Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*2170745614*

**BIOLOGY** **9700/22**

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

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CAMBRIDGE International Examinations

Answer **all** the questions.

**1** Statements **A** to **E** are about the structure and functioning of enzymes.

State the correct term to match each of the statements **A** to **E**.

**A** The energy level, lowered by enzyme action, that needs to be overcome by reactants in order for products to be formed.

.....

**B** The mechanism of enzyme action that relies on the active site being partially flexible and changing shape in order to bind the substrate.

.....

**C** The term to describe a protein, such as an enzyme, with a tertiary or quaternary structure that results in an approximately spherical shape.

.....

**D** The term for enzymes that function outside cells.

.....

**E** The concentration of substrate that enables an enzyme to achieve half the maximum rate of reaction.

.....

[5]

[Total: 5]

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**2** Marram grass, *Ammophila arenaria*, is an important plant of sand dunes. Leaves of marram grass are well adapted to reduce water loss by transpiration.

Fig. 2.1 is a photomicrograph of a section though the leaf of marram grass.

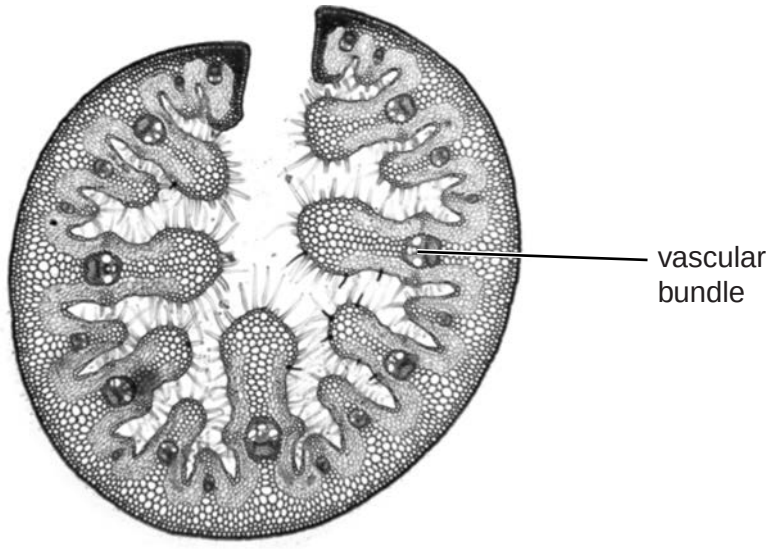


**Fig. 2.1**

**(a)** Examples of adaptations to reduce water loss by transpiration include a thick cuticle and no stomata on the outer surface, and stomata in pits on the inner surface.

**(i)** State **one** other adaptation, visible in Fig. 2.1, which reduces water loss by transpiration.

.....[1]

**(ii)** Explain how this adaptation reduces water loss.

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.....[2]

**(b)** State the term used to describe a plant type that has adaptations to reduce water loss by transpiration.

.....[1]

[Total: 4]

**3** Globally, measles is an important disease that mainly affects children. Many deaths from measles occur in children under five years of age.

Table 3.1 shows the population of six countries in Africa in 2009 and the number of cases of measles per 100 000 people for the four years 2009 to 2012.
All six countries are classified as low-income countries.

**Table 3.1**

| country | population in 2009 | number of cases per 100 000 people | | | |
|---|---|---|---|---|---|
| | | 2009 | 2010 | 2011 | 2012 |
| Central African Republic | 4 266 000 | 0.26 | 0.05 | 15.31 | 3.12 |
| Chad | 11 371 000 | 1.45 | 1.66 | 71.60 | 0.96 |
| Eritrea | 5 558 000 | 1.48 | 0.89 | 0.81 | 3.16 |
| Ethiopia | 84 838 000 | 1.39 | 4.86 | 3.64 | 4.74 |
| Gambia | 1 628 000 | 0.00 | 0.12 | 0.00 | 0.00 |
| Niger | 15 303 000 | 5.23 | 2.34 | 4.67 | 1.59 |

**(a) (i)** The actual number of cases of measles in Chad in 2009 was 165 and in Eritrea was 82.

Calculate the actual number of cases of measles in Ethiopia in 2009.
Show your working.

[2]

**(ii)** Use the data for Chad, Eritrea and Ethopia to explain the advantages of showing the data in Table 3.1 as number of cases of measles per 100 000 people rather than the actual number of cases.

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.....[3]

**Question 3 continues on page 6**

Fig. 3.1 shows the percentage of children vaccinated against measles over a ten year period from 2003 to 2012.

- The percentage vaccinated represents children under one year of age who have been given at least one dose of the vaccine against measles in the given year.
- The data are for the six African countries shown in Table 3.1.

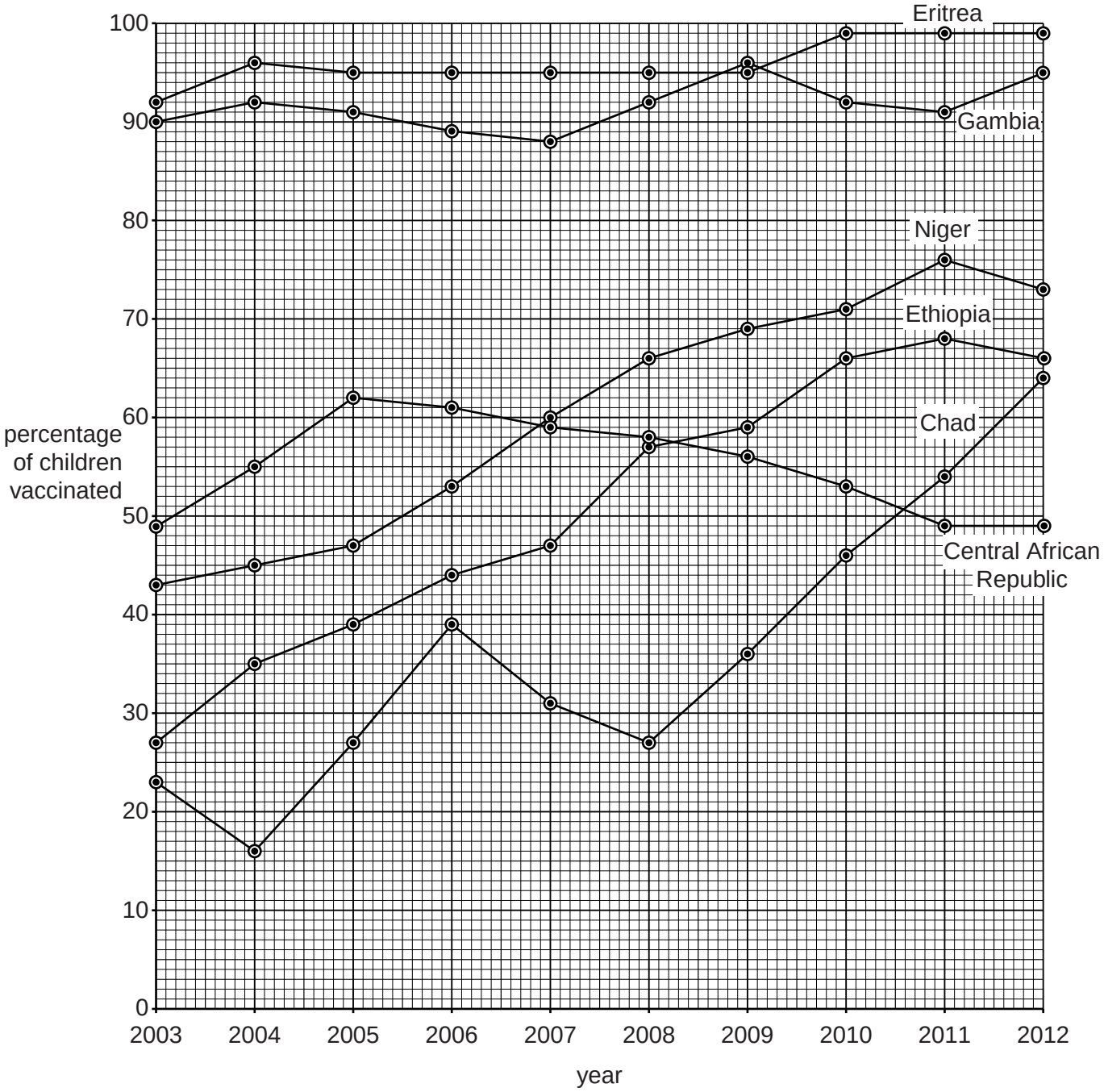


**Fig. 3.1**

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**(b)** Vaccination is known to protect populations against infectious diseases.

Some of the data in Table 3.1 (on page 4) and Fig. 3.1 (on page 6) support this statement.

Describe the data that support this statement **and** comment on the data that do **not** support this statement.

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.....[4]

**(c)** The successful eradication of smallpox involved an intensive global vaccination programme. It is hoped that the same can be achieved with measles.

Outline **two** features, apart from cost, of the smallpox eradication programme that may have made it easier to eradicate than measles.

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.....[2]

**(d)** State precisely the type of immunity gained by receiving a measles vaccine.

.....[1]

**(e)** Planning the prevention and control of measles using a vaccination programme means that financial costs must be considered.

State two examples of these costs.

1 .....

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2 .....

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.....[2]

[Total: 14]

**4** Fig. 4.1 is a simplified diagram of the circulatory system of a mammal. Some of the lymph system is also shown.

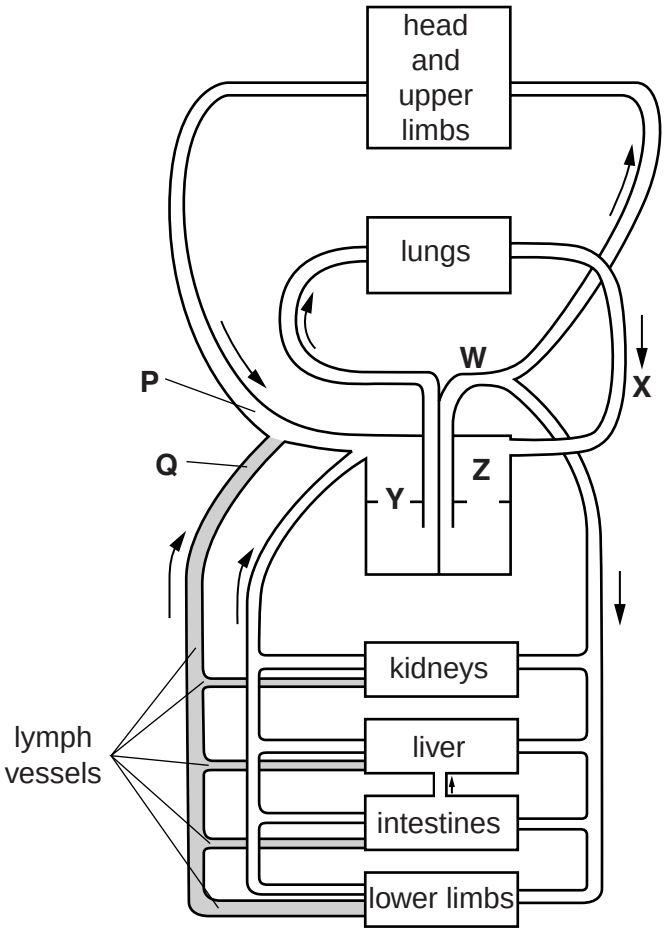


**Fig. 4.1**

**(a)** The type of circulatory system shown in Fig. 4.1 is a closed double circulation.

Explain what is meant by a *closed double circulation*.

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.....[2]

**(b)** With reference to Fig. 4.1, name:

blood vessel **W** .....

blood vessel **X** .....

valve **Y** .....

heart chamber **Z** ..... [4]

**(c)** State the component present in the blood at location **P** that is **not** present in the lymph at location **Q** in Fig. 4.1.

.....[1]

**(d)** As blood passes through the capillary network in the lungs, gas exchange occurs.

Describe the process of gas exchange between the alveolus and the blood.

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.....[4]

**(e)** As blood passes through the small intestine, small soluble products of digestion such as glucose are absorbed into the capillaries to be transported to the liver.

Fig. 4.2 is a transmission electron micrograph of intestinal epithelial cells.

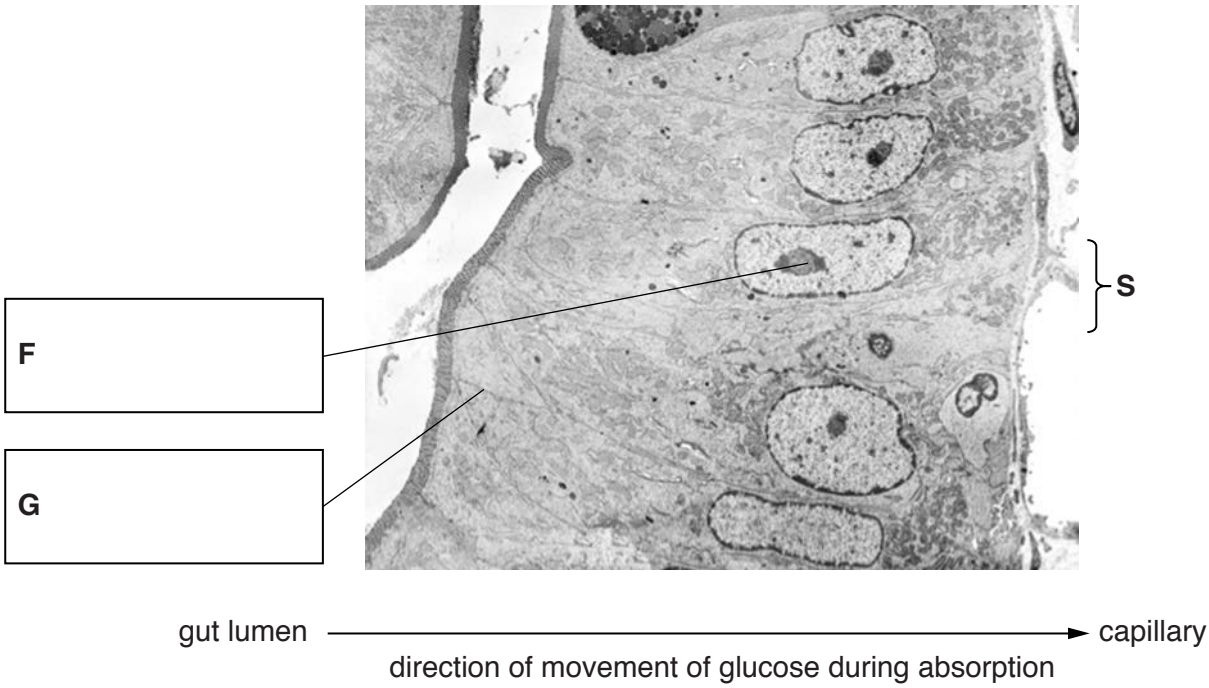


**Fig 4.2**

**(i)** Write the name of cell structures **F** and **G** in the boxes provided on Fig. 4.2. [2]

**(ii)** At the surface labelled **S**, movement of glucose molecules out of the intestinal epithelial cell occurs by facilitated diffusion.

Outline the features of facilitated diffusion of glucose molecules.

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.....[3]

[Total: 16]

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**Question 5 starts on page 12**

**5** Fig. 5.1 shows plant cells in stages of mitosis.


**Fig. 5.1**

**(a)** Individual chromosomes cannot be seen in the cell at the start of prophase. Changes to the chromatin occur so that by late prophase chromosomes are clearly visible.

**(i)** Outline what occurs during early prophase so that chromosomes become visible in late prophase.

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.....[1]

**(ii)** Describe the structure of the chromosome in late prophase.

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.....[3]

**(b)** State **two** differences between the chromosome at metaphase and the chromosome at late anaphase.

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.....

.....[2]

**(c)** One of the functions of a plant hormone known as cytokinin is to act as a cell signalling molecule and promote cytokinesis.

Suggest how cytokinin acts as a cell signalling molecule.

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.....[3]

[Total: 9]

**6** One of the enzymes involved in glycogen synthesis is glycogen synthase. The monomer of the glycogen polymer is $\alpha$-glucose.

**(a) (i)** Draw the ring form of $\alpha$-glucose in the space provided.

[2]

**(ii)** Glycogen synthase catalyses the formation of a covalent bond between two $\alpha$-glucose molecules during glycogen synthesis.

Name the type of bond formed.

.....[1]

**(iii)** Glycogen branching enzyme is another enzyme that is required for glycogen synthesis.

Suggest why glycogen branching enzyme is needed in addition to glycogen synthase.

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.....

.....[1]

**(b)** The gene coding for glycogen synthase in muscle cells is known as *GYS1*.

**(i)** Explain what is meant by a *gene*.

.....

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.....[2]

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**(ii)** There are a number of known mutations for *GYS1*.

Outline how a mutation in *GYS1* can lead to the formation of an altered polypeptide where one amino acid is replaced by a different amino acid.

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.....[3]

**(c)** Table 6.1 shows three functions of cell structures that are involved in the synthesis of glycogen synthase.

Complete Table 6.1 by naming the cell structure that carries out the function listed.

**Table 6.1**

| function | name of cell structure |
|---|---|
| assembles ribosomes for polypeptide synthesis | |
| synthesises ATP to provide a supply of energy for transcription of *GYS1* | |
| folds and modifies synthesised polypeptide to produce functioning glycogen synthase | |

[3]

[Total: 12]

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