UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/22**

Paper 2 Structured Questions AS **October/November 2013**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black ink.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

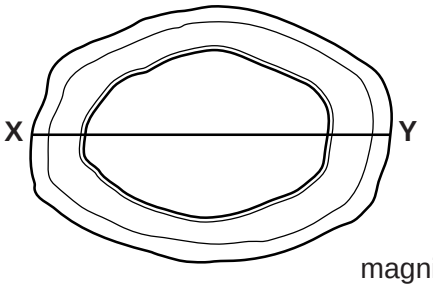
This document consists of **14** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

Answer **all** the questions.

For Examiner's Use

1 Fig. 1.1 is a diagram of a transverse section through a vein.



magnification × 35

Fig. 1.1

(a) Calculate the actual diameter of the vein marked by the line **X**–**Y**.

Show your working and give your answer in millimetres (mm).

answer ..... mm [2]

(b) The presence of a valve would help to confirm that the blood vessel in Fig. 1.1 is a vein and not an artery.

Describe three structural features of the blood vessel shown in Fig. 1.1 that would help to identify it as a vein and **not** as an artery.

1. .....

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2. .....

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3. .....

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(c) Explain how the following structural features of a capillary are related to its function.

For Examiner's Use

(i) The capillary wall is composed of a single layer of squamous epithelial cells.

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..... [1]

(ii) The diameter of the capillary lumen is approximately 8 μm.

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..... [1]

(d) The inner lining of arteries and veins is composed of a layer of epithelial cells supported by a layer of elastic and connective tissue. The epithelial cells are capable of cell division by mitosis.

(i) State the role of mitosis in cell division of epithelial cells.

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..... [2]

(ii) Explain why the epithelial cells undergo mitosis and **not** meiosis.

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(e) Fig. 1.2 is a diagram of a cell in late prophase of mitosis.

For Examiner's Use

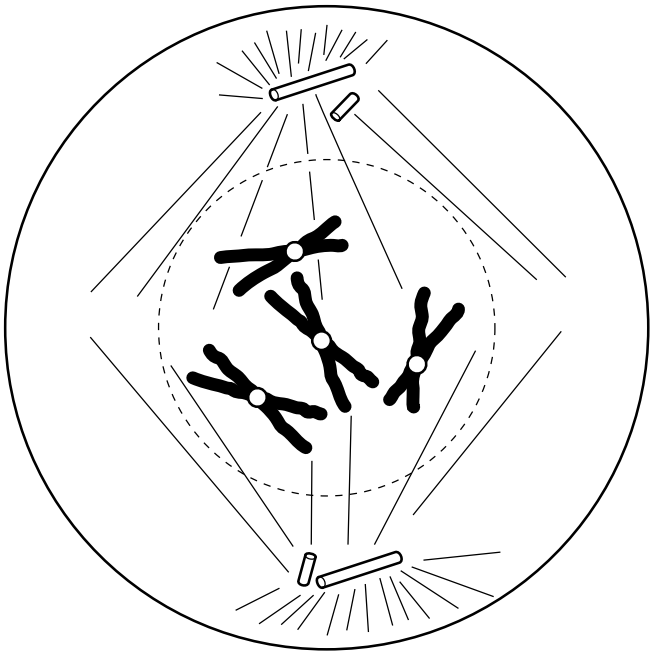

Fig. 1.2

Complete Fig. 1.3 to show the **same cell** in the **anaphase** stage of mitosis.

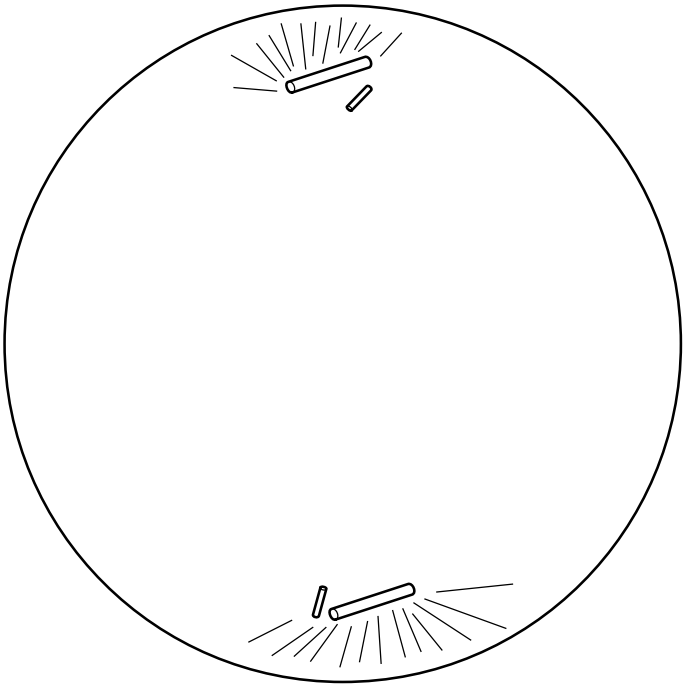

Fig. 1.3

[2]

[Total: 13]

2 Keratin and chitin are two important biological molecules. Keratin is found in hair, fur and skin. Chitin is a modified polysaccharide found in a number of different organisms, for example in fungal cell walls and the hard outer skeletons of insects.

For Examiner's Use

(a) Features of chitin and keratin are shown in the boxes in Fig. 2.1.

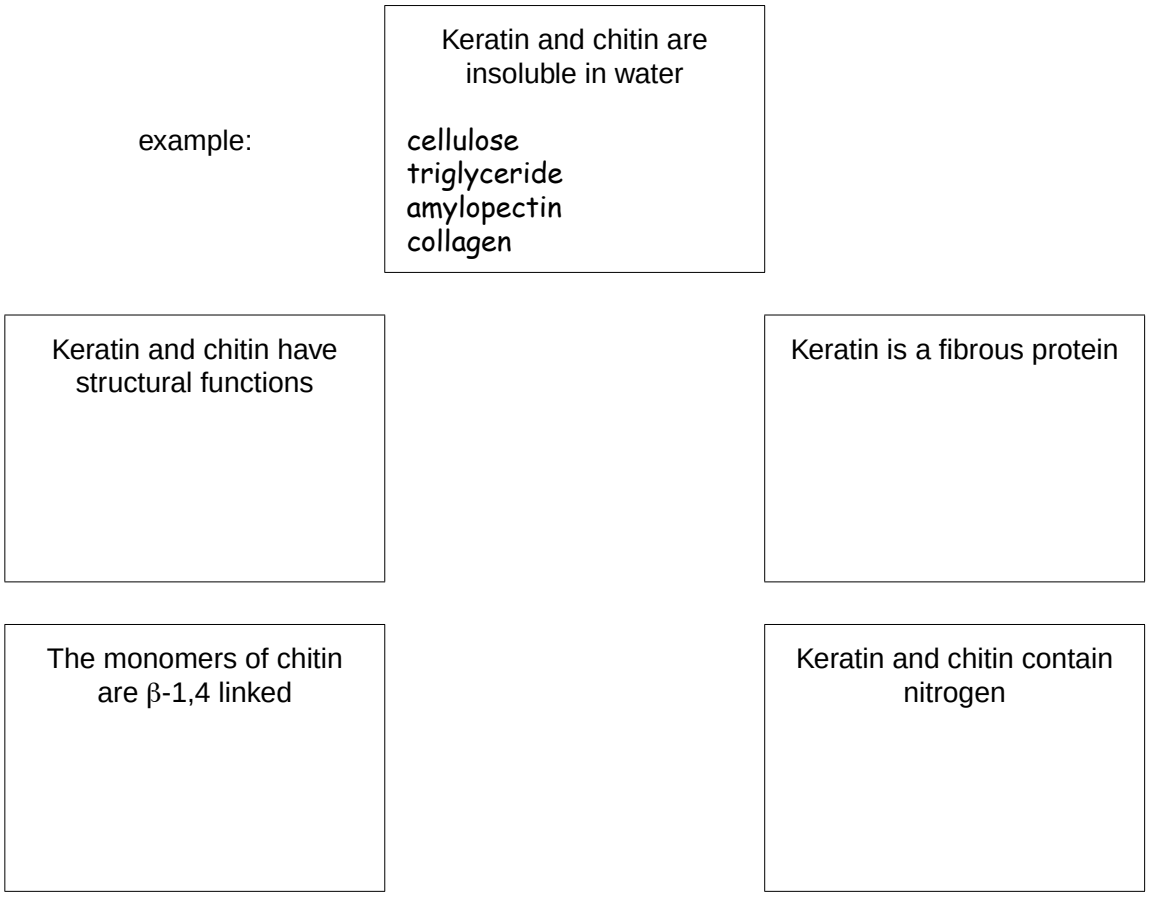

Fig. 2.1

Write, in each box, the biological molecules from the list below that have the same feature.

Each box may contain one, or more than one, biological molecule. The first box has been completed as an example.

amylopectin
cellulose
collagen
haemoglobin
mRNA
triglyceride

[5]

(b) Chitin and the products of chitin hydrolysis have many useful medical and environmental applications. Chitinase enzymes can be used commercially to hydrolyse chitin. Enzyme stability and activity are important considerations in technological applications of chitinase.

For Examiner's Use

Fig. 2.2 is a graph showing the effects of temperature on chitinase extracted from a soil bacterium.

The relative activity of the enzyme was measured at different temperatures, with 100% representing maximum enzyme activity.

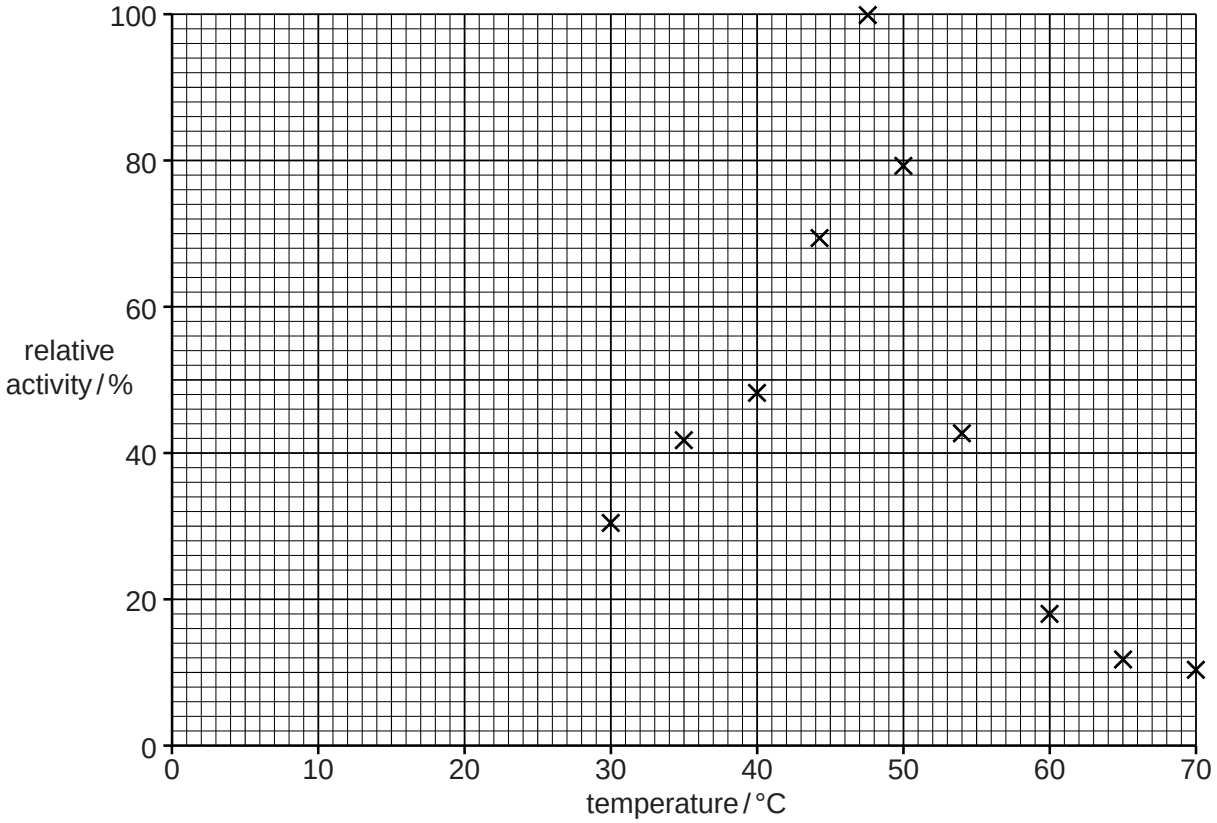

Fig. 2.2

(i) With reference to Fig. 2.2, state the optimum temperature for the chitinase enzyme.

.....[1]

Fig. 2.3 is a graph showing how temperature affects the stability of chitinase. The activity of the enzyme was measured over a time period of 72 hours at each of five different temperatures.

For Examiner's Use

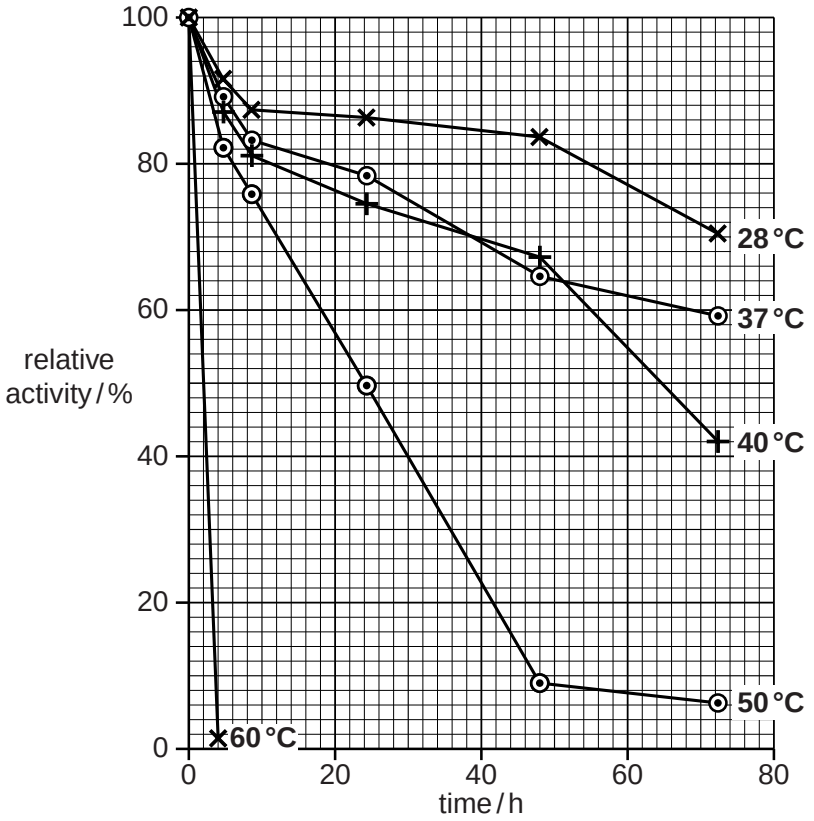

Fig. 2.3

(ii) With reference to Fig. 2.2 and Fig. 2.3, describe **and** discuss the effect of temperature on chitinase activity **and** stability.

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[Total: 11]

3 **(a)** Explain the need for transport systems in plants.

For Examiner's Use

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(b) Fig. 3.1 is a drawing of a transverse section through part of the stem of a dicotyledonous plant. Cell **A** and cell **B** are involved in the transport of dissolved organic molecules.

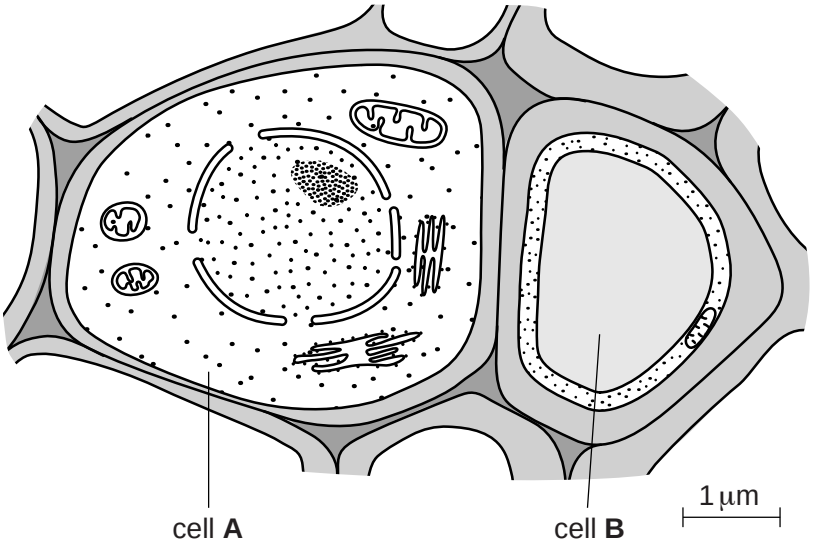

Fig. 3.1

(i) Name cell **A** and cell **B**.

*cell **A*** .....

*cell **B*** .....[1]

(ii) With reference to Fig. 3.1, explain how the different structures of cell types **A** and **B** are related to their function.

For Examiner's Use

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(c) Complete Table 3.1 to state four differences between transport systems in mammals and in plants.

Table 3.1

transport system in mammals	transport system in plants

[4]

[Total: 13]

4 *Staphylococcus aureus* is a bacterium that is the cause of many different infectious diseases.

For Examiner's Use

(a) Fig. 4.1 is a diagram of *S. aureus*.

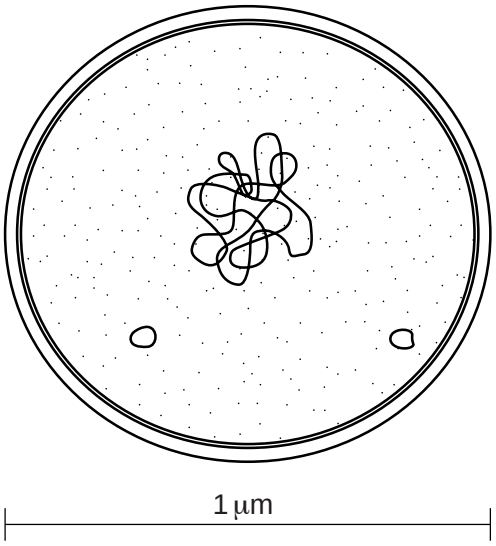

Fig. 4.1

(i) Cell structures, such as mitochondria, endoplasmic reticula (ER), Golgi apparatus, lysosomes and chloroplasts are found only in eukaryotic cells. These are not present in Fig. 4.1.

With reference to Fig. 4.1, describe **other features** that support the fact that *S. aureus* is a prokaryote.

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(ii) State the main difference in the composition of the plant cell wall compared to the bacterial cell wall.

plant cell wall .....

bacterial cell wall .....[2]

(b) Bacterial cells behave in a similar way to plant cells when immersed in solutions of different water potential.

For Examiner's Use

Suggest **and** explain what would happen to bacteria placed in a solution with a water potential more negative than their cell contents.

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.....[3]

(c) Some strains of *S. aureus* have become resistant to one or more of the antibiotics used to treat infections.

The mechanisms of antibiotic resistance involve proteins, for example:

- enzymes to breakdown antibiotics
- membrane proteins that inactivate antibiotics
- membrane proteins that pump out antibiotics.

Explain why antibiotic resistance arises as a result of mutation.

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[Total: 10]

5 Read the following passage.

For Examiner's Use

The three-toed sloth, *Bradypus variegatus*, is a very slow-moving mammal found in Central and South America that spends most of its life living in trees.

The thick, long grey fur of the sloth in Fig. 5.1 has a green appearance. Individual hairs of the sloth have grooves in them where water can collect.

Fig. 5.1

Research has shown that the green colour is due to the presence of algae living on the sloth's fur, the most common species being *Trichophilus welckeri*. Algae are eukaryotic, photosynthetic organisms.

Many other species of non-photosynthetic eukaryotes, both unicellular and multicellular, have been found living on the sloth's fur. These include different species of roundworms, insects and saprotrophic fungi.

(a) Explain the ecological terms *population* and *community*, **using examples given in the passage**.

For Examiner's Use

population .....

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community .....

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(b) Suggest why the sloth and its fur can be described as a small ecosystem.

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[Total: 7]

For Examiner's Use

6 **(a)** Nicotine, in cigarette smoke, is highly addictive. A nicotine vaccine has been developed to try and reduce the effects of addiction. The vaccine stimulates an immune response to produce antibodies that bind to the nicotine molecule. Fig. 6.1 is a diagram of an antibody molecule.

On Fig. 6.1:

- label **three** structural features that enable an antibody molecule to carry out its function.
- next to each label, state the function of the feature.

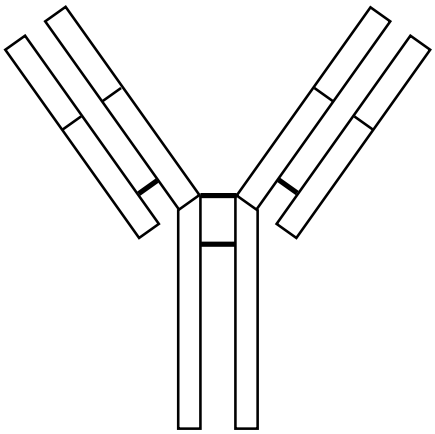

Fig. 6.1

[3]

(b) Nicotine has an effect on the cardiovascular system, such as making platelets sticky, so causing blood to clot. This increases the risk of thrombosis and reduces blood flow.

Outline **other** effects of nicotine on the cardiovascular system.

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[Total: 6]

15

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