



Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE
NAME

Script 2

CENTRE
NUMBER

CANDIDATE
NUMBER



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.



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.

Activation energy

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

Induced fit enzyme

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

Globular protein

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

Extracellular enzymes

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

Limiting factor

[5]

[Total: 5]



- 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 through the leaf of marram grass.

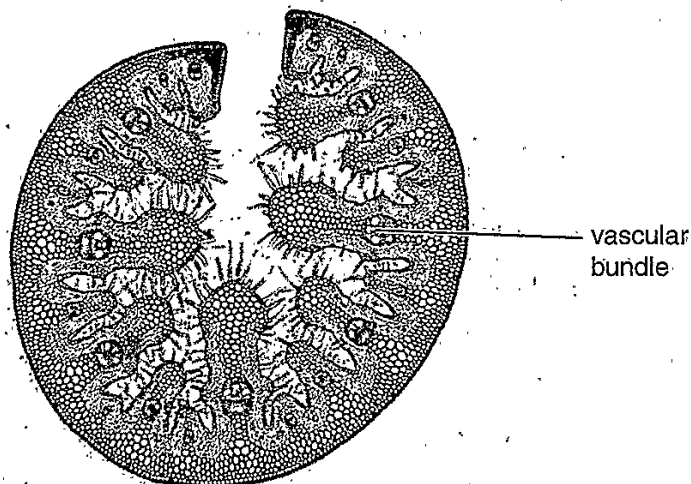


Fig. 2.1

- (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.

The leaves of marram grass are curled in. Rolled leaves [1]

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

The leaf is rolled so the hairy structure helps to store the water during hot day. It will lower the rate of transpiration.

.....

 [2]

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

Xerophyte [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.

$$\text{Ethiopia} = \frac{1.39}{100\,000} \times 84\,838\,000 = 1179.2482$$

$$\approx 1179$$

[2]

- (ii) Use the data for Chad, Eritrea and Ethiopia 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.

Easy to compare the data with smaller value. It is to avoid

[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.

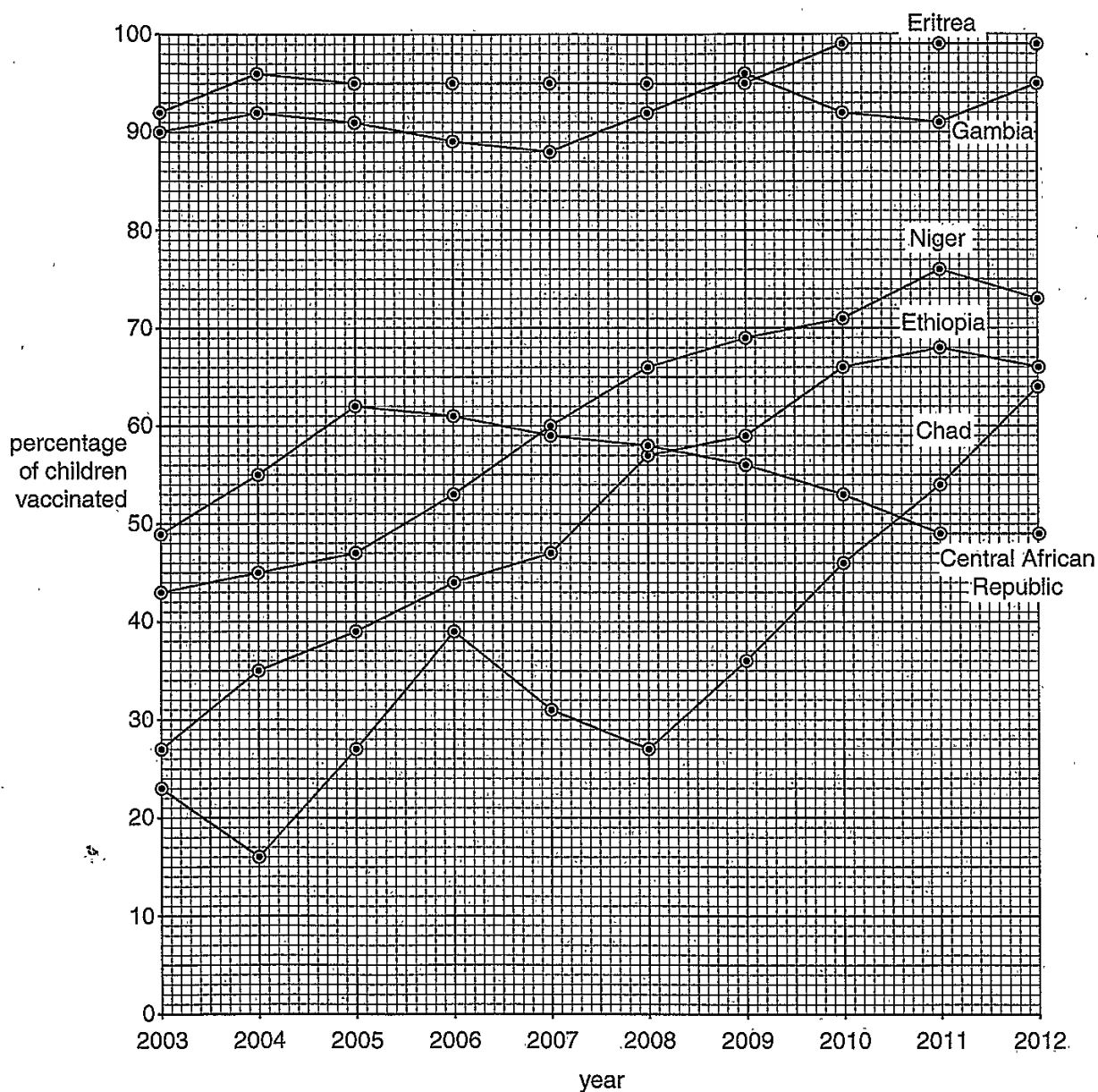


Fig. 3.1



- (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.

The data in Table 3.1 (on page 4) shows that country for Gambia give a result of 0.00 for a percentage of 95% number of cases per 100 000 people in 2012. When 95% of children vaccinated (shown in Fig. 3.1, on page 6). The number of cases per 100 000 people in ^{Ethiopia} ~~Ethiopia~~ in 2012 is ^{4.74} ~~0.96~~ (in Table 3.1) but the percentage of children vaccinated is 66%. This data do not support the statement above because ~~66%~~ there should be a decrease in number of cases.

[4]

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

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

~~Provide clean~~ Provide clean food supplies and quarantine place in order to ^{avoid} prevent the crowd.

[2]

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

Artificial active immunity

[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 The cost should be affordable -
 - 2 The cost should be free for poor countries.
- [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.

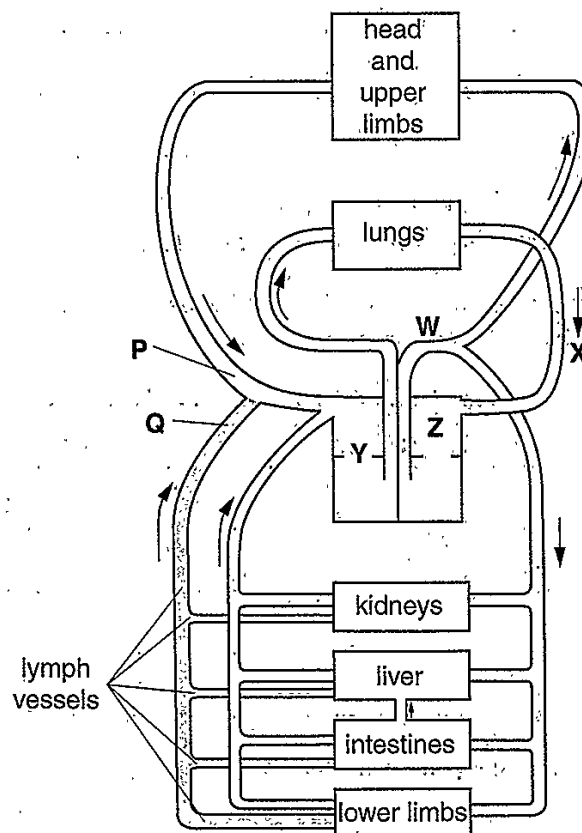


Fig. 4.1



- (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*.

Closed means that blood
 Blood is always inside artery, veins and capillary. Double
 circulation means that blood is ^{carry} ~~circulate~~ twice in one
 circulation.

[2]

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

blood vessel W Aorta
 blood vessel X Pulmonary Artery
 valve Y Tricuspid valve
 heart chamber Z Left ventricle [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.

Tissue fluid. [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.

In the alveolus, the oxygen is highly saturated than in the
 blood. So, the oxygen will diffuse into the blood through
 alveolar walls and endothelium cell, down concentration
 gradient. Meanwhile, carbon dioxide will diffuse out of
 the ^{blood} ~~cell~~. This process is known as diffusion.

[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.

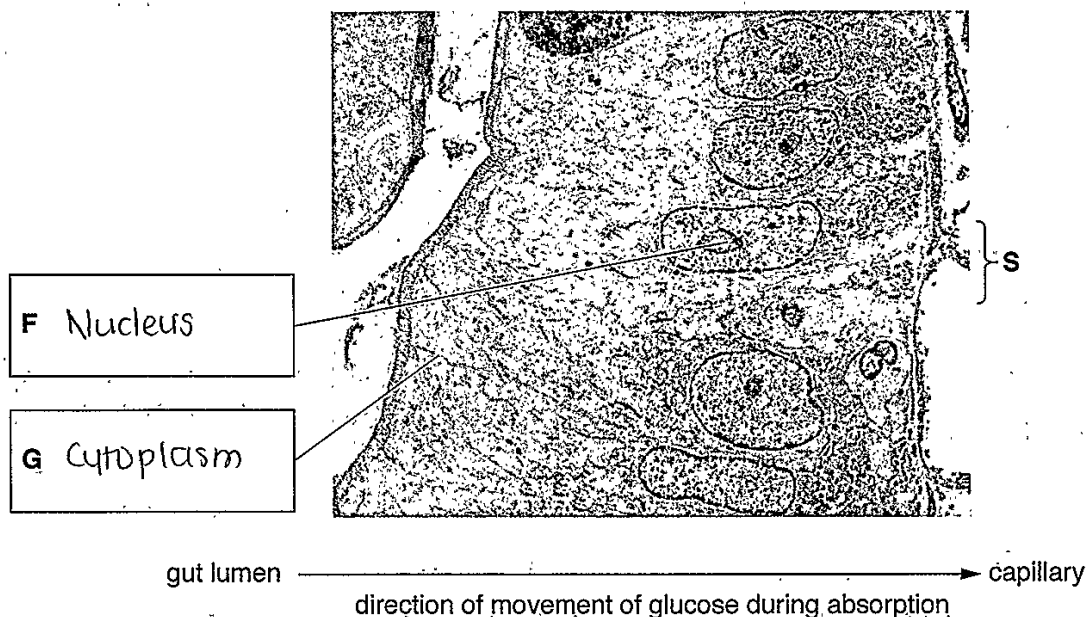


Fig 4.2

- (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.

Glucose move out of the intestinal epithelial cell through channel proteins. Glucose molecule move from a region of high concentration of glucose to a region of low concentration down a concentration gradient. Facilitated diffusion does not require ATP to carry the glucose molecules.

[3]

[Total: 16]

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11



Question 5 starts on page 12





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

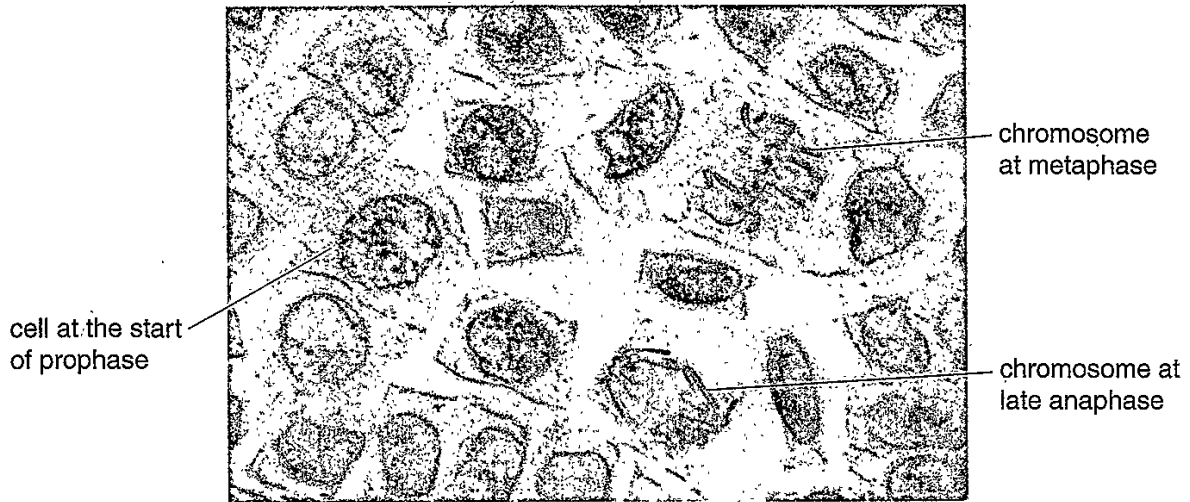


Fig. 5.1

(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.

The chromosomes unwind, and shorten.

[1]

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

The chromosome starts to separate and condense.

[3]



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

The chromosome at metaphase is arranged at the equator but at late anaphase, the chromosome is pulled apart by the spindle fibre.

[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.

Cell signalling molecule such as cytokinin will have a receptor on its cell surface membrane. So when there is a chemical reaction, it will ^{stimulate} ~~circulate~~ this hormone. Therefore, when this hormone is stimulated then, it will promote cytokinesis.

[3]

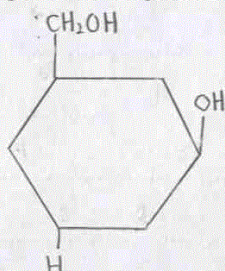
[Total: 9]





- 6 One of the enzymes involved in glycogen synthesis is glycogen synthase. The monomer of the glycogen polymer is α -glucose.

(a) (i) Draw the ring form of α -glucose in the space provided.



[2]

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

Name the type of bond formed.

Glycosidic bond

[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.

For energy storage

[1]

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

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

A gene is a length of variable codes for different amino acid.

[2]



- (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.

Mutation can occur due to gene substitution. It will not functioned normally.

[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	Rough Endoplasmic Reticulum
synthesises ATP to provide a supply of energy for transcription of <i>GYS1</i>	Mitochondria
folds and modifies synthesised polypeptide to produce functioning glycogen synthase	Golgi body

[3]

[Total: 12]





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