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Monday 2 June 2014 – 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

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* 1 1 8 4 2 8 4 3 3 0 *

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 2006, the scientific journal, Nature, reported the discovery of a fossil from around 380 million years ago. It was given the name *Tiktaalik roseae*.

This fossil has some features in common with fish and some features in common with amphibians.

A photograph of the fossil is shown in Fig. 1.1.



Fig. 1.1

A diagram of the fossil viewed from above is shown in Fig. 1.2.

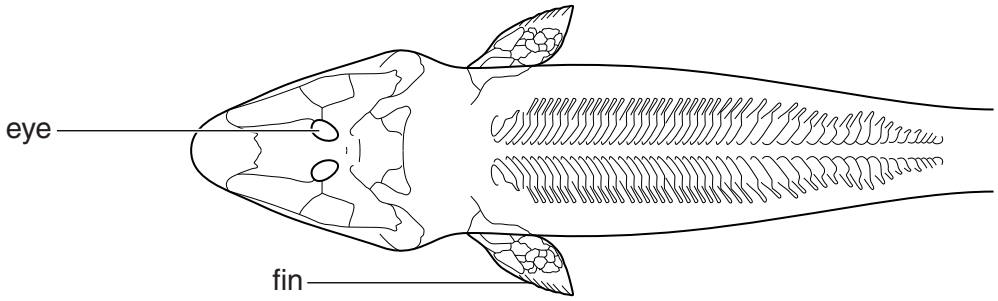


Fig. 1.2

(a) (i) Suggest **one** adaptation, **visible in Fig. 1.1 and Fig. 1.2**, which would be an advantage for life under water.

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

(ii) Suggest **one** adaptation, **visible in Fig. 1.1 and Fig. 1.2**, which would be useful for an animal that lives on the sea bed.

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

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(b) *Tiktaalik roseae* is a member of the kingdom Animalia. The structure of its individual cells has not been preserved by fossilisation.

State **two** features of cells of an organism from the kingdom **Plantae** that would **not** have been present in the cells of *T. roseae.*

1 .....

2 .....

[2]

(c) Fossils provide strong evidence that organisms have evolved over time.

Describe **other** types of evidence that support the theory of evolution.

In your answer you should describe some different types of evidence.

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[6]

[Total: 10]

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2 Many reactions in living organisms are catalysed by enzymes.

Amylase is an extracellular enzyme that catalyses the breakdown of the polysaccharide starch (amylose) in the digestive system of many animals.

(a) Why is the enzyme amylase described as being extracellular?

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

(b) A student investigated the effect of changing the concentration of starch on the rate of starch breakdown by amylase.

The results of the investigation are shown in Fig. 2.1.

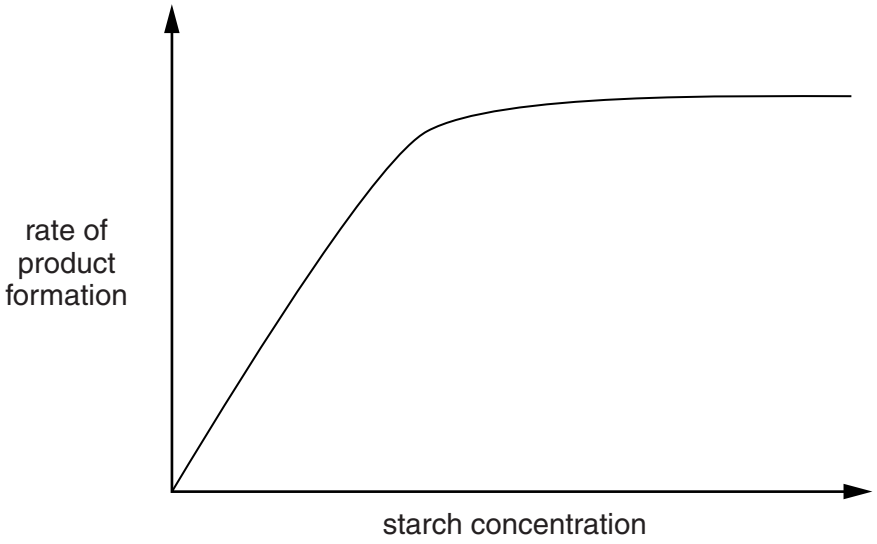


Fig. 2.1

(i) To calculate the rate of starch breakdown, the student measured the concentration of the breakdown **product**.

State the other variable the student needed to know in order to calculate the **rate** of this reaction.

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

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(ii) **Explain** the shape of the graph shown in Fig. 2.1.

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

(iii) The student kept the pH of the solution constant during the experiment.

Explain why it is important that the pH was kept constant.

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

(iv) Suggest **two** other variables the student should have kept constant during the experiment.

1 .....

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2 .....

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

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(c) Cellulose is another polysaccharide that is present in some living organisms.

(i) Complete the following table to show **three** other differences in the **structures** of starch (amylose) and cellulose molecules.

Amylose	Cellulose
coiled	no coiling

[3]

(ii) Which properties of cellulose make it suitable for forming cell walls?

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

[Total: 17]

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Question 3 starts on page 8

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3 The Royal Botanic Gardens at Kew plays an important role in plant conservation. One plant that has been conserved at Kew is the world's smallest water lily, the thermal lily, *Nymphaea thermarum*.

In its natural habitat, the thermal lily grows in hot water springs in central Africa.

(a) State the genus to which the thermal lily belongs.

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

(b) Explain why it is sometimes necessary to conserve a plant species, such as *N. thermarum*, outside its natural habitat (*ex situ*).

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

(c) The Royal Botanic Gardens also manages the Millennium Seed Bank, which aims to store seeds from one quarter of all plant species.

Give **three** advantages of conserving plant species as seeds and **not** as adult plants.

1 .....

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2 .....

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[3]

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(d) When measuring the biodiversity of a habitat, it is difficult to count every organism. It is therefore necessary to sample a proportion of the habitat. The sampling process must not be biased.

Outline an unbiased sampling method that can be used to measure the biodiversity of plant species in grassland.

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

(e) Scientists try to estimate the total number of species on Earth.

Suggest **three** reasons why such estimates are not likely to be accurate.

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2 .....

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3 .....

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[3]

[Total: 14]

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4 Proteins are important biological molecules.

(a) Protein structure can be represented at four levels: primary, secondary, tertiary and quaternary.

Below is a set of features that may be used when describing the structure of a protein such as haemoglobin.

Features	Letter
hydrogen bonds	**A**
peptide bonds	**B**
α and β subunits	**C**
the sequence of amino acids	**D**
the initial folding of the polypeptide chain	**E**
the overall 3D shape	**F**
ionic bonds	**G**

(i) Select the letters of the features that describe the primary level of protein structure.

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

(ii) Select the letter or letters of the feature(s) found in the secondary level of protein structure that are **not** present in the primary structure.

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

(iii) Select the letter or letters of the feature(s) that are found in the tertiary level of protein structure that are **not** present in the primary and secondary structures.

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

(iv) Select the letter or letters of the feature(s) found only in the quaternary level of protein structure.

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

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(b) Hydrogen bonds also form between water molecules.

(i) Describe the formation of a hydrogen bond between two molecules of water and explain why water can form these bonds.

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

(ii) Hydrogen bonds allow water to act as a solvent.

Why is the ability of water to act as a solvent important for the survival of organisms?

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

[Total: 10]

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5 Charles Darwin sailed on HMS Beagle on its voyage around the world between 1831 and 1836.

(a) Darwin made the following observation:

'offspring generally appear similar to their parents'

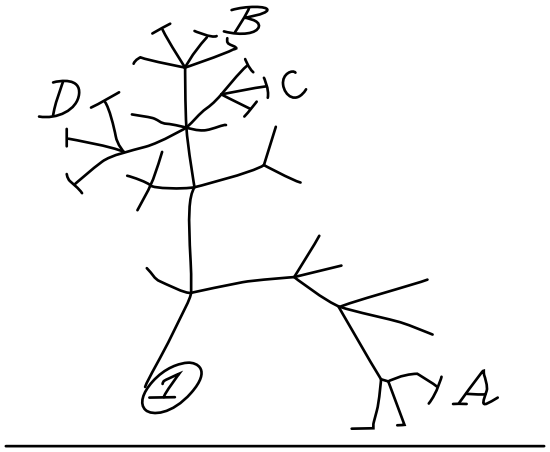
State the conclusion that Darwin drew from this observation.

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

(b) Shortly after the voyage, Darwin sketched a diagram in his notebook.

His sketch is shown in Fig. 5.1.



Charles Darwin (1837)

Fig. 5.1

- A, B, C and D represent different modern day organisms.
- (1) represents an ancestral organism.

Explain what the sketch shows about the relationship between organisms A, B, C, and D.

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

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(c) In 1859, Darwin published his book, *On the Origin of Species*, in which he explained how organisms evolve by natural selection:

- Darwin's book caused controversy at the time of its publication
- his theory of natural selection is now widely accepted by scientists.

Why is natural selection now more widely accepted by scientists than it was in the 19th Century?

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

(d) Genes are important in the process of natural selection. Genes are made of DNA.

(i) State the role of a gene.

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

(ii) Explain how the structure of DNA allows replication.

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

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(e) During the voyage of HMS Beagle, Darwin visited the Galapagos Islands off the coast of South America.

He observed that many of the closely related species showed significant variation.

(i) State the name given to the evolution of a new species.

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

(ii) Suggest why a higher number of species have evolved in the Galapagos Islands, compared with an area of the same size on the South American mainland.

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

[Total: 12]

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Question 6 starts on page 16

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6 Smoking has a number of negative effects on a person's health.

(a) State what is meant by the term *health.*

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

(b) An investigation was carried out on the causes of death in a large number of heavy smokers.

- The investigators recorded the number of deaths from a range of diseases within the group of smokers.
- This was compared with the expected number of deaths from the same number of people across the population as a whole.

The results are shown in Table 6.1.

Cause of death	Recorded deaths	Expected deaths	Percentage by which deaths are increased in smokers
Coronary heart disease (CHD)	3361	1973	70.3
Lung cancer	397	37	973.0
Other lung diseases e.g. COPD	231	81	

Table 6.1

(i) Calculate the percentage by which deaths from **other lung diseases** was increased in the smoking group. Show your working and **write your answer in the table**.

[2]

(ii) Outline **two** conclusions that could be drawn from the data in Table 6.1 about the effects of smoking on lung cancer or CHD.

1 .....

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2 .....

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[2]

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(c) Describe how the components of tobacco smoke can affect the **cardiovascular system** of smokers.



In your answer you should link the chemicals in tobacco smoke to their effects on the cardiovascular system.

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7 A breed of cattle, known as Chillingham cattle, is thought to resemble the wild cattle from which modern domestic breeds have been produced.

Fig. 7.1 shows one of the Chillingham cows and Fig. 7.2 shows a modern cow.



Fig. 7.1 Chillingham cow



Fig. 7.2 modern cow

(a) (i) Suggest **one** feature of the Chillingham cow that is likely to have changed during selective breeding to increase productivity.

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

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(ii) Describe how modern cattle have been produced from less productive wild cattle ancestors.

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

Question 7 continues on page 20

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(b) Many people in the UK consume large amounts of milk and beef.

Over-consumption of milk and beef can lead to an unbalanced diet and malnutrition.

(i) Define the term *balanced diet.*

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

(ii) Milk and beef both contain triglyceride molecules.

Fig. 7.3 represents a triglyceride molecule.

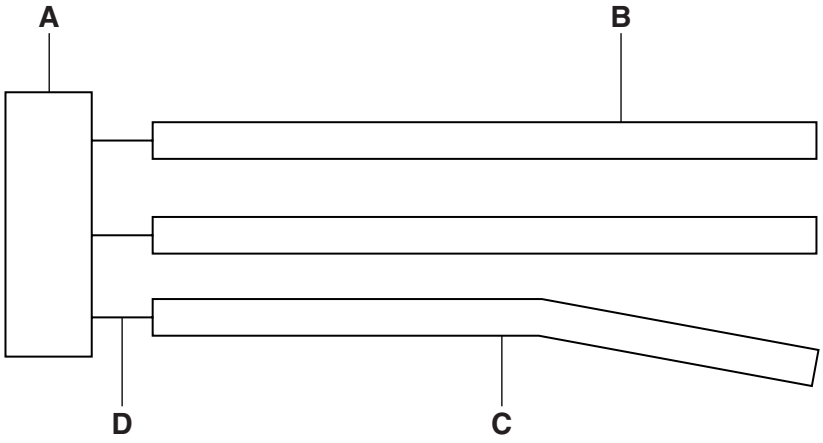


Fig. 7.3

Identify **A**, **C** and **D** on Fig. 7.3.

A .....

C .....

D .....

[3]

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(iii) Suggest and explain why over-consumption of milk and beef can lead to malnutrition.

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

(c) In the past, beef was preserved by adding salt.

Explain how salting preserves food.

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

[Total: 16]

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8 Vaccination can provide immunity to disease.

(a) Complete the following passage by using the most appropriate term from the list.

active antigen(s) double-helix membrane(s) memory
mutation passive phagocytic receptor(s)
species specific strand strain white blood

Some vaccines contain a dead or weakened form of a pathogen. The ……. on the cell surface of the pathogen are still able to trigger the production of ……. antibodies in the person being vaccinated. Cells called ……. cells are also produced, which retain the ability to divide and produce the antibodies quickly, should the pathogen return.

A new ……. of pathogen can arise if there is a ……. in the DNA of the pathogen. If this happens, the original vaccine is not likely to be effective.

[5]

(b) The term *immunity* is often used when describing how vaccines work.

In a piece of school homework a student wrote:

"Bacteria can evolve quickly and many are now immune to antibiotics."

Explain why the student's use of the word 'immune' was incorrect.

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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 margins.

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ADDITIONAL ANSWER SPACE

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