Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **9700/23**

Paper 2 Structured Questions AS **May/June 2015**

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 at the top of the page.
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.

Answer **all** the questions.

1 The cell surface membrane has a fluid mosaic structure.

(a) Describe what is meant by the term *fluid mosaic*.

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.....[2]

(b) In 1934, the biologists Davson and Danielli published their suggestion for the structure of the cell surface membrane, as shown in Fig. 1.1.

They suggested that the membrane was a phospholipid bilayer with a layer of hydrophilic protein on both surfaces.

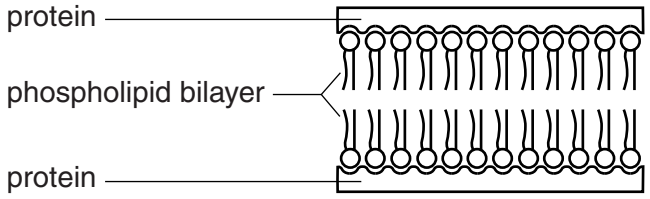

Fig 1.1

State **one** way in which the Davson-Danielli structure is similar to the fluid mosaic structure **and one** way in which it differs from the fluid mosaic model.

similarity

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.....[1]

difference

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.....[1]

(c) One way in which substances can cross cell membranes is by active transport.

Describe the mechanism of active transport.

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.....[3]

(d) High temperature can damage cell membranes. One factor contributing to this damage is the denaturation of membrane proteins.

Describe how proteins become denatured at high temperature **and** explain how this could lead to damaging cell membranes.

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.....[3]

[Total: 10]

2 DNA replication is an important event in the cell cycle.

(a) State when, during the cell cycle, DNA replication occurs.

.....[1]

(b) Fig. 2.1 shows pairing between two bases, **X** and **Y**, in a DNA molecule.

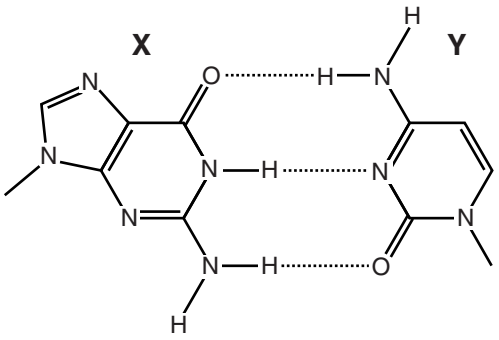

Fig. 2.1

(i) Name the type of bond shown by the dotted lines between the bases.

.....[1]

(ii) State which base, **X** or **Y**, is a pyrimidine **and** explain your answer.

.....

.....[1]

(c) The compound benzopyrene, found in tar from tobacco smoke, can become chemically changed in cells and interferes with DNA replication, causing gene mutations.

(i) State what is meant by the term *gene mutation*.

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.....[2]

(ii) Mutations that occur in dividing cells of the gas exchange system may result in lung cancer.

Suggest the differences in the cell cycle of a cancer cell compared with that of a normal cell of the same type.

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[Total: 7]

3 Fig. 3.1 is an electron micrograph of a type of B-lymphocyte called a plasma cell.

Plasma cells secrete antibody molecules.

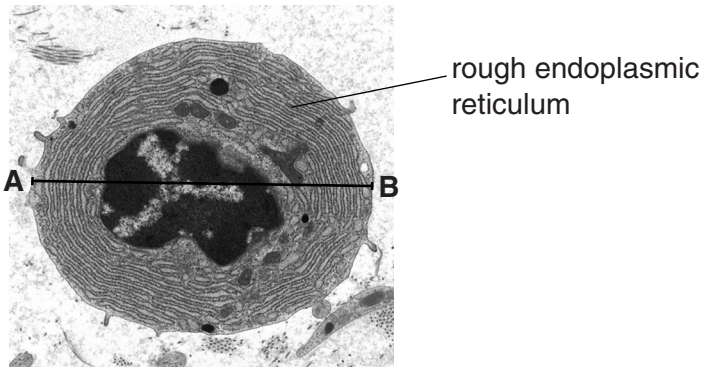

Fig. 3.1

(a) Suggest why plasma cells contain a large quantity of rough endoplasmic reticulum.

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.....[2]

(b) The diameter **A** – **B** of the plasma cell in Fig. 3.1 is 15 μm.

Calculate the magnification of Fig. 3.1.

Show your working.

magnification × ..... [2]

(c) Smallpox was the first disease to be eradicated by vaccination. The vaccine was effective for up to 10 years after one dose and did not require boosters within this time.

Name the causative organism (pathogen) of smallpox.

.....[1]

(d) When a person received the smallpox vaccine, the numbers of plasma cells specific for the smallpox pathogen were measured from blood samples taken over a period of 35 days.

Fig. 3.2 shows how the numbers of smallpox-specific plasma cells changed during 35 days after vaccination.

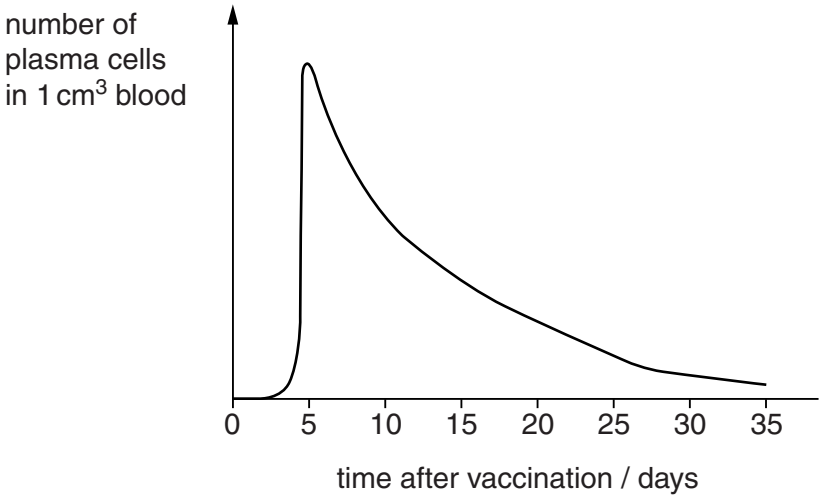

Fig. 3.2

Fig. 3.2 shows that the number of smallpox-specific plasma cells increases and then decreases within 35 days of vaccination.

Explain how a single dose of this vaccine can provide immunity for up to 10 years when the plasma cells are short-lived.

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.....[3]

(e) State two reasons why the vaccination programme was successful in eradicating smallpox.

1 .....

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2 .....

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[2]

(f) State the type of immunity provided by the smallpox vaccine.

.....[1]

[Total: 11]

4 Fig. 4.1 shows how blood pressure changes in the human systemic circulation.

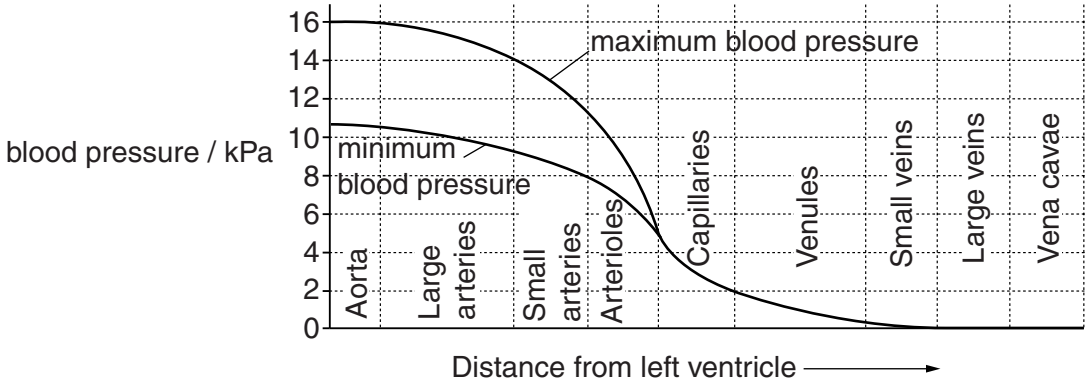

Fig. 4.1

(a) (i) Describe the changes in blood pressure shown in Fig. 4.1.

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.....[3]

(ii) Explain how the structure of veins is related to their function in returning blood to the heart.

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.....[2]

(b) Angiotensin is a polypeptide produced in the body to raise blood pressure.
Angiotensin converting enzyme (ACE) catalyses the final step in angiotensin production.
Fig. 4.2 shows this step.

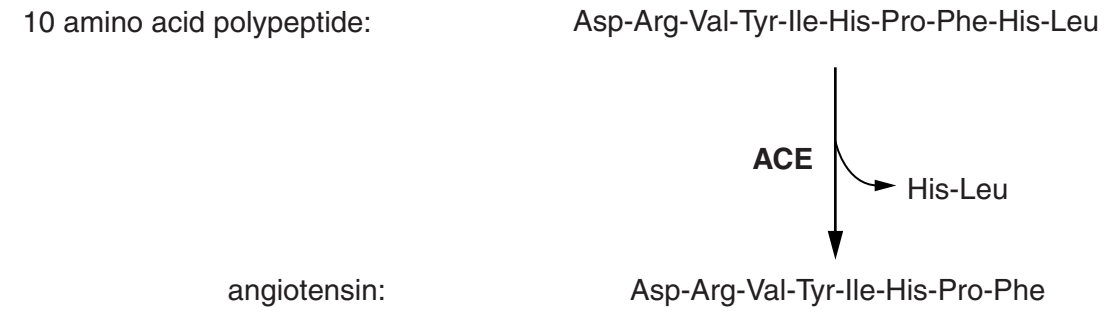

Fig. 4.2

Describe the step shown in Fig. 4.2.

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.....[3]

(c) People with high blood pressure can be treated with a drug which lowers the concentration of angiotensin in the blood.

This drug is a competitive inhibitor of ACE.

Explain how this drug acts as a competitive inhibitor.

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[Total: 11]

5 Fig. 5.1 is a light micrograph of some unicellular photosynthetic organisms called *Chlamydomonas*.

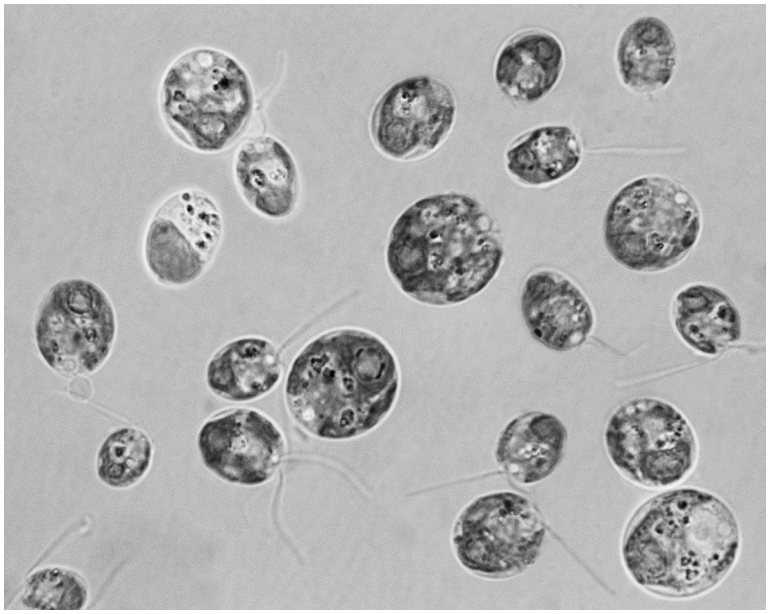

Fig. 5.1

(a) *Chlamydomonas* moves through water.

Explain why the light microscope rather than the electron microscope is used to observe the movement of *Chlamydomonas*.

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.....[2]

(b) *Chlamydomonas* live in water and obtain minerals, such as magnesium ions, from the water.

(i) State **one** role of magnesium ions in photosynthetic organisms.

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.....[1]

(ii) State two properties of water which make it possible for organisms such as *Chlamydomonas* to live in water.

1 .....

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2 .....

..... [2]

(c) Explain why multicellular organisms require transport systems while unicellular organisms, such as *Chlamydomonas*, do not.

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(d) Some plants, such as the banana plant, *Musa acuminata*, produce fruit. The banana fruit has a high content of carbohydrate.

Describe how sugars are transported in phloem sieve tubes from source to sink in plants such as *M. acuminata*.

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.....[5]

[Total: 14]

6 In the oceans, parts of the nitrogen cycle involve different bacteria from those that are involved on the land.

A bacterium found in oceans is *Nitrococcus mobilis*, which carries out the following step in the nitrogen cycle:

$$NO_2^- \longrightarrow NO_3^-$$

nitrite nitrate

(a) (i) Name the stage in the nitrogen cycle in which this step occurs.

.....[1]

(ii) Describe how nitrogen in nitrate can be returned to the atmosphere in the form of nitrogen gas.

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.....[2]

(b) Phytoplankton are microscopic photosynthetic organisms that are the main producers in ocean ecosystems. Their habitat is the upper layers of the oceans where sunlight can penetrate through the water.

Define the terms:

(i) ecosystem

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.....[2]

(ii) producer

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.....[1]

(iii) habitat.

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.....[1]

[Total: 7]

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