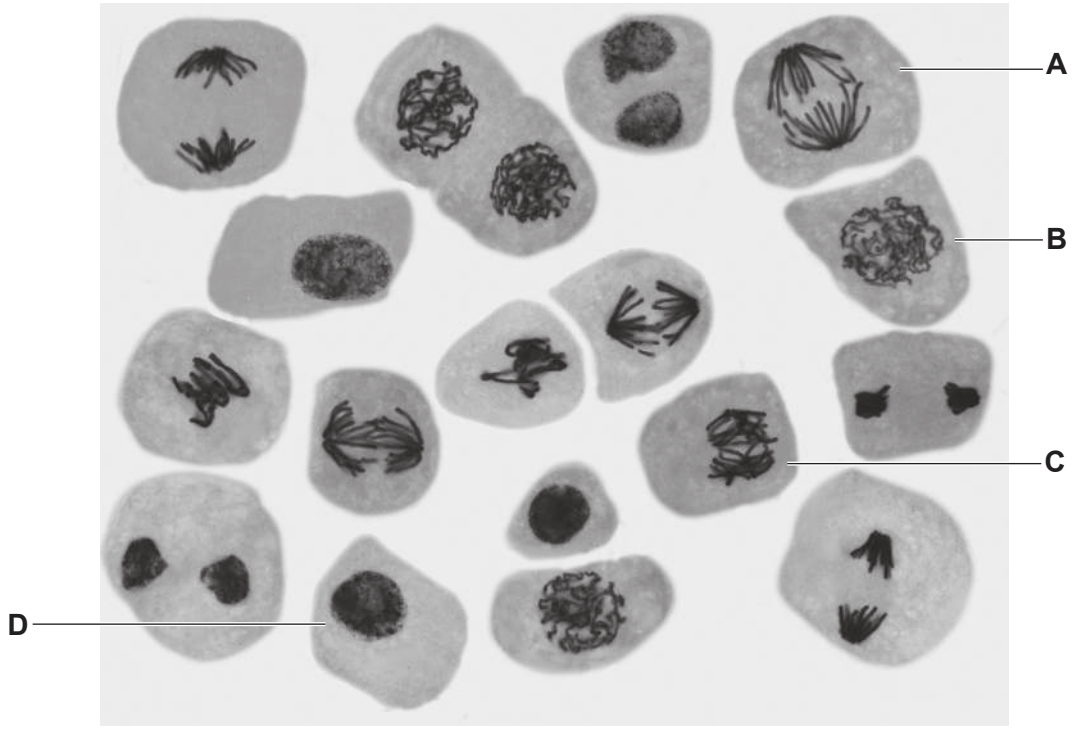

Fig. 1.1

(i) Identify the stages of mitosis occurring in the cells labelled **B** and **C** in Fig. 1.1.

B .....

C .....
[2]

(ii) Describe the behaviour of the chromosomes in the stage of mitosis shown in cell **A** in Fig. 1.1.

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..... [3]

(iii) Cell **D** in Fig. 1.1 is in interphase.

Describe the role of DNA ligase in interphase.

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..... [3]

(b) Telomerase is an enzyme that is active during interphase in some cells.

Telomerase helps to maintain telomeres present on chromosomes.

(i) State the location of telomeres on a chromosome.

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..... [1]

(ii) Some people with a long lifespan have cells showing a higher than normal activity of telomerase.

Suggest why a long lifespan could result from a higher telomerase activity.

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..... [2]

[Total: 11]

2 The number of cases of tuberculosis (TB) is affected by many biological, social and economic factors.

(a) The number of reported cases of TB in the USA between 1980 and 2000 is shown in Fig. 2.1.

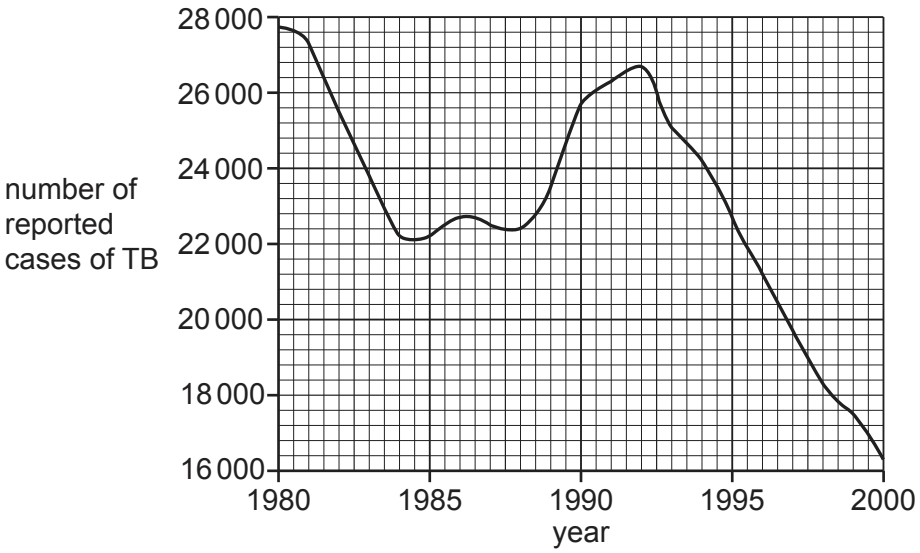

Fig. 2.1

(i) Describe the trends shown in Fig. 2.1 between 1980 and 2000.

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..... [3]

(ii) The number of reported cases of TB between 1984 and 1992 in the USA may have been affected by an increase in the number of people infected with HIV.

Explain how an increase in the number of people infected with HIV could have affected the number of TB cases.

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..... [2]

(b) *Mycobacterium tuberculosis* is a species of bacterium that causes TB. Strains of *M. tuberculosis* have evolved resistance to some of the antibiotics used to treat the disease.

State **two** ways that the impact of antibiotic resistance can be reduced.

1 .....

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2 .....

.....

[2]

(c) TB can affect every part of the human gas exchange system, including the trachea, bronchi and alveoli.

(i) The cartilage in the bronchi can be damaged in some people with TB.

Suggest the effect that damage to cartilage may have on the bronchi.

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..... [1]

(ii) Table 2.1 shows four types of cell and three structures found in the gas exchange system.

Complete Table 2.1 to show the distribution of cell types in each structure of the gas exchange system.

Use a tick (✓) if the cell type is present in the structure and a cross (✗) if the cell type is **not** present.

Put a tick (✓) or a cross (✗) in every box.

Table 2.1

cell type	alveolus	bronchus	trachea
ciliated epithelial cell			
goblet cell			
smooth muscle cell			
squamous epithelial cell			

[3]

[Total: 11]

3 Blood contains white blood cells and red blood cells.

(a) Fig. 3.1 is a photomicrograph showing different types of blood cell.

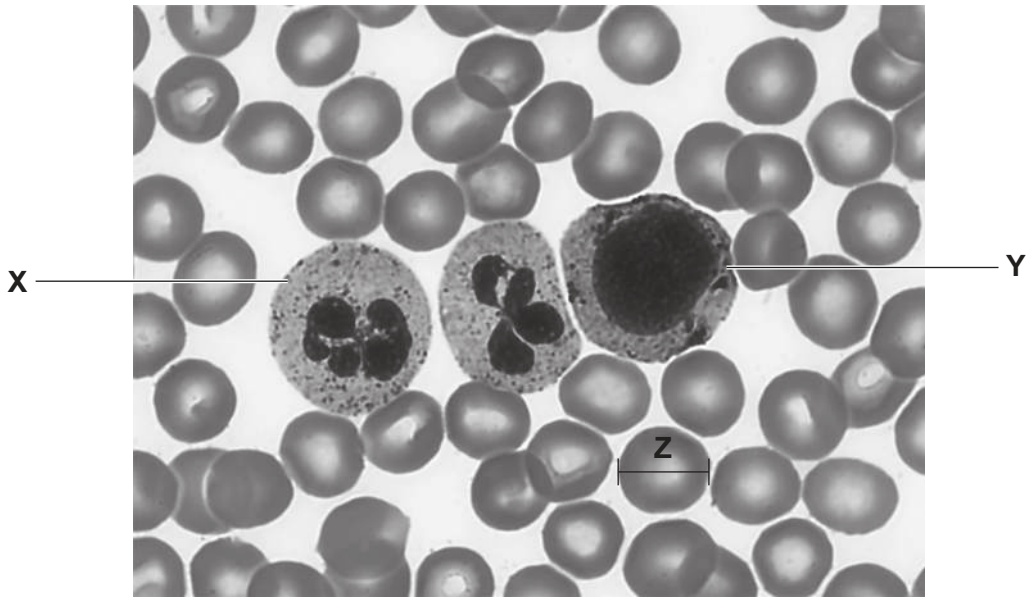

Fig. 3.1

(i) Identify cell **X** and cell **Y** in Fig. 3.1.

X .....

Y .....

[2]

(ii) The width of one of the cells in Fig. 3.1 is represented by the line **Z**.

The actual width of cell **Z** is 8 μm.

Calculate the magnification used to produce the image shown in Fig. 3.1.

Write down the formula you will use to make your calculation.

formula

magnification = x ..... [2]

(b) Carbonic anhydrase is an enzyme found in red blood cells.

(i) Describe how carbonic anhydrase is involved in the release of oxygen from red blood cells at respiring tissues.

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..... [4]

(ii) Sulfonamide is a competitive inhibitor of carbonic anhydrase.

Fig. 3.2 shows the effect of increasing substrate concentration on the rate of the reaction catalysed by carbonic anhydrase.

Sketch a curve **on Fig. 3.2** to show the effect of sulfonamide on the rate of reaction catalysed by carbonic anhydrase.

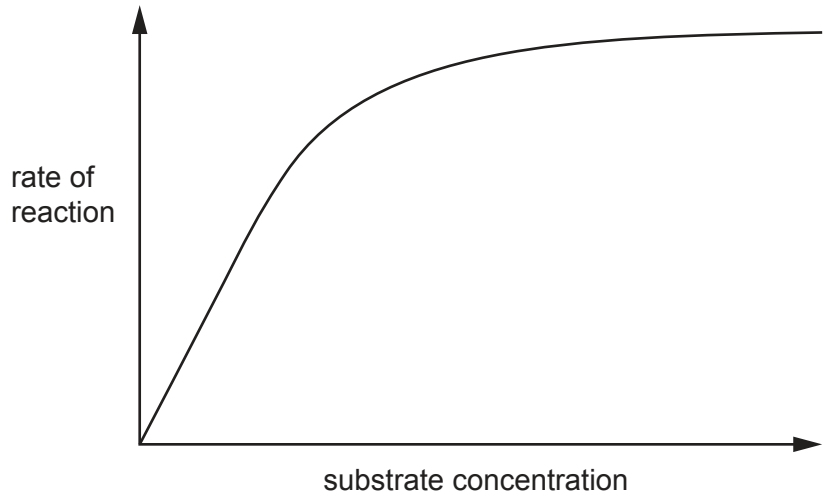

Fig. 3.2

[2]

[Total: 10]

4 Food crops such as barley and wheat contain gluten. Gluten contains two proteins, glutenin and gliadin.

(a) (i) Table 4.1 contains descriptions of the structures of glutenin and gliadin.

Complete Table 4.1 by writing the level of protein structure that applies to each description.

Table 4.1

description	level of protein structure
a gliadin protein is a single polypeptide that forms a compact structure	
20% of the amino acids in a glutenin molecule are glycine	
gliadin and glutenin molecules contain regions of β-pleated sheets	

[3]

(ii) Many genes in eukaryotic cells contain introns. The genes that code for gliadin do **not** contain introns.

Explain how a lack of introns in a gliadin gene affects the production of mRNA from the primary transcript.

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..... [1]

(b) Coeliac disease is a condition in which the immune system of a person responds to gluten in their diet.

In coeliac disease, there is a response to the presence of peptides (short chains of amino acids) that are produced as a result of gliadin digestion.

(i) The gliadin peptides produced as result of digestion are often as large as 33 amino acids in length. Intestinal cells take up large numbers of these peptides at the same time.

Suggest **and** explain how gliadin peptides are transported into intestinal cells.

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..... [2]

(ii) The presence of gliadin causes the immune system of a person with coeliac disease to respond by producing anti-gliadin antibodies.

Describe the sequence of events that results in the immune system producing anti-gliadin antibodies.

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..... [4]

[Total: 10]

5 Phloem and xylem are specialised tissues involved in the transport of water, ions and assimilates in plants.

(a) A photomicrograph of a transverse section of a dicotyledonous stem is shown in Fig. 5.1.

Fig. 5.1

Use label lines and labels to identify the phloem tissue **and** xylem tissue in Fig. 5.1. [2]

(b) **(i)** Describe how sucrose is transported in phloem sieve tubes from photosynthesising leaves to other parts of the plant.

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..... [4]

(ii) Cyanide ions (CN^-) inhibit the activity of an enzyme involved in respiration.

Suggest why the treatment of photosynthesising leaves with CN^- results in less sucrose being transported into phloem sieve tubes.

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..... [2]

(c) A student was asked to carry out semi-quantitative Benedict's tests on two solutions.

- Solution **A** was extracted from the cytoplasm of cells in the mesophyll tissue of photosynthesising leaves.
- Solution **B** was extracted from the phloem sap in phloem sieve tubes.

The solutions were taken from the same plant, and other variables were standardised.

For each solution, the student measured the time taken for the first colour change to appear.

Suggest which of the two solutions, **A** or **B**, would change colour in the shortest time.

Explain your answer.

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..... [2]

[Total: 10]

6 Polysaccharides, such as glycogen, are composed of thousands of monomers.

Oligosaccharides are carbohydrates that contain three to ten monomers in their chain.

(a) Nystose is one example of an oligosaccharide. The structure of nystose is shown in Fig. 6.1.

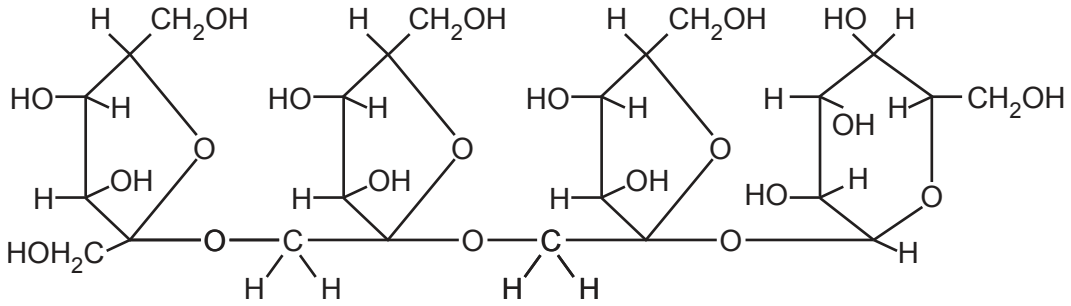

Fig. 6.1

State **three** differences between the structures of nystose and glycogen, **other** than the number of monomers in the molecules.

1 .....

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2 .....

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3 .....

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[3]

(b) Cells use oligosaccharides to synthesise glycoproteins, which are transported to cell surface membranes.

Describe the roles of the rough endoplasmic reticulum and the Golgi body in synthesising glycoproteins.

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(c) State **one** role of glycoproteins in the cell surface membrane.

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..... [1]

[Total: 8]

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