OCR
Oxford Cambridge and RSA

Tuesday 7 June 2016 – Afternoon

AS GCE BIOLOGY

F212/01 Molecules, Biodiversity, Food and Health

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 45 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- Where you see this icon, you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **24** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 In cells, glucose can exist as α-glucose or as β-glucose.

(a) Fig. 1.1 represents the structural formula of a molecule of α-glucose.

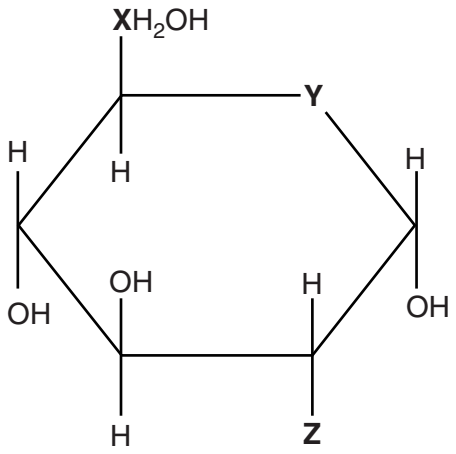


Fig. 1.1

(i) In Fig. 1.1 some atoms or groups have been replaced by the letters **X**, **Y** and **Z**.

Identify the correct atom or group that has been replaced by each letter.

X .....

Y .....

Z .....

[3]

(ii) Describe how the structure drawn in Fig. 1.1 above would be different if it represented a molecule of **β-glucose**.

.....

..... **[2]**

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(iii) Two α-glucose molecules can be joined to form a disaccharide molecule.

State the **precise** name of the covalent bond that forms between the two glucose molecules and the name of the disaccharide that is formed.

bond .....

disaccharide .....

[2]

(b) Glucose, glycogen and amylose are carbohydrates.

- Glycogen and amylose are used for energy storage.
- Glycogen is found in animals.
- Amylose is found in plants.

Describe how the structure of glycogen allows it to perform its function **and** explain the advantage to animals of using glycogen as an energy store.

In your answer you should make clear the links between structure and function.

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(c) Alpha (α) and beta (β) are prefixes that are frequently used to describe a range of biological molecules, such as α-glucose and β-glucose.

The prefixes α and β can also be used when describing protein structure.

Complete the following statements about proteins using the most appropriate terms.

- The secondary structure of a protein may contain many regions folded in zig-zag patterns known as ..... .
- The secondary structure of a protein is determined by the arrangement of ..... bonds, which stabilise the structure.
- The ..... structure of collagen is described as a left-handed helix because of the direction in which the polypeptide twists.
- Polypeptides known as alpha (α) and beta (β) ..... form part of the ..... structure of haemoglobin. **[5]**

[Total: 19]

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2 Influenza (flu) is a disease that affects millions of people worldwide. Many vulnerable people receive vaccinations against flu each year.

(a) A flu vaccination consists of a suspension of antigenic material from the flu virus, which is then injected into patients.

Tick the box that best describes the type of immunity provided by the flu vaccination.

active and natural	
active and artificial	
passive and natural	
passive and artificial	

[1]

(b) Fig. 2.1 represents an influenza virus. Various protein antigens are attached to the outer surface of the virus.

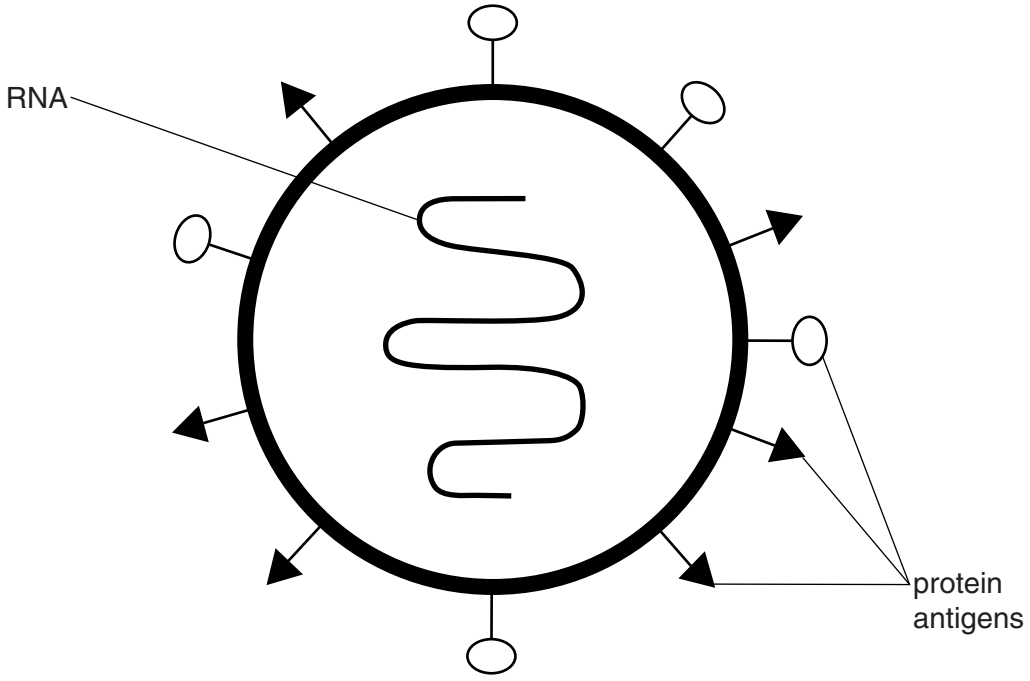


Fig. 2.1

When a virus infects a human host, it causes the host's cells to produce many new copies of the virus.

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(i) The flu vaccination must be given each year because there are frequent mutations in the RNA of the virus.

The antigens on the surface of the virus are made of protein.

The virus uses the organelles and enzymes in the host's cells to produce new copies of itself.

Suggest the role of the viral RNA in the production of viral proteins.

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..... **[2]**

(ii) Explain why a mutation in the viral RNA leads to a change in the 3-D shape of the protein antigens.

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..... **[3]**

(iii) The head teacher of a school decided to offer teachers free flu vaccinations every year.

Suggest why the head teacher thought this would be a good use of the school's money.

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..... **[1]**

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(c) Compare the primary and secondary immune response by filling in the table below.

	Primary response	**Secondary response**
Relative concentration of antibodies produced		
Relative duration of response		

[2]

(d) Name **two different** types of T-lymphocytes **and** describe their roles in the immune response.

1 .....

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2 .....

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[2]

[Total: 11]

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3 Enzymes are important molecules in living organisms.

(a) (i) A student decided to use the biuret test to detect the presence of enzyme in a solution.

Outline the procedure the student should follow in order to detect the presence of enzyme in a solution using the biuret test.

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..... **[2]**

(ii) State why the structure of enzyme molecules allows them to be detected **in solution** using the biuret test.

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..... **[1]**

(b) The student wished to determine the mass of enzyme in 250 cm^3 of an enzyme solution of unknown concentration.

To determine the concentration of this enzyme solution, the student first carried out the biuret test on three enzyme solutions of known concentration:

- solution **1** 0.5 $mg\,cm^{-3}$ of enzyme
- solution **2** 1.0 $mg\,cm^{-3}$ of enzyme
- solution **3** 2.0 $mg\,cm^{-3}$ of enzyme

After completing the biuret tests, the absorbance of light by each solution was measured using a colorimeter. The student plotted a graph of the results. The graph is shown in Fig. 3.1.

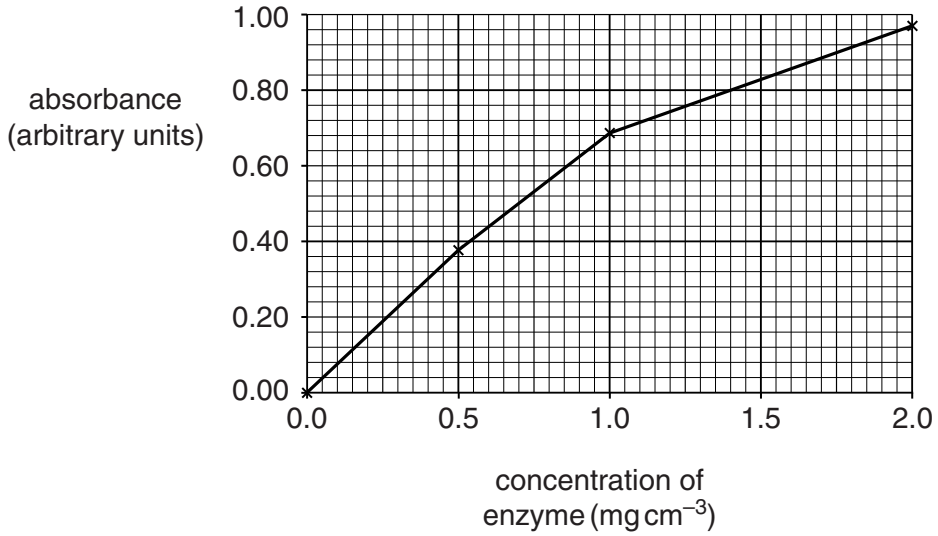


Fig. 3.1

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(i) The student then carried out the same procedure on the enzyme solution of unknown concentration.

The absorbance reading on the colorimeter was 0.8 arbitrary units.

Using the line drawn by the student in Fig. 3.1, determine the concentration of the enzyme solution.

Concentration = ... $mg\,cm^{-3}$

Calculate the **mass** of enzyme, **in grams**, in 250 cm^3 of the enzyme solution.
Show your working. Give your answer to **two** decimal places.

Answer = ... g **[2]**

(ii) The student performed the calculation correctly. However, the teacher said that the value for the mass of enzyme given by the student was inaccurate.

Explain how the student's **method** could be improved to increase the accuracy of this value.

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..... **[2]**

(iii) Outline the practical procedures the student would have taken to generate the point on the graph at the origin (0.0, 0.00).

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..... **[2]**

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(c) Some enzymes work better in the presence of other molecules or ions.

Explain how these molecules or ions increase the activity of enzymes.

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..... **[5]**

[Total: 14]

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4 *Nymphaea thermarum* is the world's smallest and most endangered water lily. It was first discovered by scientists in central Africa, in 1987. It has not been seen in the wild since 2008 and is only known to exist in a few botanic gardens.

(a) *N. thermarum* is the only lily that grows in damp mud rather than water.

The site where it was originally discovered has not been directly affected by the activities of humans in the local area.

Suggest why *N. thermarum* is no longer found in the area where it was first discovered.

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..... **[2]**

(b) Botanic gardens collect plant species from around the world to maintain biodiversity.

(i) State two levels at which biodiversity may be considered.

1 .....

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2 .....

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[2]

(ii) State **one** benefit to human health of maintaining plant biodiversity.

.....

..... **[1]**

(iii) Explain the benefits to agriculture of maintaining plant biodiversity.

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..... **[3]**

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(c) When *N. thermarum* was first collected from the wild, it proved very difficult to grow successfully in a botanic garden.

Some scientists thought that successful growing of *N. thermarum* would depend on the availability of water in the soil.

Outline, briefly, a valid investigation that could determine the effect of varying the moisture content of the soil on the growth of *N. thermarum*.

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..... **[4]**

(d) In 2014, a *N. thermarum* plant was stolen from the Royal Botanical Gardens at Kew.

It is thought that the thief intended to sell the plant to a private collector.

(i) An international agreement exists to restrict the sale of rare species such as *N. thermarum*.

Name this agreement.

..... **[1]**

(ii) Other international agreements exist.

Under the terms of one such agreement, some of the money made **legally** from endangered species goes to the country where the species was first discovered in the wild.

Name the agreement that encourages fair sharing of benefits from the legal use of endangered species.

..... **[1]**

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(e) Individual *N. thermarum* plants measure 10–20 cm across.

Explain why the size of *N. thermarum* is an example of **continuous** variation.

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..... **[3]**

[Total: 17]

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5 Tobacco smoke contains a mixture of chemicals known as tar.

The tar in tobacco smoke has many negative consequences for health.

Outline the effects of tar on the lungs and airways.

In your answer you should discuss a range of effects and their consequences.

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..... **[9]**

[Total: 9]

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6 Six major groups of organisms are listed below:

animals	**bacteria**	**plants**
archaea	**fungi**	**protoctists**

(a) A teacher constructed a **dichotomous key** to help her students distinguish between each of these groups.

The key consisted of a series of questions with '**yes**' or '**no**' answers.

(i) The first question is shown in the box below. Complete the key by choosing the correct answer from the groups of organisms listed.

Question 1: Does the organism have walls made of chitin?

Yes = ...

No go to question 2

[1]

(ii) Write a question in the box below to distinguish plants and protoctists from the remaining groups of organisms.

Question 2: .....

.....

Yes = plants or protoctists

No go to question 3

[1]

(iii) Write a question in the box below to distinguish the archaea and bacteria from animals.

Question 3: .....

.....

Yes = animals

No archaea or bacteria

[1]

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(b) (i) Fig. 6.1 is a diagram representing the taxonomic hierarchy of organisms within the animal kingdom.

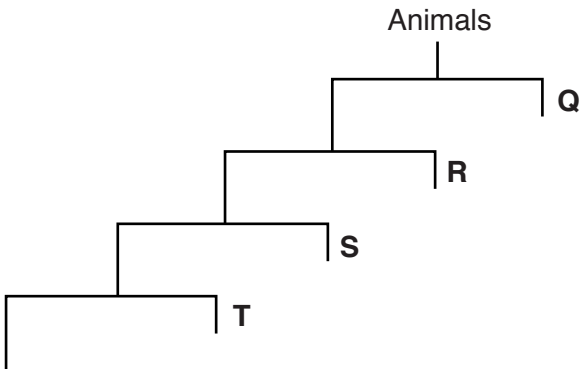


Fig. 6.1

State the level of taxonomic group represented by the letters **Q**, **R**, **S** and **T**.

Q .....

R .....

S .....

T ..... **[2]**

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(ii) Fig. 6.2 shows a diagram representing the phylogenies of some groups of organisms.

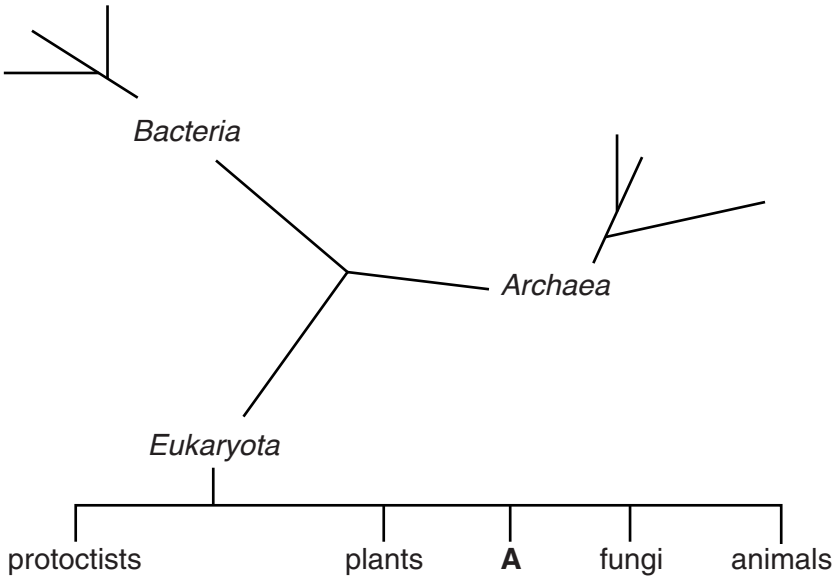


Fig. 6.2

The letter '**A**' on Fig. 6.2 represents a group of organisms called slime moulds.

With reference to Fig. 6.2, discuss the **classification** of slime moulds and include the range of evidence on which this classification might be based.

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..... **[3]**

(iii) State **three** reasons why the three-domain classification system is now used in preference to the five-kingdom system.

1 .....

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2 .....

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3 .....

..... **[3]**

[Total: 11]

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7 Lipoproteins contain protein, cholesterol, triglycerides and phospholipids. They are involved in the transport of cholesterol in the blood.

(a) The protein molecules in a lipoprotein are made up of amino acids. One of these amino acids is alanine.

The R group in alanine is CH_3.

Describe the structure of the amino acid alanine.

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..... **[4]**

(b) **(i)** Explain why a diet high in saturated fat leads to an increase in blood cholesterol.

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..... **[2]**

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(ii) Outline the mechanism by which increased blood cholesterol leads to coronary heart disease (CHD).

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..... **[4]**

(c) Large amounts of fat in the diet can also lead to obesity.

Orlistat is a drug that directly reduces the breakdown of fat in the small intestine. This reduction in breakdown leads to less fat being absorbed into the body.

Suggest the mechanism by which orlistat reduces the breakdown of fat.

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..... **[1]**

[Total: 11]

Question 8 begins on page 20

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8 A teacher was reviewing some common mistakes in a variety of students' answers to biological questions.

Some of the answers given by the students are written below.

(a) "When investigating the effect of temperature on enzyme activity it is important to keep the amount of substrate the same."

Suggest a more suitable word than 'amount'.

..... **[1]**

(b) "Productivity of domestic animals can be improved by selective breeding. However, inbreeding can be a problem as it causes mutations which can lead to genetic diseases in the animals."

State and explain the incorrect biology in this answer.

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..... **[2]**

(c) "The Simpson's Index of Diversity for the area of woodland is very high. This means that the habitat is stable and so the electricity company's application to build a power station is likely to be approved after the Environmental Impact Assessment has been carried out."

Explain the incorrect biology in this answer.

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..... **[2]**

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(d) In response to the question "Explain why some types of food are stored in a freezer", a student wrote:

"Food does not decay when frozen because the very low temperature denatures the bacterial enzymes so the enzymes cannot bind to the substrate molecules in the food."

Suggest a better answer to the question.

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..... **[3]**

[Total: 8]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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