Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1784306385

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **May/June 2019**

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 **15** printed pages and **1** blank page.

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Cambridge Assessment International Education

[Turn over

Answer **all** questions.

1 Fig. 1.1 is a photomicrograph of a low power image of part of the common sunflower, *Helianthus annuus*. Fig. 1.1 is a transverse section.

Fig. 1.1

(a) State, **with a reason**, whether Fig. 1.1 shows a section through the root or the stem of *H. annuus*.

It is a stem as vascular bundles are around the edges and the pith is in the center

..... [1]

(b) Cell type **A** in Fig. 1.1 has a large central vacuole.

Suggest, with reasons, the role of the tissue formed by this type of cell.

- provides support
- stores water
- storage of starch

..... [2]

(c) Structure **B** in Fig. 1.1 contains phloem tissue and xylem tissue and other tissues that provide support.

(i) Name structure **B**.

vascular bundle ..... [1]

(ii) The actual length of structure **B** is 650 μm.

State the actual length of structure **B** in mm.

0.65mm ..... [1]

(d) When structure **B** is observed at a higher magnification, more detail of xylem vessel elements and phloem sieve tube elements can be seen.

Outline the differences in the structure of a xylem vessel element and a phloem sieve tube element.

- Xylem has no cytoplasm while phloem sieve tube does
- Xylem has no organelles while phloem has some organelles.
- Xylem is lignified while phloem has no lignin
- Xylem has no end walls / no sieve plate
- Xylem contains pits
- Xylem has no plasmodesmata
- Xylem has a thicker cell wall. ..... [3]

[Total: 8]

2 Some tissues of the gas exchange system include cells that are able to produce and secrete mucins. Mucins are stored in vesicles in these cells, ready for secretion. Once outside the cell, mucins adsorb water to form mucus.

(a) Name the structures in the gas exchange system that produce and secrete mucins.

Mucous gland cells and goblet cells

..... [2]

(b) Mucins are described as glycosylated proteins. The process of glycosylation involves the addition of sugar components after polypeptides are synthesised.

Suggest **one** location in the cell where glycosylation of mucin could occur.

golgi body OR RER ..... [1]

(c) The processes that occur in the production and secretion of mucins are listed.

translation **exocytosis** **glycosylation** **transcription**

Complete Table 2.1 by writing the processes in the correct order in which they would take place.

Table 2.1

first process	transcription
second process	translation
third process	glycosylation
fourth process	exocytosis

[2]

(d) Chloride ions move out of the mucin-producing cells at the same time as mucin is secreted.

Suggest **and** explain how the exit of chloride ions helps the formation of mucus from mucin.

Chloride leaving cell causes water potential out of the cel to decrease. Hence, water potential gradient is created resulting in water to leave the cell by osmosis to be taken up by mucin to form mucus from high to low water potential.

[3]

(e) The gas exchange system includes some cells that are able to divide by mitosis.

Explain why it is important to have these cells in the gas exchange system.

As to produce new cells that are genetically identical to replace old cells and repair tissue. They are there to increase number of cells to accomodate increase in size of gaseous exchange system in growing infants.

[3]

[Total: 11]

3 Fig. 3.1 is a photomicrograph of human blood cells from a healthy individual who lives at sea level. The cells labelled **C**, **D** and **E** are white blood cells.

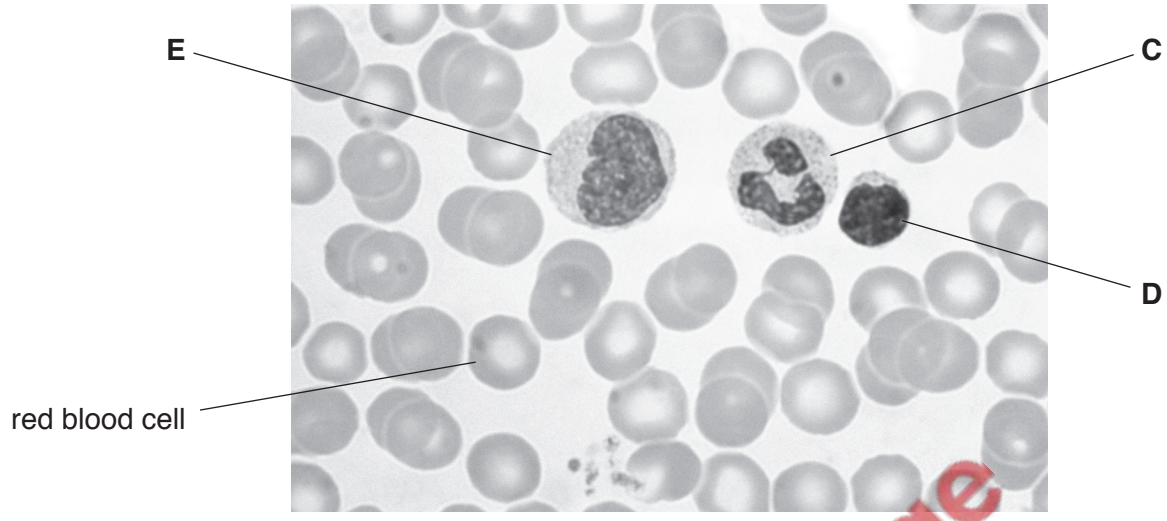

Fig. 3.1

(a) Name cells **C**, **D** and **E**.

C neutrophil

D lymphocyte

E monocyte [3]

(b) In humans, an increase in the white blood cell count can be associated with leukaemias and with infectious diseases, such as measles.

Chronic lymphocytic leukaemia (CLL) is a type of cancer that starts in the bone marrow. In the early stages, many people with CLL feel well. The disease is sometimes diagnosed by chance during a routine blood analysis, when a high white blood cell count is noticed. Many of these white blood cells are only partially mature.

(i) Suggest why CLL starts in the bone marrow and **not** in any other location in the body.

As lymphocytes / blood cells originate from the bone marrow as bone marrow has stem cells which are multipotent. Bone marrow has cells that can carry out mitosis / cell division to make many cells. [2]

(ii) Explain why a high white blood cell count is a feature of measles and of CLL.

measles Immune response stimulated so antigen recognition occurs stimulating lymphocyte to undergo clonal proliferation

CLL resulted by uncontrolled mitosis as of a mutation so cells do not respond to signals that control division. [3]

(c) Most of the oxygen that enters the mammalian circulatory system is transported by red blood cells.

(i) Describe **and** explain the passage of oxygen across the cell surface membrane of the red blood cell.

Simple diffusion of oxygen across the phospholipid bilayer from high to low concentration. This is as oxygen is small sized and non-polar/ uncharged.

[2]

(ii) At a high altitude, the partial pressure of oxygen in the atmosphere is lower than at sea level. If a person travels from low altitude to high altitude and remains there for a few weeks, the red blood cell count increases.

Explain why the body needs to respond to high altitude by increasing the number of red blood cells.

There is less oxygen in inhaled air so Hb carries less oxygen due to Hb having lower affinity for oxygen so more Hb required so more red blood cells to compensate hence same amount of oxygen reaches body cells compared to at low altitude.

[3]

(d) Polypeptide synthesis occurs before a red blood cell is released into the circulation.

The *HBB* gene codes for the β-globin polypeptide of haemoglobin.

There are two alleles of *HBB*, known as Hb^A and Hb^S.

Describe the difference between the Hb^A allele and the Hb^S allele **and** state how this difference affects:

- the β-globin polypeptide
- the haemoglobin molecule.

Alleles have different base sequences resulting in different polypeptide sequences as of base substitution hence alleles have different mRNA codons which results in one amino acid change of glutamic acid to valine. This changes Hb's tertiary structure s.o hydrophobic amino acid faces outside instead of towards the center. so oxygen taken up less easily.

[4]

[Total: 17]

4 The bacterium *Vibrio cholerae* is the causative organism of the infectious disease cholera.

V. cholerae has structural features typical of all bacterial cells. It also has a flagellum for movement.

(a) Fig. 4.1 is an outline drawing of *V. cholerae*.

Complete Fig. 4.1 by drawing **and** labelling the structures found in *V. cholerae*.

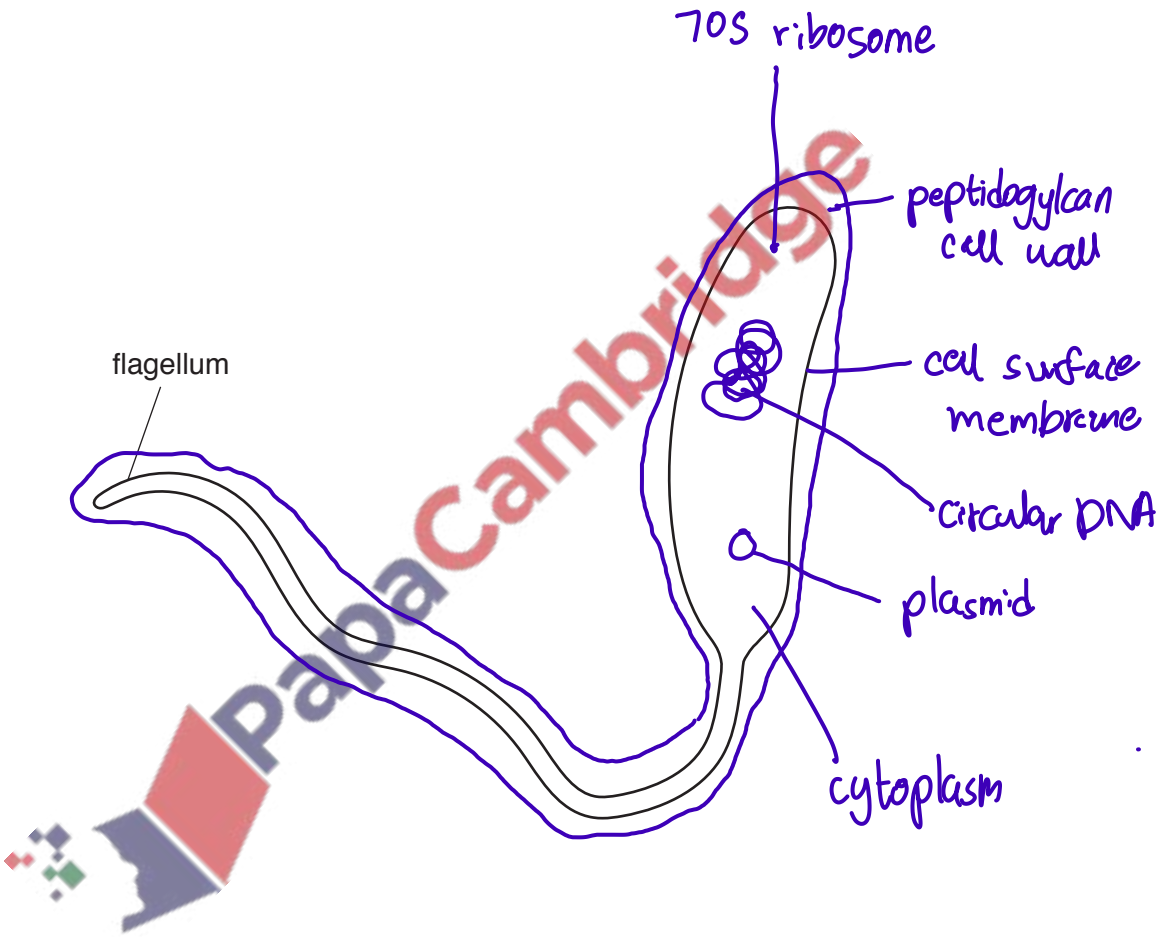

Fig. 4.1

[4]

(b) The World Health Organization (WHO) collects data about cholera from the 194 countries that are members of the World Health Assembly (WHA).

In 2015:

- there were cases of cholera in 42 of the member countries of the WHA
- the total number of cases of cholera reported was 172 454
- there were deaths as a result of cholera in 23 of these countries
- the total number of deaths from cholera reported was 1304.

The case fatality rate for cholera is the proportion of cases of cholera that results in death within a particular time period.

A country with cases of cholera that are properly treated should have a case fatality rate of less than 1%.

(i) Calculate the case fatality rate for the 42 member countries of the WHA for 2015.

Give your answer to the nearest 0.1%.

$\frac{1304}{172454} \times 100 = 0.8\%$

case fatality rate = 0.8 % [1]

(ii) Many of the 23 countries reporting deaths from cholera in 2015 had a case fatality rate of less than 1%.

However, two of the 23 countries had case fatality rates greater than 5%.

Suggest **two** explanations for the higher case fatality rate in these two countries.

As of delay in diagnosis and delay in treatment by ORS (oral rehydrating solution). Also there could be a lack of antibiotic therapy and the people could have antibiotic resistant strains.

[2]

(c) In 2010, the country of Haiti experienced a major earthquake. This led to an outbreak of cholera.

(i) Explain why an earthquake may lead to a cholera outbreak.

Poor sanitation following earthquake and damage to sewage treatment plants resulting in water being contaminated with sewage.

[1]

(ii) Fig. 4.2 shows data about cholera collected by WHO over a period of 8 years, from 2008 to 2015. These data include:

- the total number of cases of cholera for each year
- the number of countries in each year that had cases of cholera.

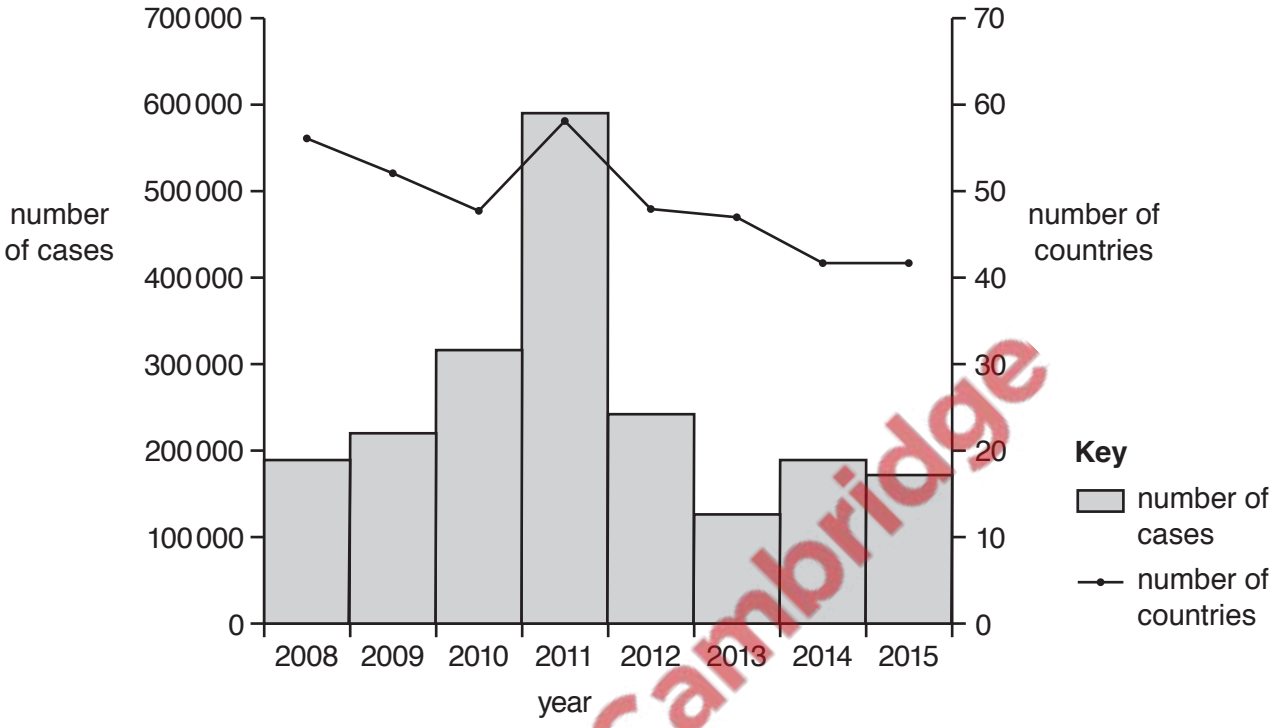

Fig. 4.2

Comment on the trends shown in Fig. 4.2.

• 2011 had the highest number of cases as of outbreak of cholera in 2010 in Haiti and an epidemic: Cholera spread to countries neighbouring Haiti.
• Overall decrease in number of countries with cases of cholera.
• The decrease in number of countries could be due to improved infrastructure of water treatment.
• Lowest number of cases in 2013

[3]

[Total: 11]

5 Cells contain carbohydrates, proteins, lipids and nucleic acids.

(a) Fig. 5.1 is a list of biological molecules, some of which are components of larger molecules.

cellulose
thymine nucleotide
α-glucose
β-glucose
messenger RNA
glycogen
glycine
α-globin

Fig. 5.1

Complete Table 5.1 by using **only** the molecules listed in Fig. 5.1.

- Each example can be written under **one or more** correct headings.
- **All** the examples in Fig. 5.1 should appear at least **once** in Table 5.1.

Table 5.1

examples			
monomers	polymers	monosaccharides	polysaccharides
glycine α-glucose β-glucose thymine nucleotide	glycogen cellulose α-globin messenger RNA	α-glucose β-glucose	glycogen cellulose

[5]

(b) Explain how the structure of phospholipids allows the formation of the phospholipid bilayer of cell membranes.

- phosphate head that is polar and hydrophilic
- fatty acid tails that are non-polar and hydrophobic
- heads face watery environment
- tails form hydrophobic core
- tails form hydrophobic interactions with each other.

[3]

[Total: 8]

6 Catalase is an enzyme that catalyses the breakdown of hydrogen peroxide, which is a waste product of cell metabolism.

The reaction catalysed by catalase is shown in Fig. 6.1.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

Fig. 6.1

(a) A student carried out two experiments to investigate the progress of the reaction shown in Fig. 6.1. Potato tissue was used as the source of the enzyme.

Six pieces of potato were cut, each measuring 20 mm × 10 mm × 10 mm.

In the first experiment, hydrogen peroxide solution was added to three of the pieces of potato tissue and the progress of the reaction was measured.

Fig. 6.2 shows how the first experiment was set up.

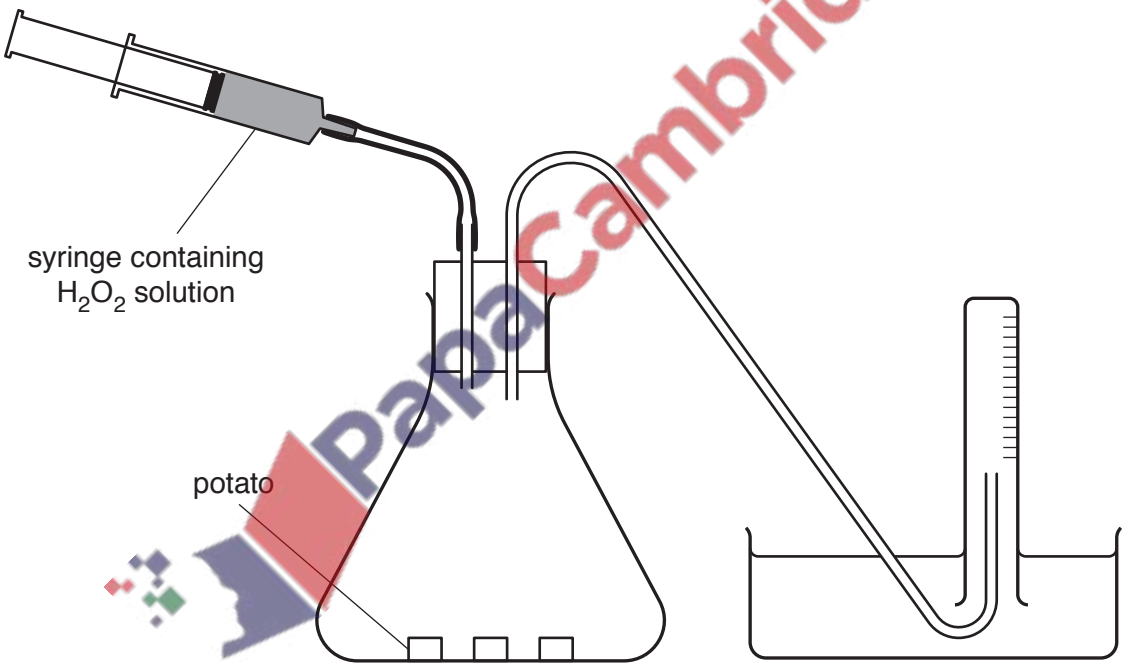

Fig. 6.2

(i) Suggest how the progress of the reaction could be measured.

The volume of water displaced by oxygen in a certain time will tell us rate of the reaction.

..... [2]

(ii) In the second experiment, the student cut each of the three remaining pieces of potato to obtain six pieces, each measuring 10 mm × 10 mm × 10 mm.

Using exactly the same conditions, the student measured the progress of the reaction and obtained different results to the first experiment.

Explain why the results of the second experiment were different from the results of the first experiment.

Greater surface area over which catalase is released. Also as greater number of cells cut open to release catalase, there will be more catalase present so higher rate of reaction.

[2]

(b) The student then investigated the effect of temperature on the activity of catalase.

On Fig. 6.3, sketch a curve to show how temperature affects the activity of an enzyme such as catalase.

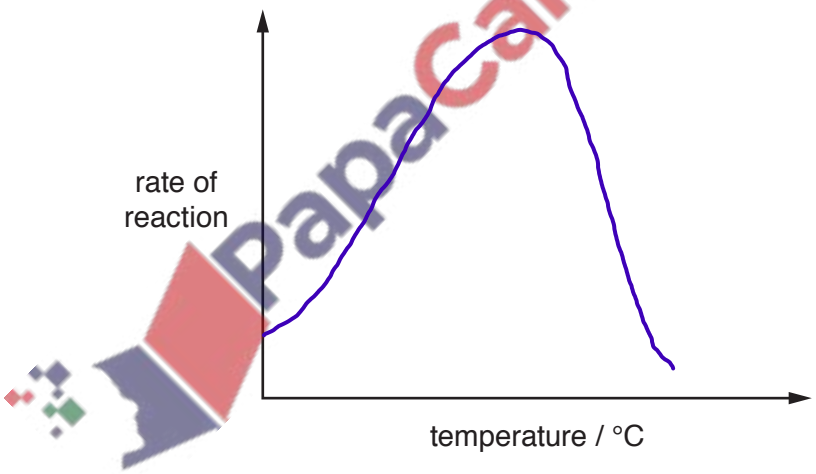

Fig. 6.3

[1]

[Total: 5]

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