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* 0000800000001 * DFD

CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 4 2 1 7 6 7 7 0 4 9 *

BIOLOGY **9700/24**

Paper 2 AS Level Structured Questions **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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.

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1 The mitotic cell cycle occurs in plant cells and in animal cells. The cycle is a continuous process that can be divided into three main parts, interphase, mitosis and cytokinesis.

(a) One essential feature of the mitotic cell cycle is the replication of DNA in interphase, before mitosis begins.

(i) Explain why the replication of DNA needs to occur before mitosis begins.

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(ii) Name **two** enzymes that are essential for the successful replication of DNA in the S phase of interphase.

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(iii) The synthesis of histone proteins also occurs in interphase of the mitotic cell cycle.

State a phase of interphase during which the synthesis of histone proteins is likely to occur.

Explain your answer.

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(b) Figure 1.1 is a photomicrograph of part of a tissue where the cells are in different stages of the mitotic cell cycle.

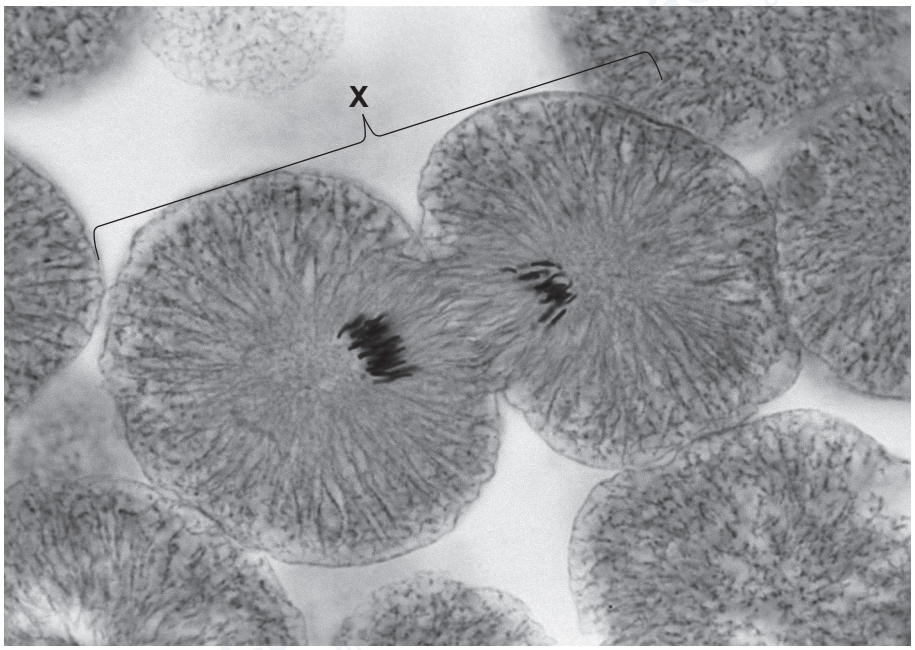


Figure 1.1

A student made two **incorrect** observations after studying Figure 1.1:

- Observation 1: Figure 1.1 shows plant cells.
- Observation 2: Area **X** shows two identical daughter cells in early interphase.

Explain why the observations made by the student are **not** correct.

Use evidence from Figure 1.1 to support your answer.

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2 Cholesterol oxidase is an enzyme produced by some species of bacteria. This enzyme is widely used in research, in diagnostic laboratories and in industry.

A student carried out an investigation into cholesterol oxidase produced by a soil-living bacterium. The bacterium secretes the enzyme to break down cholesterol in the external environment.

(a) State the term used to describe an enzyme that is synthesised in the cell and secreted to the external environment to act outside the cell.

..... [1]

(b) The student carried out experiments under standardised conditions of temperature and pH to measure the activity of cholesterol oxidase at different concentrations of substrate.

The student:

- converted the results to a unit for enzyme activity, expressed as $U\,cm^{-3}$
- plotted a graph to show the effect of substrate concentration on the activity of cholesterol oxidase
- used the graph to find out the maximum rate of reaction (V_{max}) and derive the Michaelis-Menten constant (K_m) of the enzyme
- determined the value of V_{max} as $580\,U\,cm^{-3}$
- derived the value of K_m as $0.15\,mmol\,dm^{-3}$.

Figure 2.1 shows the axes of the graph that the student used to plot the experimental results.

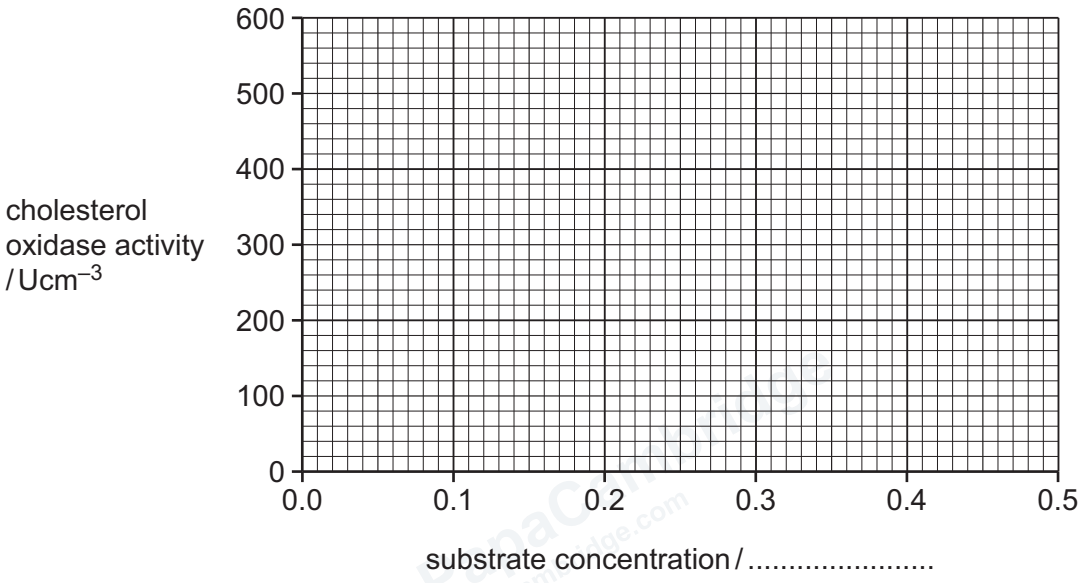


Figure 2.1

(i) Use the values of V_{max} and K_m obtained by the student to:

- add the correct units for substrate concentration on the dotted line provided in Figure 2.1
- sketch a curve on Figure 2.1 that will provide the same values of V_{max} and K_m as those obtained by the student.

[2]

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(ii) The student then carried out experiments to show the effect of pH on the activity of cholesterol oxidase.

The results are shown in Figure 2.2.

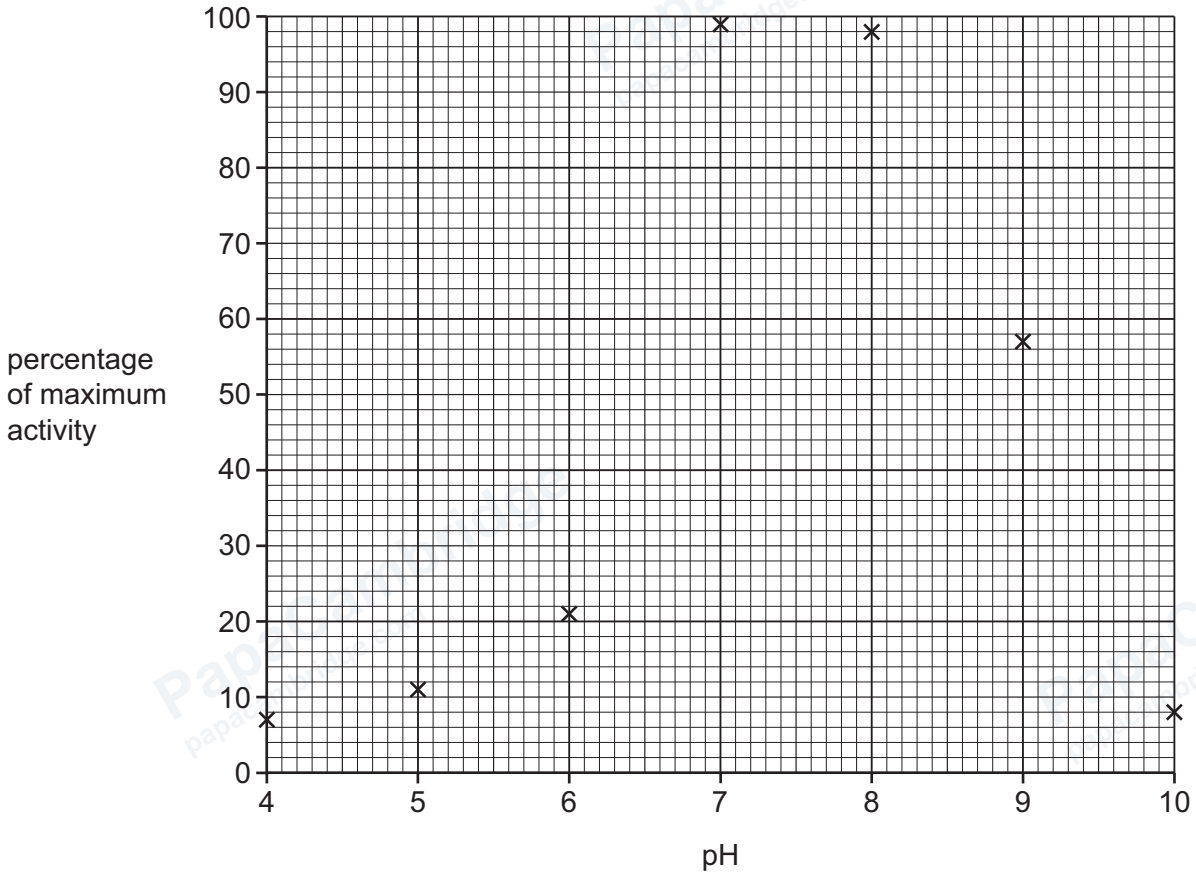


Figure 2.2

The student concluded that the cholesterol oxidase could be useful in the food industry to determine the concentration of cholesterol in food samples.

With reference to Figure 2.1 and Figure 2.2, explain whether you agree with the conclusion made by the student.

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(c) *Mycobacterium tuberculosis*, the pathogen that causes tuberculosis (TB), synthesises cholesterol oxidase. This enzyme is secreted by the bacterium and is **also** found in the cell surface membrane of the bacterium.

Suggest **and** explain how cholesterol oxidase can help *M. tuberculosis* to enter a host cell and then cause harm to the host cell.

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(d) There may be benefits in using a chemical that can act on cholesterol oxidase as a drug to treat people with TB and to control the spread of the disease.

Suggest **and** explain the potential benefits in using a chemical that can act on cholesterol oxidase as a drug to treat people with TB and to control the spread of the disease.

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

(a) A person who lives in an area where cholera is endemic (always present), and who does **not** have access to vaccines, can use different ways to prevent infection by *V. cholerae*.

Outline the ways in which a person who does **not** have access to vaccines can prevent infection by *V. cholerae*.

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(b) In 2023, the highest number of cases of cholera and deaths from cholera were in the World Health Organization Africa region.

Table 3.1 shows data for the five countries with the highest number of cases of cholera in the Africa region. The case fatality rate (CFR) is the number of deaths expressed as a percentage of the number of cases. This has been included for three countries.

Table 3.1

country	total number of cases	total number of deaths	CFR /%
Democratic Republic of the Congo	52 654	473	
Malawi	32 530	817	2.5
Ethiopia	30 389	446	1.5
Somalia	18 304	46	0.3
Sudan	8 895	246	

(i) A student made a statement after studying Table 3.1.

As the number of cases of cholera decreases, the CFR also decreases.

Explain whether you agree with this statement.

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(ii) The treatment for cholera varies depending on the severity of the disease. With the correct treatment, a person with cholera can make a full recovery.

The CFR for a particular country indicates if any improvements can be made in the response to the disease, for example in the availability and quality of treatment.

Table 3.1 shows that Malawi and Ethiopia have approximately the same number of cases of cholera but very different CFRs.

Suggest explanations for the differences in the CFR between Malawi and Ethiopia.

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(c) Genes that are essential for bacteria to survive are located on a large, circular DNA molecule in the cell cytoplasm. *V. cholerae* is unusual as it has two of these circular molecules.

(i) Explain what is meant by a gene.

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(ii) *V. cholerae* is a unicellular organism with a diameter similar to other bacteria.

V. cholerae has structural features that provide evidence that it is a bacterium, such as the presence of circular, double-stranded DNA.

State **other** structural features present in a *V. cholerae* cell, which would provide evidence that the organism is a bacterium.

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4 Figure 4.1 shows an oxygen dissociation curve of adult haemoglobin.

The curve is obtained by measuring the percentage saturation of haemoglobin with oxygen at different partial pressures of oxygen under standardised conditions.

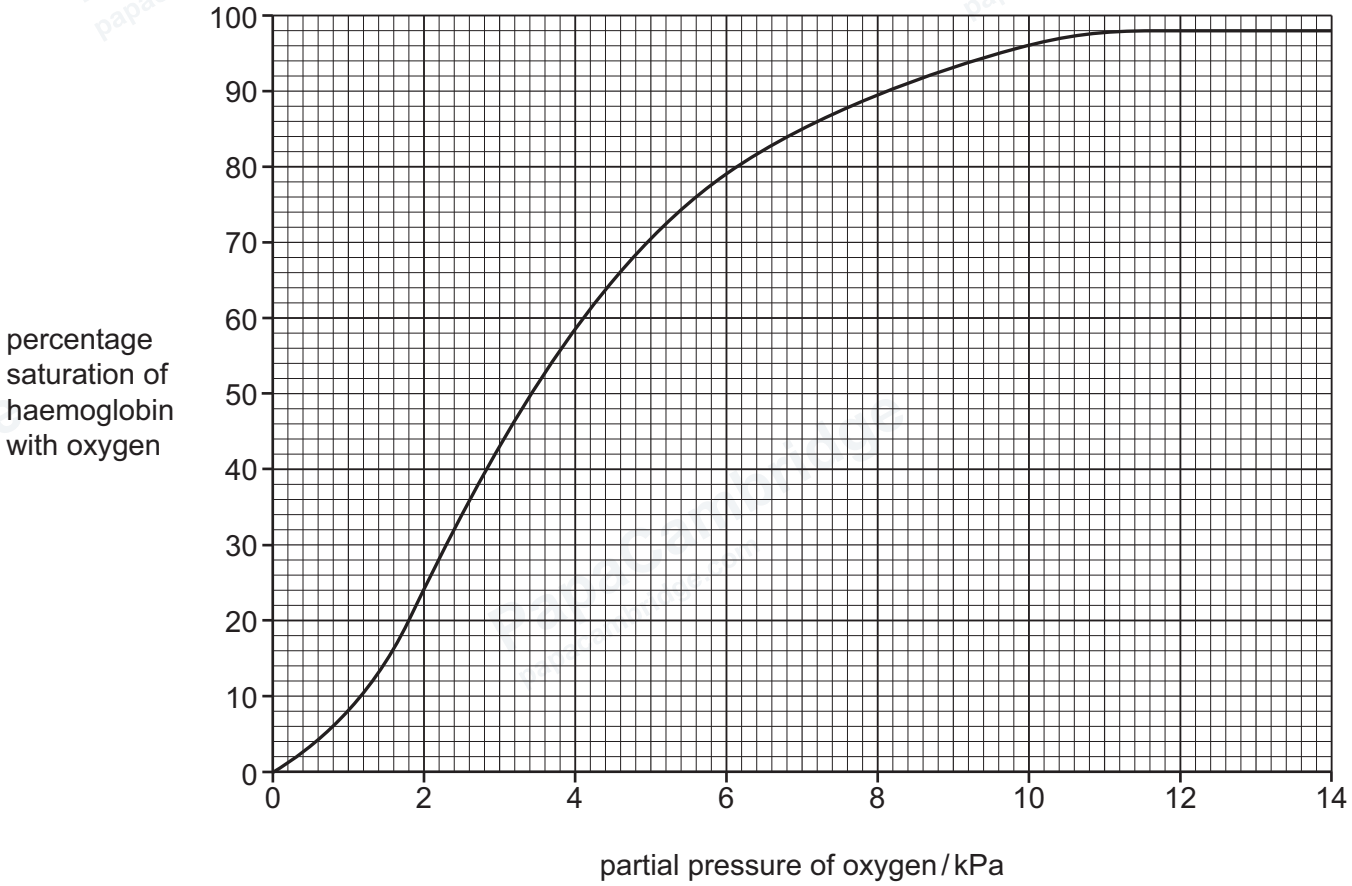


Figure 4.1

(a) At sea level, the partial pressure of oxygen in the alveoli remains approximately the same at 13.2 kPa to 13.3 kPa.

With reference to Figure 4.1, explain why a partial pressure of 13.2 kPa to 13.3 kPa in the alveoli allows the uptake of oxygen into the alveolar capillaries.

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(b) The partial pressure of oxygen (pO_2) in a tissue can vary under different conditions.

(i) With reference to Figure 4.1, calculate the difference in percentage saturation of haemoglobin with oxygen when a tissue pO_2 changes from 5.6 kPa to 2.4 kPa.

Show your working.

difference = ...% [2]

(ii) Suggest **one** factor that could cause a change in pO_2 of a tissue.

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..... [1]

(c) Blood leaving the capillary network of a body tissue is eventually returned to the right atrium of the heart.

Name the blood vessel that returns blood to the right atrium of the heart.

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5 Monocotyledons are herbaceous flowering plants that differ from dicotyledons in the distribution of tissues in their roots, stems and leaves.

(a) In monocotyledons and dicotyledons, water and mineral ions are taken up from the soil solution and move to the xylem by taking the apoplast and symplast pathways.

(i) State the term used to describe:

- the passive movement of substances, such as mineral ions, across the cell surface membrane into the root cell using membrane transport proteins

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- the process by which water passes across the cell surface membrane from the soil solution into a root cell.

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[2]

(ii) Water that has entered a root cell can move passively through plasmodesmata to an adjacent cell.

Explain what causes water to move from a root cell to an adjacent cell.

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(b) Figure 5.1 is a transverse section (TS) through the root of a monocotyledon.

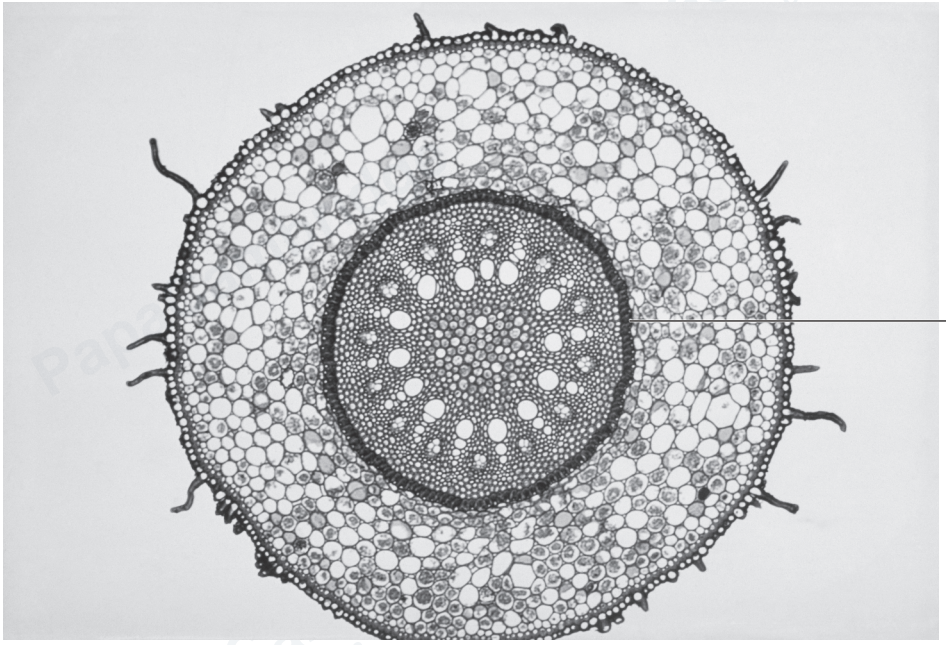


Figure 5.1

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(i) The monocotyledon root shown in Figure 5.1 has been stained to show the presence of a layer of cells, labelled **S**, where suberin is located. This layer of cells is also present in dicotyledons.

State:

- the name of the layer of cells in which suberin is located
- the role of suberin in this layer.

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(ii) Describe the similarities **and** differences in the distribution of tissues between the TS of the root of the herbaceous monocotyledon shown in Figure 5.1 and a TS of the root of a herbaceous dicotyledon.

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6 Lipids, proteins and polysaccharides are biological molecules that can be described as macromolecules.

(a) Explain why lipids, proteins and polysaccharides can be described as macromolecules, but only proteins and polysaccharides can be described as polymers.

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..... [2]

(b) Table 6.1 lists five biological molecules and shows three types of bond.

Table 6.1

biological molecule	peptide bond	glycosidic bond	ester bond
amylopectin			
cellulose			
collagen			
glycogen			
triglyceride			

(i) Complete Table 6.1 to show the type of bond present in each biological molecule listed.

Use **one** tick (✓) in each row to indicate the presence of a bond. [3]

(ii) With reference to Table 6.1, state the **two** biological molecules that are **most similar** to each other **and** explain your answer.

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(c) Mucin is an example of a glycoprotein. Mucin is present in the mucus that lines the surface of the ciliated epithelium of the gas exchange system.

Name **two** structures in the gas exchange system that produce mucus.

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(d) A large proportion of substances that are known as antigens are proteins, glycoproteins and polysaccharides.

Outline **other** features that would help to identify a substance as an antigen.

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