Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME **Script 1**

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.

CAMBRIDGE International Examinations

[Turn over

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 mechanism

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 enzyme

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

Vmax

[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 though the leaf of marram grass.

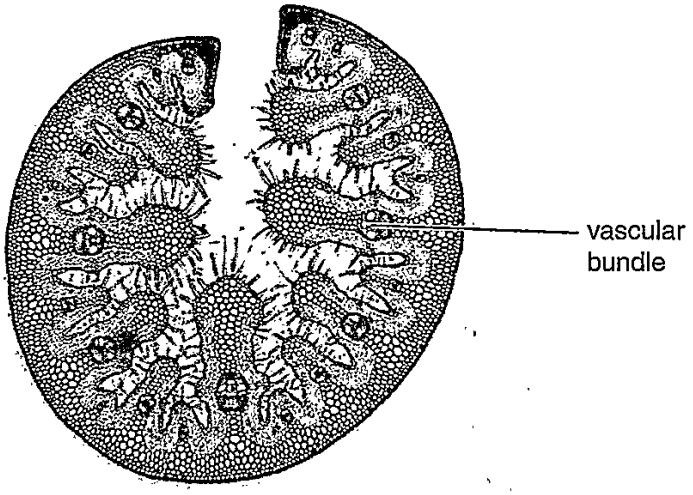


Fig. 2.1

(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.

~~Sunken stomata~~ ~~Curled leaves~~ ~~leaf~~ Hairy leaves/ leaf [1]

(ii) Explain how this adaptation reduces water loss.

Hairy leaf causes the ~~to~~ # water trapped around the stomata this lower the difference in water potential gradient. ~~thus reduce wa~~ low water loss to the surrounding.

thick cuticle prevent water to loss to the surrounding because it is thick enough to not allowing water diffuse out. [2]

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

Xerophytes [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	1.45 165	1.66	71.60	0.96
Eritrea	5 558 000	1.48 82	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

$\frac{82}{n} \quad \frac{1.48}{100000}$

(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.

$\frac{n}{1.39} = \frac{165}{1.45}$, $n = 158$

∴ actual number of cases is 158 ✗

$\frac{n}{1.48} = \frac{165}{147}$

$n = \frac{1.39}{100000} \times 84838000$

$= 1179$

∴ actual number of cases is 1179 ✗ 1172.

[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.

To make valid conclusion.

Data also easier to visualise.

~~the~~ Mostly, the higher the population in the country, the ~~higher~~ lower number of cases per 100 000 people

Example, the population in Chad is 11371000, whereas Eritrea is 5558000, The number of cases ~~per 100 000 people is higher~~ per 100 000 people is lower for Chad which is 1.45 ~~or~~ whereas Eritrea is 1.48.

[3]

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.

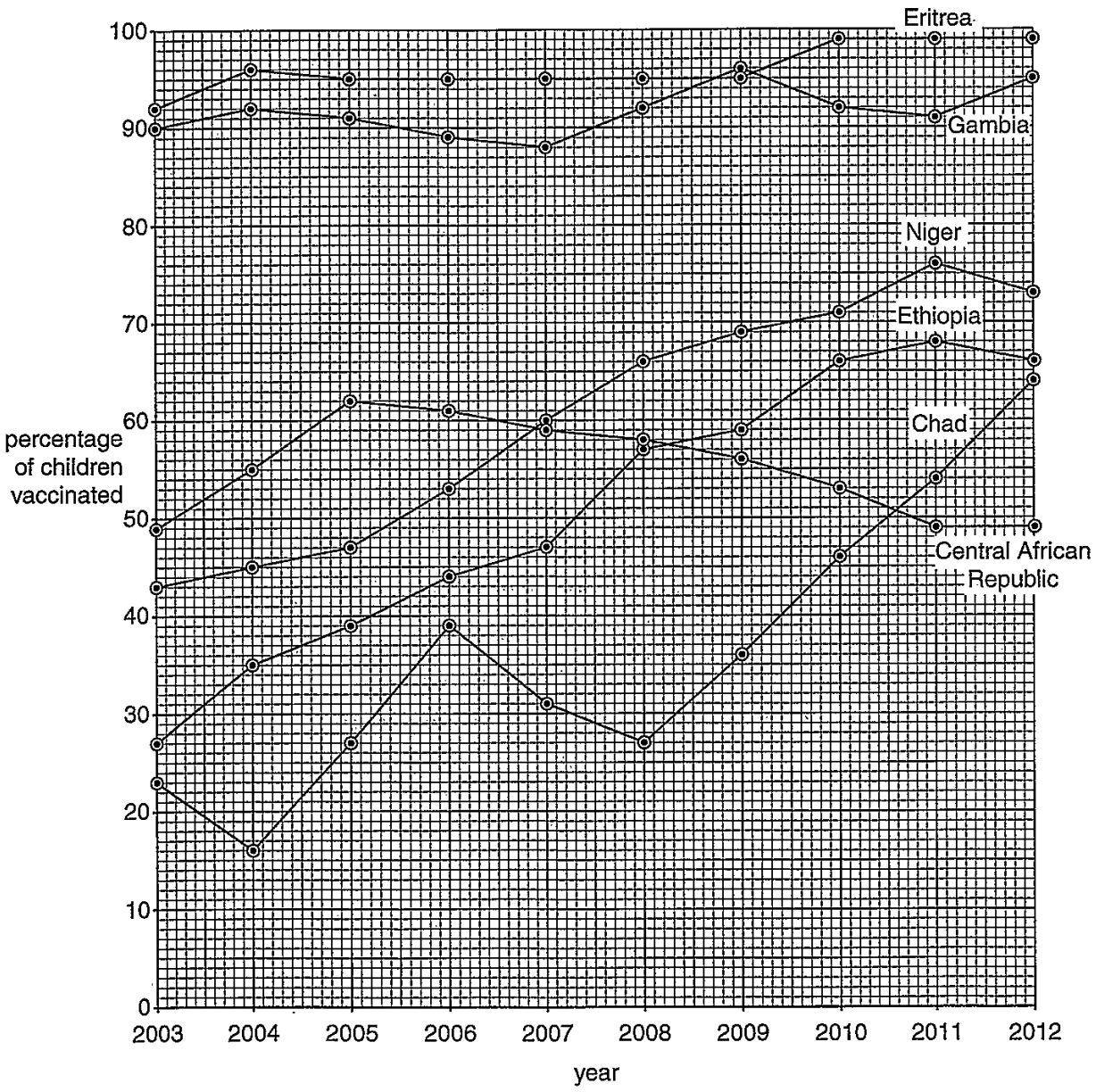


Fig. 3.1

(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.

Vaccination in the Ethiopia country support this statement because, when there is high percentage of children vaccinated, there are low number of cases per 100 000 people. for example, at 2009, the percentage of children vaccinated is highest for ~~the~~ Gambia ~~that~~ which is 96%, the number of cases per 100 000 people is zero.

But there is data that does not support this statement which is Eritrea country. At this country, although high percentage of children vaccinated, the number of cases is still high.

For example, at year 2009, there are 95% children vaccinated in Eritrea But the number of cases per 100 000 people is still high ~~the highest in that year~~ which is 1.48. [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.

~~pathogen causes small pox does not mutate.~~

vaccine use is effective

~~Vac~~ Same vaccine use worldwide

[2]

(d) State precisely the type of immunity gained by receiving a measles vaccine. 4mc

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 Costs to investigate the antigen of the pathogen and to produce the antigen in the vaccine which has similar shape to the antigen of pathogen

2 Costs to produce a very large amount of identical vaccine.

[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.

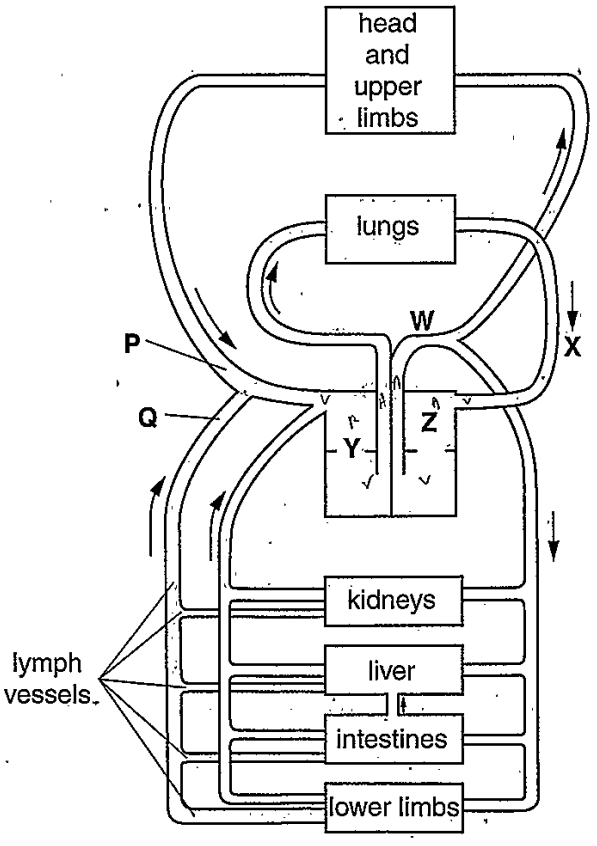


Fig. 4.1

(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*.

the term closed means blood flow within blood vessels. whereas the term double circulation means blood past through the heart twice in one complete circulation which is by systemic circulation and pulmonary circulation.

[2]

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

blood vessel **W** Aorta

blood vessel **X** Pulmonary vein

valve **Y** Atrioventricular valve

heart chamber **Z** Left Atrium [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.

Protein [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.

Oxygen diffuse into blood, whereas Carbon dioxide diffuse into alveolus. Diffusion of oxygen and carbon dioxide is down the concentration gradient.

~~It~~ & Oxygen and carbon dioxide diffuse through blood capillary and alveolar wall.

Oxygen enters blood in capillary.

oxygen then bind with haemoglobin forming oxyhaemoglobin.

alveolus has high concentration of oxygen, blood has low concentration of oxygen. Thus oxygen diffuse from alveolus into blood.

[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.

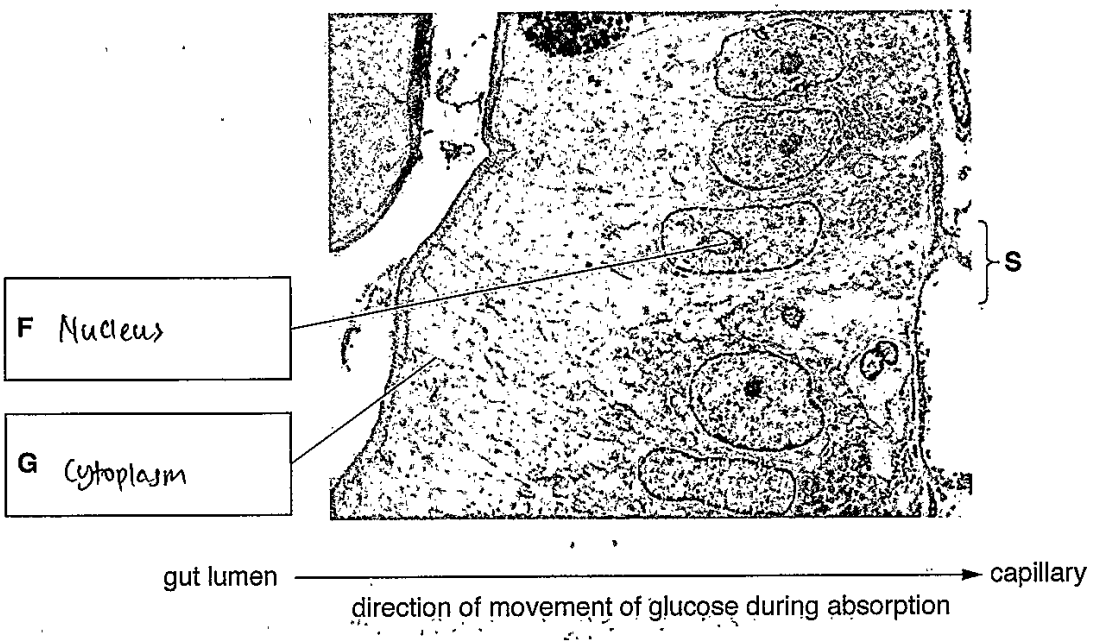


Fig 4.2

(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 molecules is polar molecules.

glucose can not pass through the hydrophobic core of phospholipid bilayer.

Thus movement of ~~the~~ glucose is helped by ~~the~~ transport protein. ~~This is~~

The ~~movement of~~ diffusion through transport protein is called facilitated ~~diff~~ diffusion.

Facilitated diffusion increase the ~~plasma~~ permeability of the glucose to the membrane.

.....[3]

[Total: 16]

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

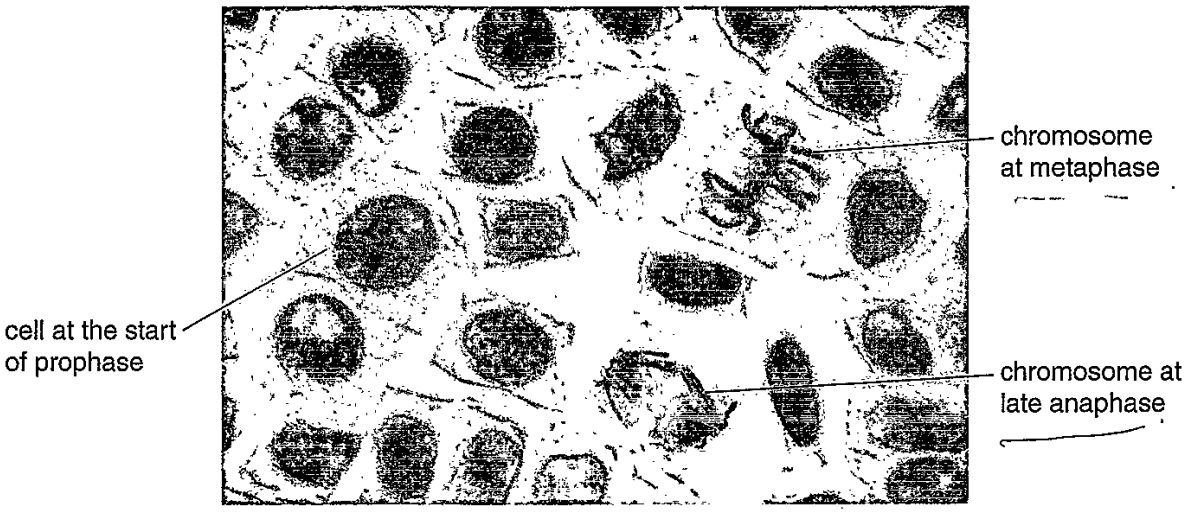


Fig. 5.1

(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.

Chromatin coiled up, become shorter and thicker ~~so that~~ until it is ~~we~~ visible ~~enou~~ enough in late prophase.

.....[1]

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

Chromosome consists of 2 sister chromatids.
they are attached together by centromere.
Each chromatids contain 1 DNA molecule.
Chromosome are thicker and visible.

.....[3]

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

chromosome at metaphase is align at the equator of spindle fibre

~~where as~~ whereas chromosome at ~~late~~ late anaphase are already reach the

opposite poles of nucleus.

Chromosome at metaphase consists of 2 sister chromatids, whereas

Chromosome at late anaphase consists of only 1 sister chromatids.

[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.

Cytokinin ~~bind~~ binds ~~attach~~ to the receptor of cells.

It ~~attach~~ binds to receptor of targetted cells.

this ~~causes~~ causes enzyme inside the cell become activated.

activated enzyme leads to a specific response.

The specific response ~~fo~~ for this reaction is ~~to cyto~~

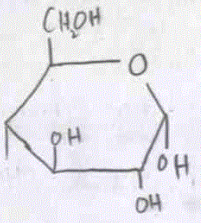
cytokinesis occur.

[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.

To provide sufficient active site for reaction.

To provide an osmotically inactive medium for reaction.

[1]

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

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

Gene is the sequence of nucleotides that carry genetic information

[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.

When there is such mutation, where amino acid is changed, the primary structure of the protein change. This caused by the mutation of gene, amino acid code by the gene change when gene is mutated. Secondary and tertiary structure of protein also change. Polypeptide may not be functioning.

.....[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 ~~Endoplasm~~ Endoplasmic Reticulum.
synthesises ATP to provide a supply of energy for transcription of *GYS1*	Mitochondria
folds and modifies synthesised polypeptide to produce functioning glycogen synthase	Golgi body

[3]

[Total: 12]