Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0714856176

BIOLOGY **9700/23**

Paper 2 Structured Questions AS **May/June 2016**

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 on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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 **12** printed pages.

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Answer **all** the questions.

1 Fig. 1.1 is a photomicrograph of epithelial cells in the bronchus.

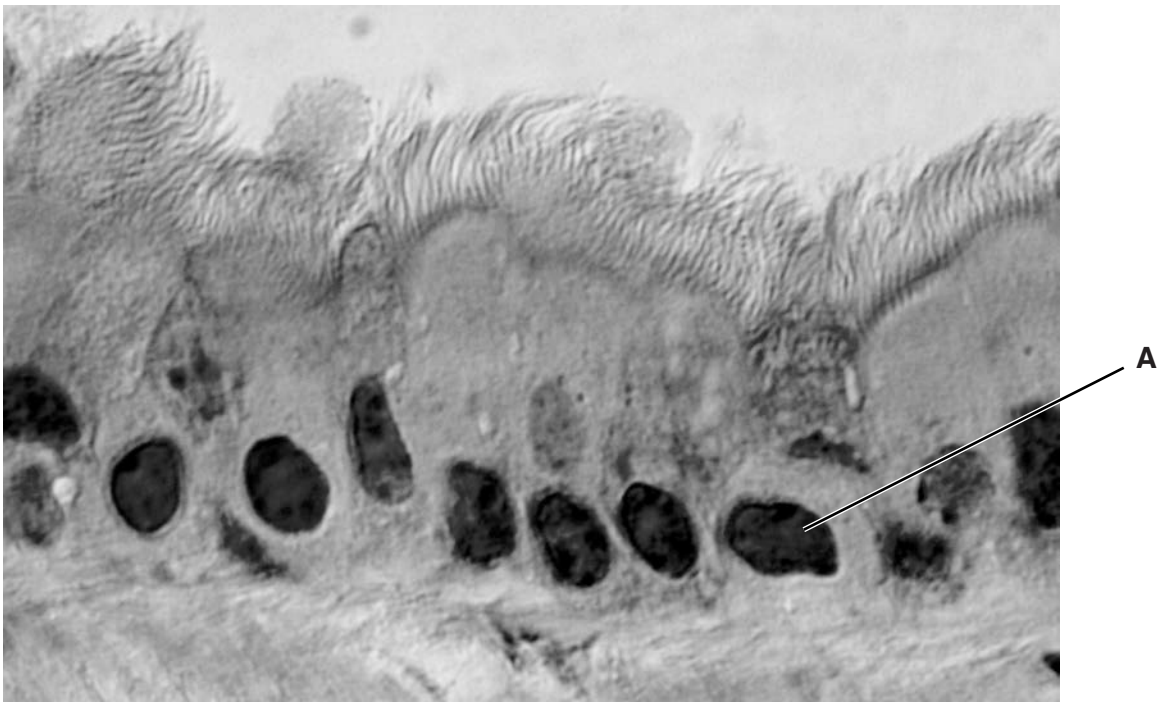


Fig. 1.1

(a) (i) Write a letter **X** on Fig. 1.1 to show the lumen of the bronchus. [1]

(ii) Name the structure in Fig. 1.1 labelled **A**.

.....[1]

(iii) State **one** feature of the cells, **visible in Fig. 1.1**, which indicates that these are **not** epithelial cells from the alveolus.

.....[1]

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(b) Epithelial cells are replaced when they are damaged.

(i) Name the type of cell division used to replace damaged epithelial cells.

.....[1]

(ii) The cells shown in Fig. 1.1 are from a non-smoker.

Smoking causes damage to the epithelial cells of the lungs.

Describe the appearance of the lining of the bronchus in a long-term smoker.

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.....[3]

[Total: 7]

2 Trypsin is a protease enzyme found in the digestive system.

Fig. 2.1 shows how the substrate concentration affects the rate of reaction of trypsin.

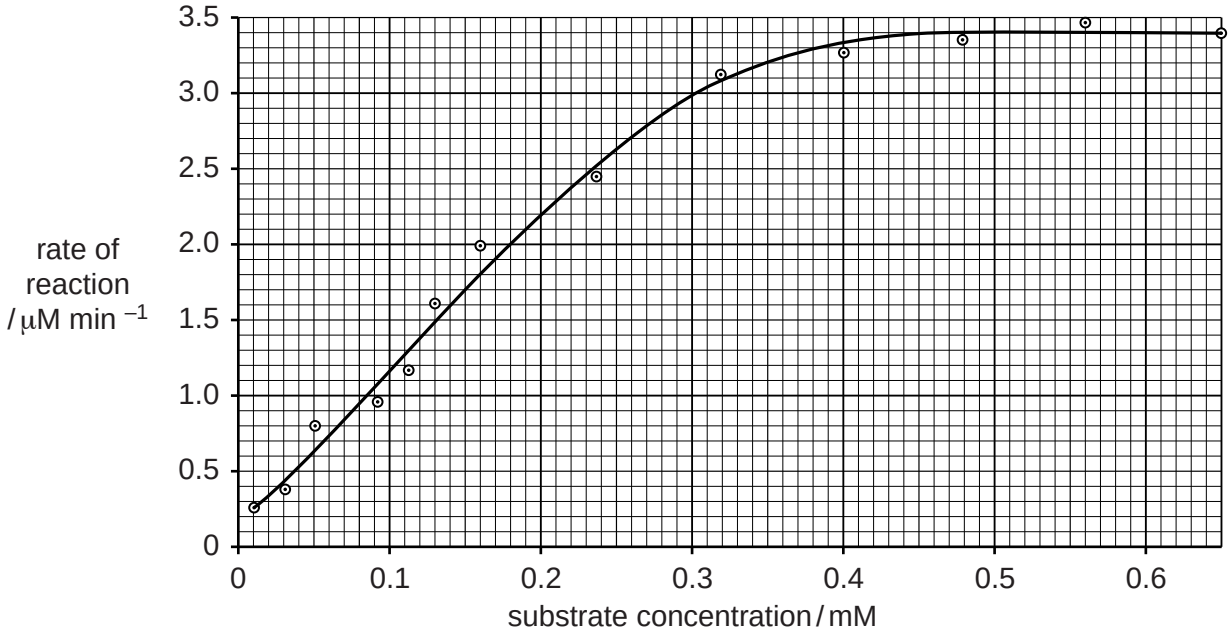


Fig. 2.1

(a) Use Fig. 2.1 to:

(i) determine V_{max} for trypsin

.....[1]

(ii) calculate K_m for trypsin.

Show your working.

.....[2]

(b) Describe **and** explain the shape of the curve in Fig. 2.1.

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.....[4]

(c) Trypsin is composed of one polypeptide chain of 223 amino acids.

The active site of trypsin contains three amino acids which catalyse a hydrolysis reaction. These three amino acids occupy the following positions in the primary structure of trypsin:

- histidine, position 57
- aspartate, position 102
- serine, position 195.

(i) In the functioning enzyme, these three amino acids are close together in the active site.

Explain how the structure of the protein makes this possible.

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.....[3]

(ii) When trypsin acts on a substrate, another substance is required as a reactant.

Name this other substance.

.....[1]

[Total: 11]

3 Rheumatoid arthritis (RA) is a disease of the joints in the human body.

(a) RA is classed as an auto-immune disease where the immune system treats some self antigens as non-self.

Explain what is meant by the term *non-self antigens*.

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.....[3]

(b) The symptoms of RA include inflammation of the joints which causes pain and difficulty in movement of the joint.

The inflammation is triggered by a chemical known as TNF-α, produced by macrophages.

One approach to the treatment of RA is by the use of monoclonal antibody against TNF-α.

Fig. 3.1 is a diagram of an antibody molecule.

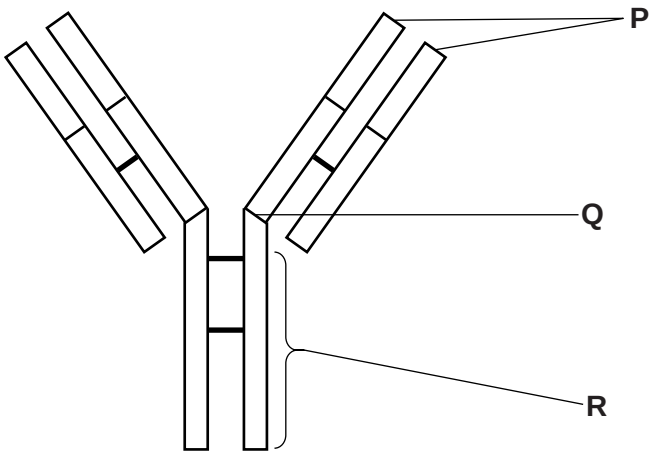


Fig. 3.1

(i) Name the parts of the antibody molecule labelled **P**, **Q** and **R**.

P .....

Q .....

R .....

[3]

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(ii) Name the type of bonds that hold the polypeptide chains together in the antibody structure.

.....[1]

(c) (i) Outline how monoclonal antibody against TNF-α is produced.

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.....[3]

(ii) Suggest how monoclonal antibody against TNF-α can reduce the symptoms of RA.

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.....[2]

[Total: 12]

4 Fig. 4.1 is an electron micrograph showing a section through the stem of Asian rice, *Oryza sativa*.

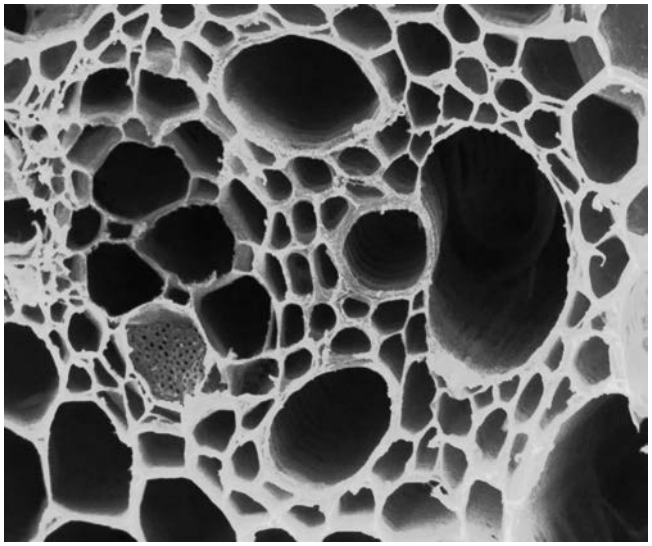


Fig. 4.1

(a) Draw a label line and label on Fig. 4.1 to show a phloem sieve tube. [1]

(b) Describe the function of phloem sieve tubes.

.....

.....

.....[2]

(c) In the root tip, some of the cells produced by mitosis differentiate into xylem vessel elements. During this differentiation, the structure of the cell wall changes.

Explain how the structure of the walls of xylem vessel elements are adapted to their functions.

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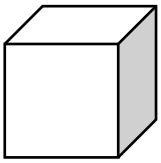
.....[3]

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(d) Organisms can be modelled as simple shapes for the calculation of surface area to volume ratios.

(i) Calculate the surface area to volume ratio of an animal modelled as a cube of side length 0.1 m.

Show your working.



surface area ..... m^2

volume ..... m^3

surface area to volume ratio .....
[3]

(ii) The surface area to volume ratio decreases as animals increase in size.

Use this fact to suggest why multicellular animals require transport systems.

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.....[2]

[Total: 11]

5 Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*.

(a) Describe how TB is transmitted.

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.....[2]

(b) Streptomycin was the first antibiotic used to treat TB.

During the first few years after the introduction of streptomycin treatment, an increasing number of *M. tuberculosis* bacteria developed resistance to streptomycin.

Outline how this happened.

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.....[4]

(c) The antibiotic rifampicin was introduced as an alternative to streptomycin.

Rifampicin acts by inhibiting the enzyme RNA polymerase.

RNA polymerase is the enzyme used in transcription.

(i) Explain what is meant by transcription.

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.....[2]

(ii) *M. tuberculosis* and humans both use RNA polymerase for transcription.

Suggest why rifampicin does **not** affect transcription in human cells.

.....

.....[1]

(d) Other drugs such as isoniazid are also used in the treatment of TB.

Some bacteria are now resistant to more than one of these drugs. These bacteria are known as multi-drug resistant (MDR) bacteria.

Outline the steps that can be taken to reduce the impact of drug resistance in bacteria.

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.....[3]

(e) Explain why antibiotics can be used to treat bacterial infections and not viral infections.

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.....[2]

[Total: 14]

6 Fig. 6.1 is a diagram of a section through a mammalian heart.

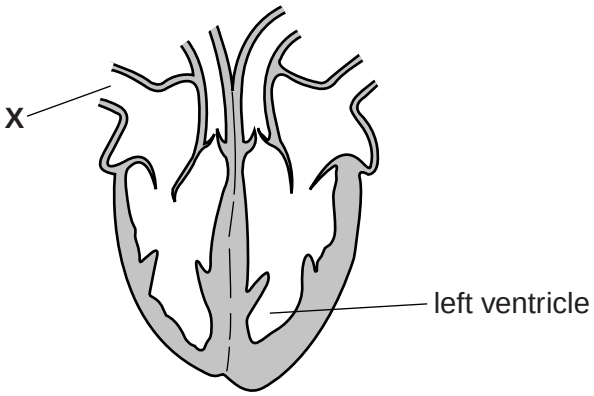


Fig. 6.1

(a) Name the blood vessel labelled **X**.

.....[1]

(b) Explain the difference in thickness between the muscle walls of the left and right ventricles.

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.....[3]

(c) Name the structure in the heart that acts as the pacemaker to initiate the cardiac cycle.

.....[1]

[Total: 5]

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