Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **February/March 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 in the spaces provided at the top of this 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.

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

CAMBRIDGE International Examinations

Answer **all** the questions.

1 Statements **A** to **E** relate to biological molecules.

For each statement, identify the most appropriate term that matches the description.

A The molecule formed from a condensation reaction between fructose and glucose.

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B The name of the bond broken when two amino acids are separated by hydrolysis.

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C The unbranched polymer consisting only of β-glucose molecules.

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D The reagent used to test for the presence of proteins.

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E The molecule produced, in addition to fatty acids, when a triglyceride is hydrolysed.

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[5]

[Total: 5]

2 Fig. 2.1 shows a root tip cell in interphase.

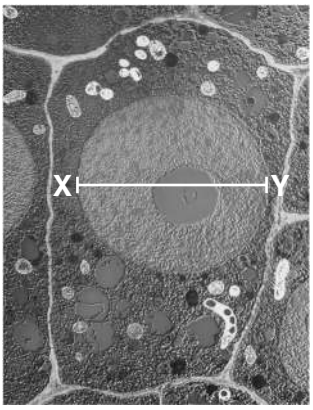

Fig. 2.1

(a) The actual diameter of the nucleus between **X** and **Y** is 9.0 µm.

Calculate the magnification of the plant cell shown in Fig. 2.1.

Write down the formula for magnification and use it to make your calculation. Show your working.

formula

magnification × ..... [3]

(b) Describe the structure of a nucleus.

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.....[3]

[Total: 6]

3 Erythropoietin, also known as EPO, is a large glycoprotein synthesised by specialised cells in the kidney. These cells are very sensitive to changes in oxygen concentration in the blood passing through the kidney and respond to a low oxygen concentration by increasing the synthesis of EPO.

EPO acts at the surface of particular target cells, such as cells in the bone marrow. These bone marrow cells are stimulated to produce red blood cells.

(a) (i) A low oxygen concentration also leads to an increase in the quantity of mRNA in the specialised cells in the kidney.

Suggest and explain why there is this increase in the quantity of mRNA.

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(ii) EPO is stored in secretory vesicles before being released from the specialised kidney cells.

Outline how EPO is released from the cells.

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(b) All cells of the body are exposed to circulating blood plasma containing EPO, but only particular target cells respond.

(i) Suggest and explain how EPO acts on target cells and why other cells are **not** affected.

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(ii) EPO cannot pass through the cell surface membrane to enter the bone marrow cells.

Suggest **one** reason why this is so.

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(c) Red blood cells originate from undifferentiated cells in the bone marrow that are capable of continuous mitotic cell division.

State the name of this type of undifferentiated cell.

.....[1]

(d) As part of an investigation into the body's response to EPO, a group of healthy young men were given injections of EPO every day for four weeks.

The haemoglobin (Hb) concentration for each subject was measured at the start of the investigation and then at intervals of one week for the next ten weeks. The first measurement was taken two weeks before the first EPO injection was given.

Fig. 3.1 shows the mean results for the subjects.

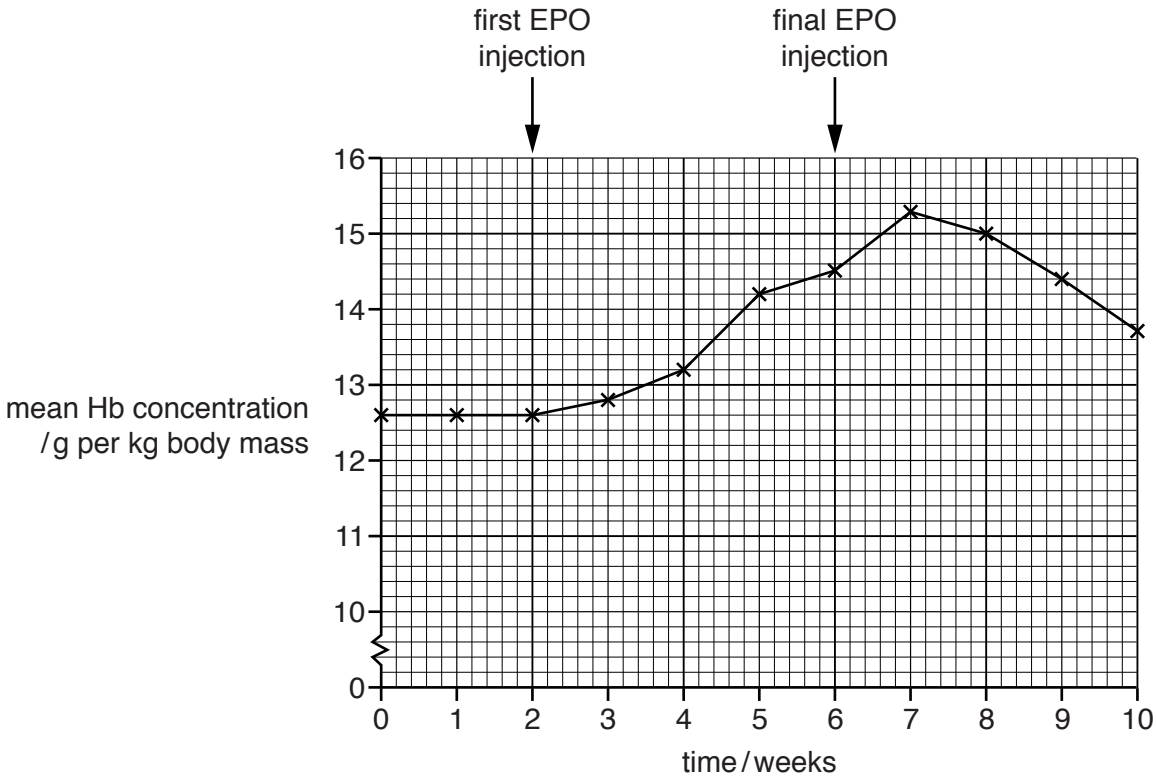

Fig. 3.1

Describe the results shown in Fig. 3.1 **and** suggest explanations for these results.

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(e) The concentration of EPO in the blood plasma of a person will increase when travelling from sea level to a high altitude. This is in response to the decrease in oxygen partial pressure in the atmosphere.

Explain why an increase in EPO blood plasma concentration will be of benefit if the person remains at high altitude.

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[Total: 16]

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4 *Morbillivirus*, which causes measles, and the human immunodeficiency virus (HIV) share these common features:

- outer envelope surrounding the protein coat
- RNA as the genetic material
- infect cells of the immune system.

(a) Compare the modes of transmission of *Morbillivirus* and HIV.

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(b) Antibiotics are not used to treat viral infections.

Explain why antibiotics do not affect viruses.

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(c) The structure of *Morbillivirus* is shown in Fig. 4.1.

Haemagglutinin (**H**) and fusion protein (**F**) are glycoproteins embedded in the viral envelope.

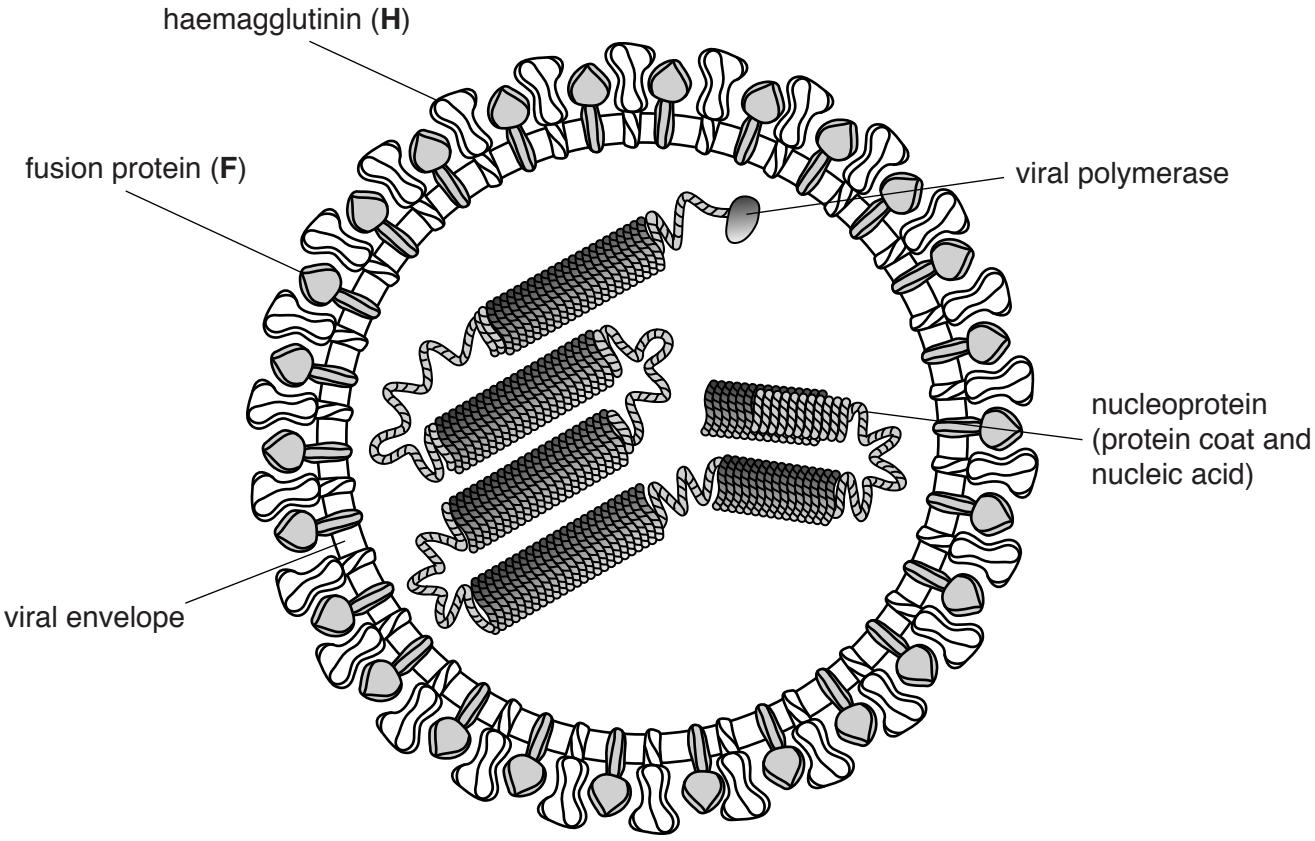

Fig. 4.1

Morbillivirus only infects cells that have a membrane glycoprotein known as signalling lymphocyte activation molecule (SLAM).

When *Morbillivirus* infects a cell, **H** acts before **F**. After the virus binds to the host cell, only the nucleoprotein with the viral polymerase enters the host cell and the virus is replicated.

New viral particles leave the host cell by budding from the cell surface membrane of the cell. This forms the main part of their envelope.

With reference to Fig. 4.1 and the information provided on pages 9 and 10,

(i) outline the structural features of the viral envelope of *Morbillivirus*

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(ii) suggest how *Morbillivirus* infects a cell with SLAM glycoproteins so that only nucleoprotein and viral polymerase enter

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(iii) suggest the role of viral polymerase in *Morbillivirus*.

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(d) HIV has an antigen known as p24.

One test for an early diagnosis of HIV infection uses a monoclonal antibody that identifies antigen p24.

(i) State the type of biological molecule that is represented by antigen p24.

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(ii) Outline how the monoclonal antibody against antigen p24 is produced.

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[Total: 17]

5 **(a)** Fig. 5.1 is a diagram of an ATP molecule.

Label Fig. 5.1 to show the structure of an ATP molecule.

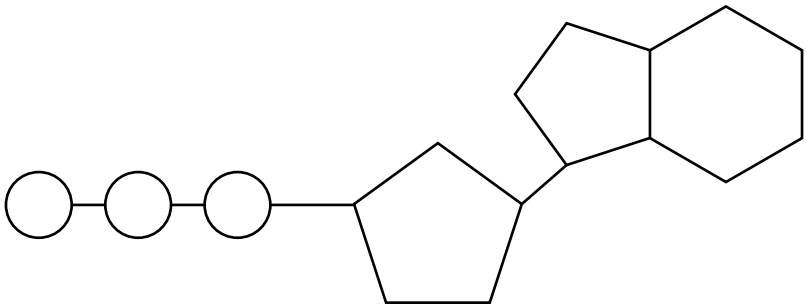

Fig. 5.1

[3]

(b) Statements **A**, **B**, **C** and **D** are part of the sequence of events that occur during the loading of sucrose into a phloem sieve tube.

A hydrogen ions bind to co-transporter protein
B diffusion of sucrose via plasmodesmata
C co-transport of hydrogen ions and sucrose
D hydrogen ions move out of companion cell

(i) State which event, **A**, **B**, **C** or **D**, requires ATP.

.....[1]

(ii) Place the letters **A** to **D** in the sequence that they would occur in the loading of sucrose into a phloem sieve tube.

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(iii) State the name used to describe any area within a plant where sucrose is loaded into a phloem sieve tube.

.....[1]

(c) ATP is used during translation in amino acid activation, when an amino acid becomes attached to its specific tRNA molecule having a particular anticodon. The reaction requires an enzyme called aminoacyl tRNA synthetase.

(i) Explain why a particular amino acid needs to be linked to a specific tRNA molecule.

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(ii) The pH of the cytoplasm of most cells varies slightly around pH7. At extremes of pH, enzymes can become denatured.

Explain how the structure of an enzyme such as aminoacyl tRNA synthetase would be altered if the pH of the cytoplasm became too acidic.

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(iii) Aminoacyl tRNA synthetase uses the induced fit mechanism.

Explain the induced fit mechanism.

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[Total: 12]

6 **(a)** Fig. 6.1 shows the first three structures of the human gas exchange system through which air from the external atmosphere passes during inhalation.

Complete Fig. 6.1 to show the pathway that air takes during inhalation.

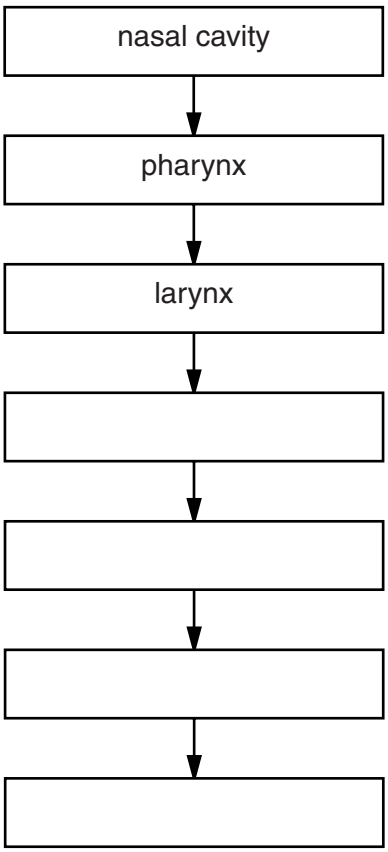

Fig. 6.1

[2]

(b) The inhalation of tobacco smoke can lead to chronic obstructive pulmonary disease (COPD). COPD is a term used to describe a collection of lung diseases.

Name two smoking-related diseases associated with COPD.

1 .....

2 .....[2]

[Total: 4]

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