Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

Friday 13 June 2014 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
6BI04/01

You must have:
Ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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1/1/1/1/c1/

P 4 2 9 2 2 A 0 1 2 4

PEARSON

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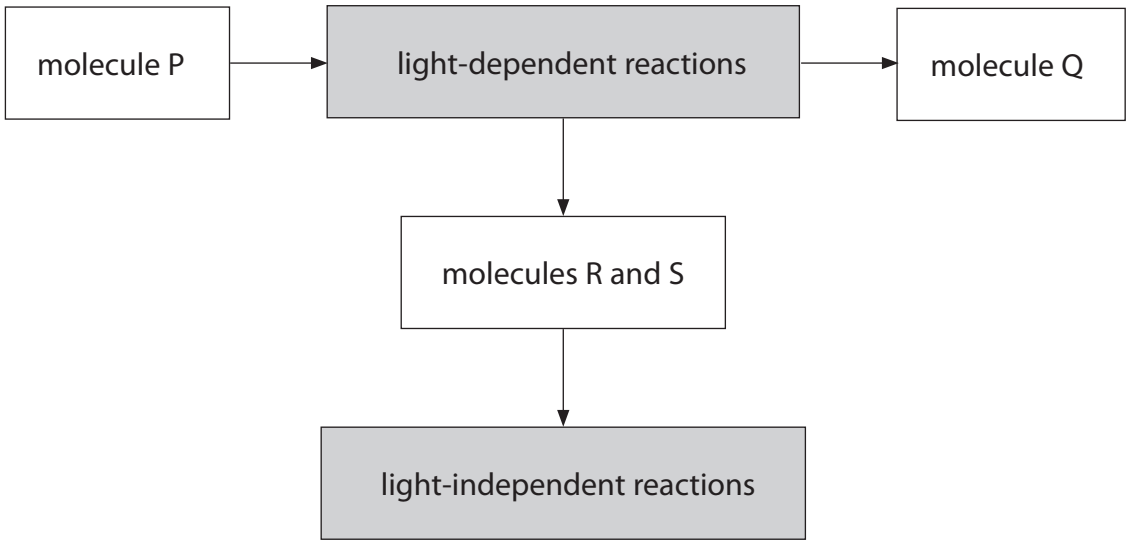
Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The diagram below shows some of the steps in the process of photosynthesis.



(i) Name molecules **P** and **Q** in the diagram.

(1)

molecule P .....

molecule Q .....

(ii) Place a cross ☒ in the box next to the names of molecules **R** and **S** in the diagram.

(1)

☒ **A** ADP and oxidised NADP

☒ **B** ADP and reduced NADP

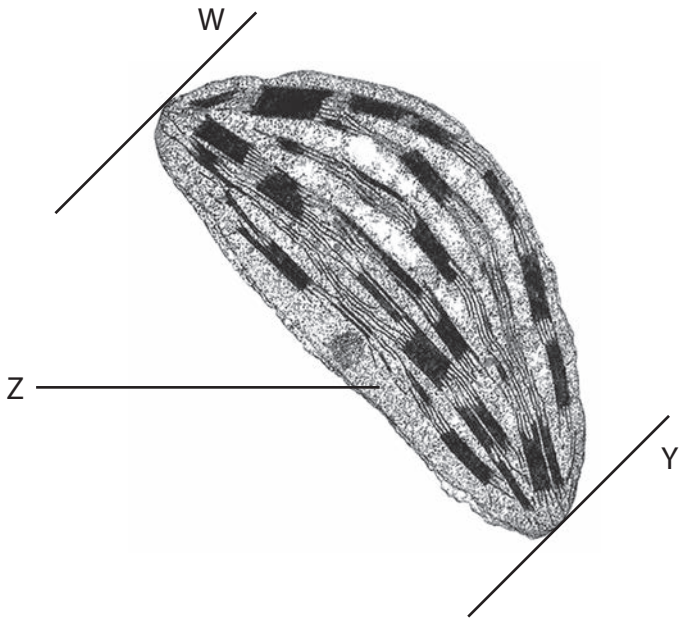
☒ **C** ATP and oxidised NADP

☒ **D** ATP and reduced NADP

(iii) Describe the role of RUBISCO in the production of GALP in the light-independent reaction.

(4)

(b) The electronmicrograph below shows a chloroplast.



Magnification ×7500

(i) Place a cross ☒ in the box next to the name of the part labelled **Z**.

(1)

☒ **A** cytoplasm

☒ **B** matrix

☒ **C** stroma

☒ **D** thylakoid

(ii) The equation below can be used to calculate the magnification of this chloroplast.

magnification = image length ÷ actual length

Use this equation to calculate the actual length of this chloroplast, between the lines labelled **W** and **Y**.

Show your working.

(3)

length of chloroplast = ...

(iii) Describe how the membranes inside the chloroplast are involved in photosynthesis.

(3)

.....

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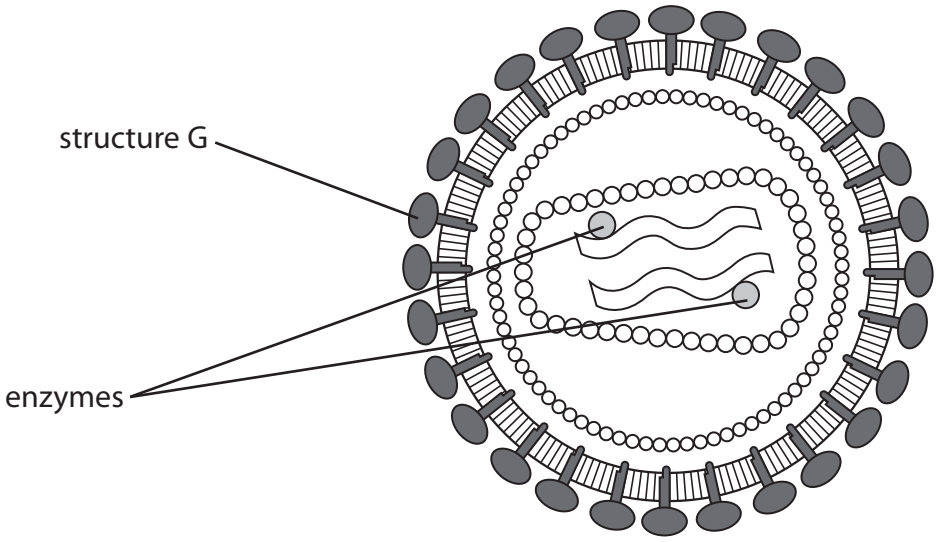
(Total for Question 1 = 13 marks)

2 Anti-viral drugs have been developed to treat patients infected with Human Immunodeficiency Virus (HIV).

The diagram below shows the structure of HIV.



(a) Explain how **structure G** enables HIV to infect human cells.

(3)

(b) Some anti-viral drugs used to treat patients infected with HIV are inhibitors of enzymes found within HIV.

(i) Describe the structure of an enzyme.

(3)

*(ii) Suggest how these anti-viral drugs would work in the treatment of patients infected with HIV.

(5)

(Total for Question 2 = 11 marks)

3 Grey tree frogs are found in the USA.

The photograph below shows a grey tree frog.

Magnification $\times 1$

Cope's grey tree frog and the eastern grey tree frog are both found in the USA.

These species of grey tree frog are very similar in appearance, but have different mating calls.

A number of scientists believe that the eastern grey tree frog evolved from Cope's grey tree frog during the last ice age.

These species have different numbers of chromosomes in their nuclei. Cope's grey tree frog has two copies of each chromosome. The eastern grey tree frog has four copies of each chromosome. As a result, the cells of the eastern grey tree frog are larger.

(a) The genetic relationship between these two species of grey tree frog has been studied using DNA profiling (DNA fingerprinting).

A small sample of DNA was taken from each species of grey tree frog. This DNA was amplified, fragmented and used to produce a DNA profile (DNA fingerprint) for each species.

*(i) Describe how a DNA profile was produced from this small sample of DNA.

(6)

(ii) Suggest how these DNA profiles were compared.

(3)

(b) Scientists in different parts of the USA are investigating the possibility that the difference in cell size is responsible for the different mating calls. This is contributing to an understanding of the evolution of grey tree frogs.

Suggest **two** ways in which the results of their investigations can be shared.

(2)

(Total for Question 3 = 11 marks)

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4 The human body responds to infection by bacteria in a number of ways.

The non-specific response includes phagocytosis and lysozyme action, which can be followed by the specific immune response. The specific immune response requires antigen presentation by macrophages.

(a) Explain how phagocytosis and lysozyme action lead to antigen presentation by macrophages.

(4)

(b) Explain how macrophages present antigens to T helper cells.

(2)

(c) There is an 'evolutionary race' between some bacteria, such as *Mycobacterium tuberculosis* (TB), and their hosts.

Suggest how this could affect antigen presentation to T helper cells. Give an explanation for your answer.

(3)

(Total for Question 4 = 9 marks)

5 First generation biofuels are made from sugars and vegetable oils found in food crops.

(a) Some countries are replacing small percentages of petrol and diesel with first generation biofuels to reduce the effect of greenhouse gases on global warming.

(i) Place a cross ☒ in the box next to a pair of greenhouse gases.

(1)

☒ **A** carbon dioxide and methane

☒ **B** carbon dioxide and carbon monoxide

☒ **C** carbon monoxide and nitrogen

☒ **D** methane and nitrogen

(ii) Suggest why using first generation biofuels instead of petrol and diesel could reduce global warming.

(3)

(b) Second generation biofuels are now being developed. These will use non-food parts of crops that contain the polymers cellulose and lignin.

Bacteria can be used to synthesise ethanol from these polymers. However, enzyme treatment is necessary before the bacteria can use these polymers.

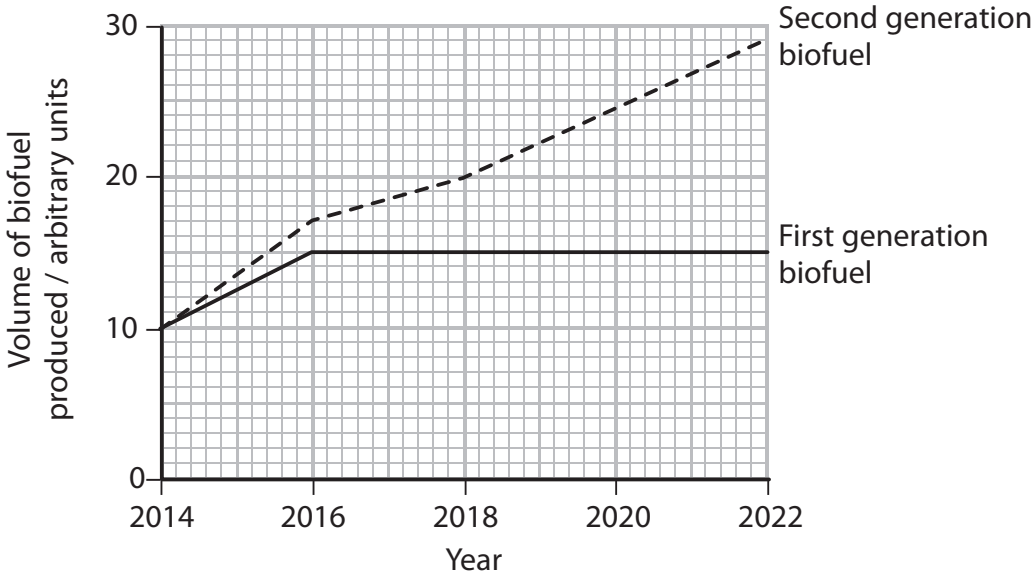
(i) Name a part of a plant stem that would contain these polymers.

(1)

(ii) Suggest why cellulose has to be treated with enzymes before the bacteria can use it as an energy source.

(2)

(c) The graph below shows how the global production of first generation and second generation biofuels could change in the future.



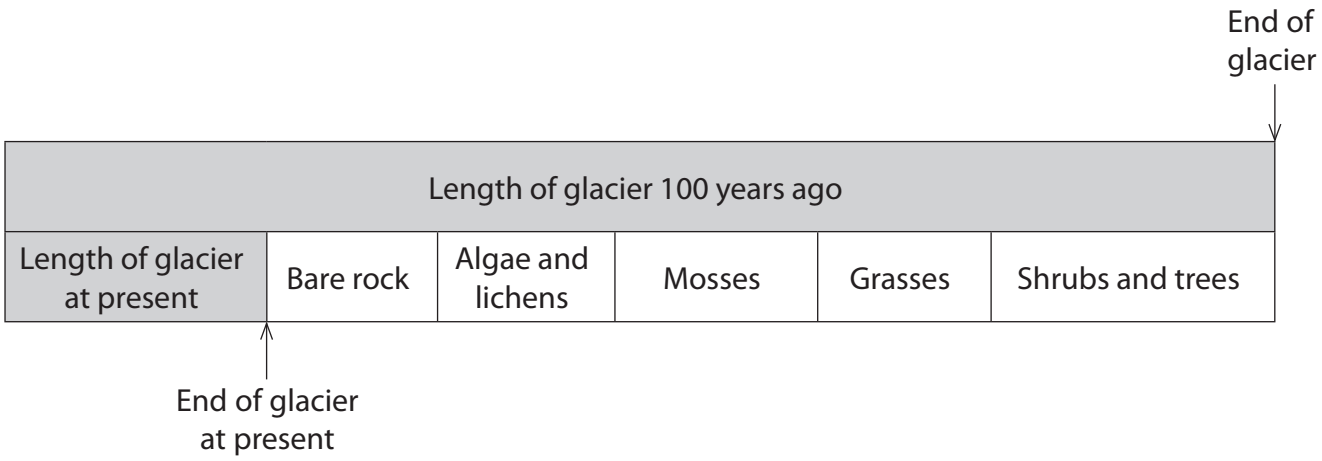
Using the information in the graph, describe the expected changes in the production of first generation and second generation biofuels. Suggest reasons for these changes.

(4)

(Total for Question 5 = 11 marks)

6 Glaciers are long, large masses of ice that formed thousands of years ago. As a result of warmer climates, more ice is melting. This is reducing the length of the glaciers. As a result, bare rock that was once covered by the glacier becomes exposed.

The diagram below shows the length of a glacier 100 years ago and the glacier at present. It also shows what is now found in a transect taken from where the front edge of the glacier is at present.



(a) Using the information in the diagram, describe and explain the changes in the distribution of organisms with distance from the front edge of this glacier.

(3)

(b) *Epilobium latifolium* is a plant that occupies a niche in an area once covered by this glacier. It is a short flowering plant that grows in clumps.

The photograph below shows three clumps of *Epilobium latifolium*.

Magnification ×0.2

(i) Explain what is meant by the term **niche**, using the plant *Epilobium latifolium* as an example.

(3)

(ii) Describe how to carry out a study of the distribution of *Epilobium latifolium* from the front edge of this glacier.

(4)

(iii) Suggest **one** abiotic factor that might affect the abundance of *Epilobium latifolium* and describe how this factor could be measured.

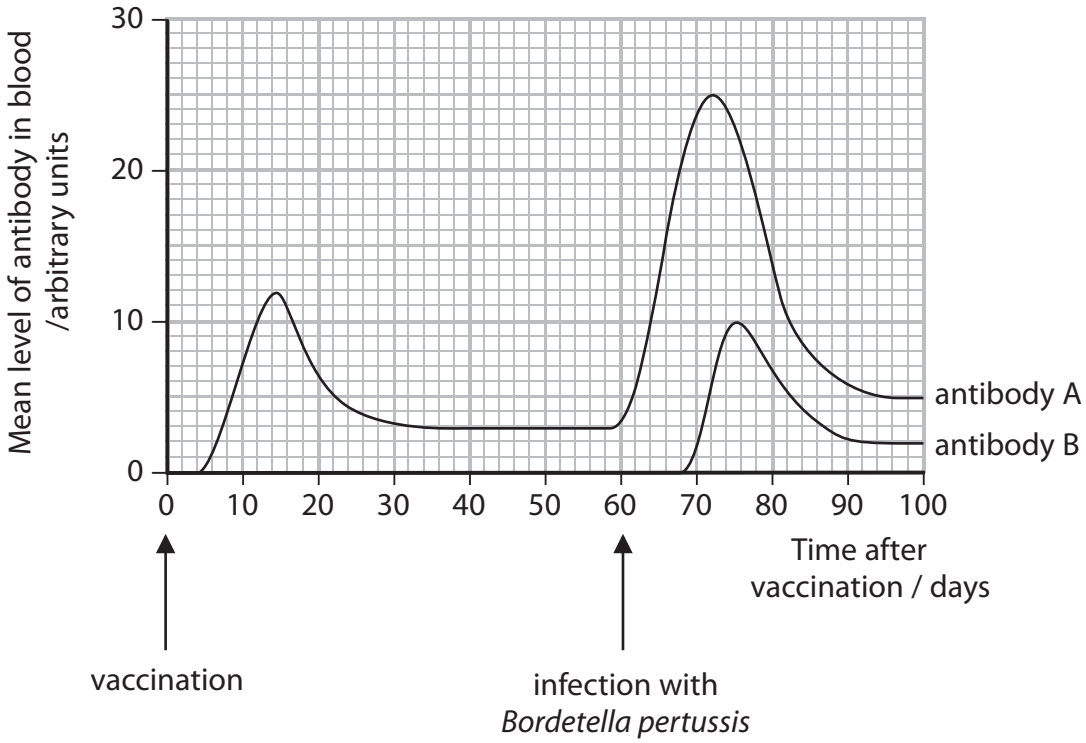
(3)

(Total for Question 6 = 13 marks)

7 Whooping cough is a disease that is particularly serious in young children. Whooping cough is caused by the bacterium *Bordetella pertussis*. Children may be vaccinated against whooping cough.

In an investigation, a group of rats was vaccinated. Sixty days later these rats were infected with *Bordetella pertussis*. In this investigation, the levels of two antibodies in the blood of the rats were measured.

The graph below shows the mean levels of antibody A and antibody B.



(a) (i) For antibody A, compare the increase in mean level after the vaccination with the increase in mean level after infection with *Bordetella pertussis*.

(2)

(ii) Explain the changes in mean level of antibody A after infection with *Bordetella pertussis*.

(3)

(b) (i) Suggest why antibody B was not present in the blood of these rats until after infection with *Bordetella pertussis*.

(2)

(ii) Place a cross ☒ in the box next to the term that describes the type of immunity that results in the production of antibody B.

(1)

☒ **A** artificial active

☒ **B** artificial passive

☒ **C** natural active

☒ **D** natural passive

(c) Comment on the reliability of the data shown in the graph.

(3)

(Total for Question 7 = 11 marks)

8 Bacteria are involved in the decomposition of organic matter.

(a) Place a cross ☒ in the box next to the type of chemical reaction that takes place in decomposition.

(1)

☒ **A** condensation

☒ **B** esterification

☒ **C** hydrolysis

☒ **D** polymerisation

(b) An investigation was carried out to study the rate of decomposition of leaves from ash trees and beech trees.

Five piles of each type of leaf were placed outside on the ground and each pile was covered with a heavy bucket. Each pile of leaves had a mass of 10 grams.

Every few weeks, one pile of each type of leaf was removed and weighed.

The table below shows the results of this investigation.

Time after falling from the tree / weeks	Mass of pile of ash leaves / g	Mass of pile of beech leaves / g
0	10.0	10.0
4	4.9	9.1
8	2.0	8.4
16	1.1	6.0
32	1.2	2.8
64	0.8	2.4

(i) Place a cross ☒ in the box next to the reason for using five piles of ash leaves in this investigation.

(1)

☒ **A** to calculate a mean

☒ **B** to give a range of values for the independent variable

☒ **C** to make the investigation valid

☒ **D** to produce reliable data

(ii) A student made the following conclusions from these results.

Decomposition of beech leaves is faster than ash leaves.

Bacteria are needed for the decomposition of beech and ash leaves.

There is a correlation between decomposition and time.

Place a cross ☒ in the box next to the number of correct conclusions made by this student.

(1)

☒ **A** none

☒ **B** one

☒ **C** two

☒ **D** three

(iii) Explain why there is a decrease in mass of the leaves.

(4)

(iv) Suggest what effect an increase in temperature would have on the rate of decomposition of these leaves. Give an explanation for your answer.

(4)

(Total for Question 8 = 11 marks)

TOTAL FOR PAPER = 90 MARKS