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Centre Number	Candidate Number
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Biology
Advanced
Unit 4: The Natural Environment and Species Survival

Friday 13 June 2014 – Afternoon Time: 1 hour 30 minutes	Paper Reference 6BI04/01R
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You must have: Ruler	Total Marks
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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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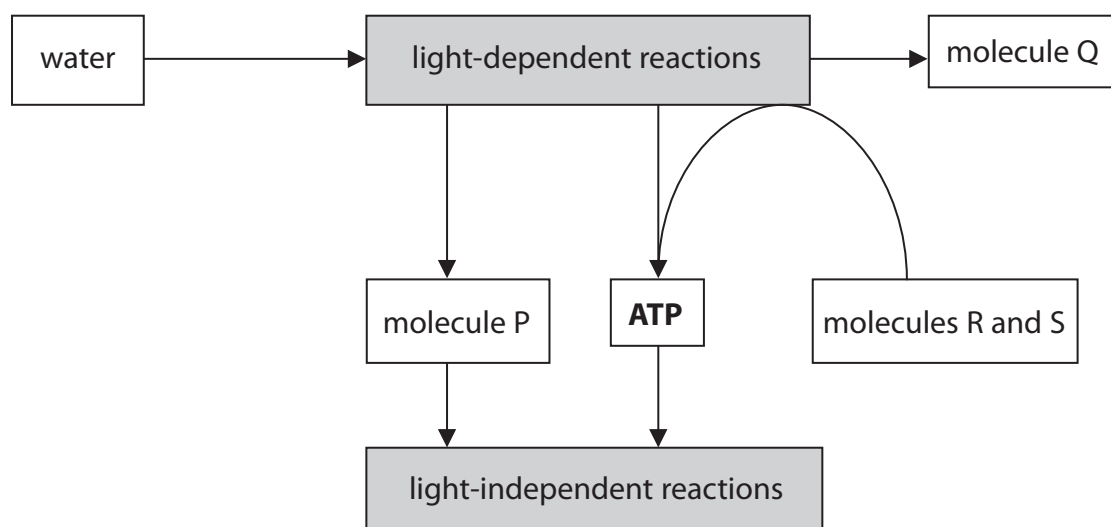
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Answer ALL questions.

Some questions must be answered with a cross . 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) Place a cross in the box next to the name of molecule **P** in the diagram.

(1)

- A** carbon dioxide
- B** oxidised NADP
- C** reduced NADP
- D** RUBISCO

(ii) Name the molecules **R** and **S** in the diagram.

(1)

molecule **R**

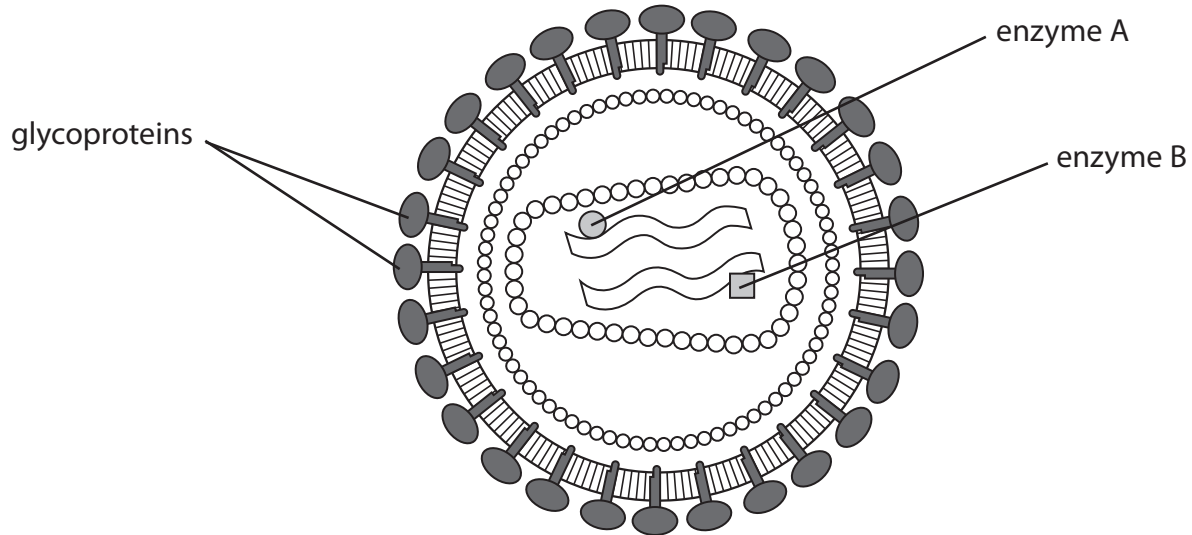
molecule **S**



P 4 4 4 9 2 A 0 3 2 8

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) A glycoprotein has a carbohydrate attached to a protein molecule.
Describe the three-dimensional structure of a glycoprotein.

(3)

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- 3 The Atlantic tomcod is a fish found in the rivers of North America.
The photograph below shows an Atlantic tomcod.



Magnification $\times 1$

Atlantic tomcod in the Hudson River are able to survive high levels of polychlorinated biphenyls (PCBs). PCBs enter the water from industrial processes.

One group of scientists identified a mutation in the DNA of these fish. They found that the AHR2 gene had six bases missing. This mutation was rarely found in Atlantic tomcod in the unpolluted St. Lawrence River.

- (a) Suggest how scientists in other countries learnt of these findings.

(2)

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(iii) Suggest **one** difference in the protein of the Atlantic tomcod from these two rivers.
Give an explanation for your answer.

(2)

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(Total for Question 3 = 12 marks)



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

The non-specific response involves interferon. The specific immune response requires antigen presentation to the cells of the immune system.

(a) Explain the importance of interferon in the body's response to infection by viruses.

(2)

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(b) Describe the role of antigen presentation in the body's specific immune response to infection by viruses.

(4)

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(c) There is an 'evolutionary race' between some viruses, such as HIV, and their host.

Suggest how this could affect the body's specific immune response to infection by viruses. Give an explanation for your answer.

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(Total for Question 4 = 9 marks)





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5 Biofuels are being developed to reduce the effect of greenhouse gases on global warming.

(a) The list below shows some of the gases found in the atmosphere:

- carbon dioxide
- helium
- methane
- nitrogen
- oxygen

Place a cross in the box next to the number of greenhouse gases in this list.

(1)

- A 1
- B 2
- C 3
- D 4

(b) Biofuels are produced from crop plants.

Bioethanols are produced from carbohydrates, such as corn starch and sugar.

Biodiesels are produced from lipids, such as soybean oil and rapeseed oil.

(i) Describe the structure of lipids.

(2)

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(ii) The table below gives some information about the **production** of biofuels from four different crop plants.

Crop plant	Carbon dioxide emissions from the production of biofuels / kg per MJ of energy produced	Level of resources used in production of biofuels		
		water	fertilisers	pesticides
Corn	81 to 85	High	High	High
Sugar cane	4 to 12	Medium to low	High	Medium
Soy	49	High	Low to medium	Medium
Rape	37	High	Medium	Medium

Using the information in the table, discuss the advantages of producing biodiesels instead of bioethanols.

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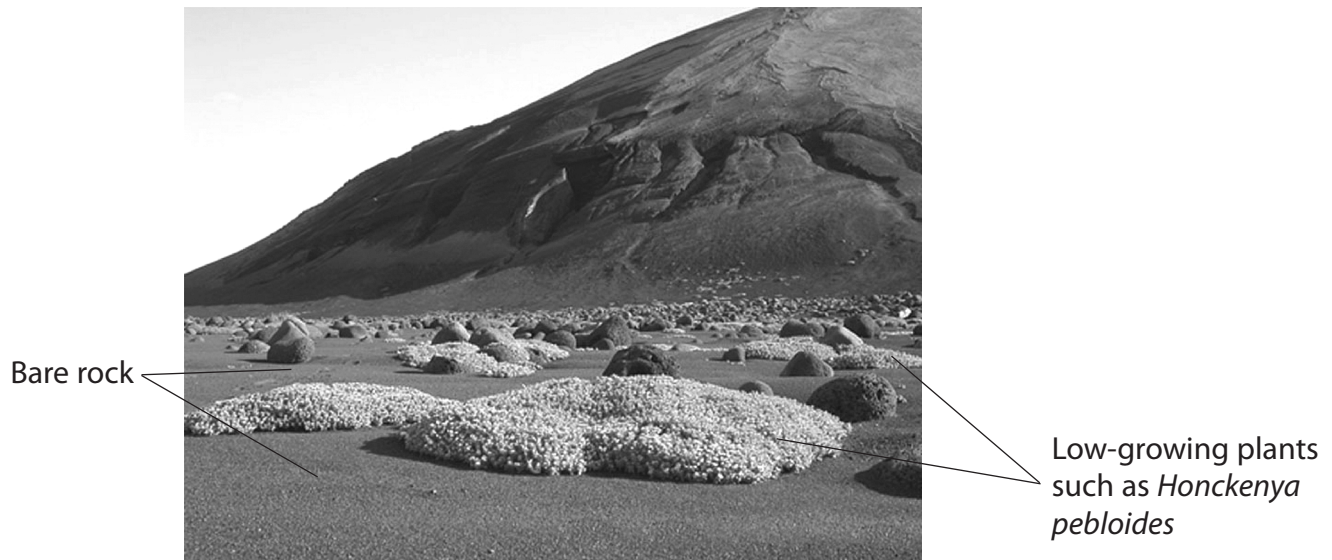
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- 6 Surtsey is a newly-formed volcanic island. The volcanic eruption finished in 1967. The island is protected so that it can be used to study succession on volcanic islands.

The photograph below shows the plants on part of the island about 10 years after the island was formed.



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

(1)

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(ii) Water availability affects the distribution of *Honckenya pebloides*.

Describe how water availability could be investigated in these two parts of the island.

(2)

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(d) In 1985, the lesser black-backed gull colonised this island.

A large increase in the number of species of plants was recorded after these birds colonised the island.

Suggest an explanation for this increase in the number of species of plants.

(2)

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(Total for Question 6 = 13 marks)

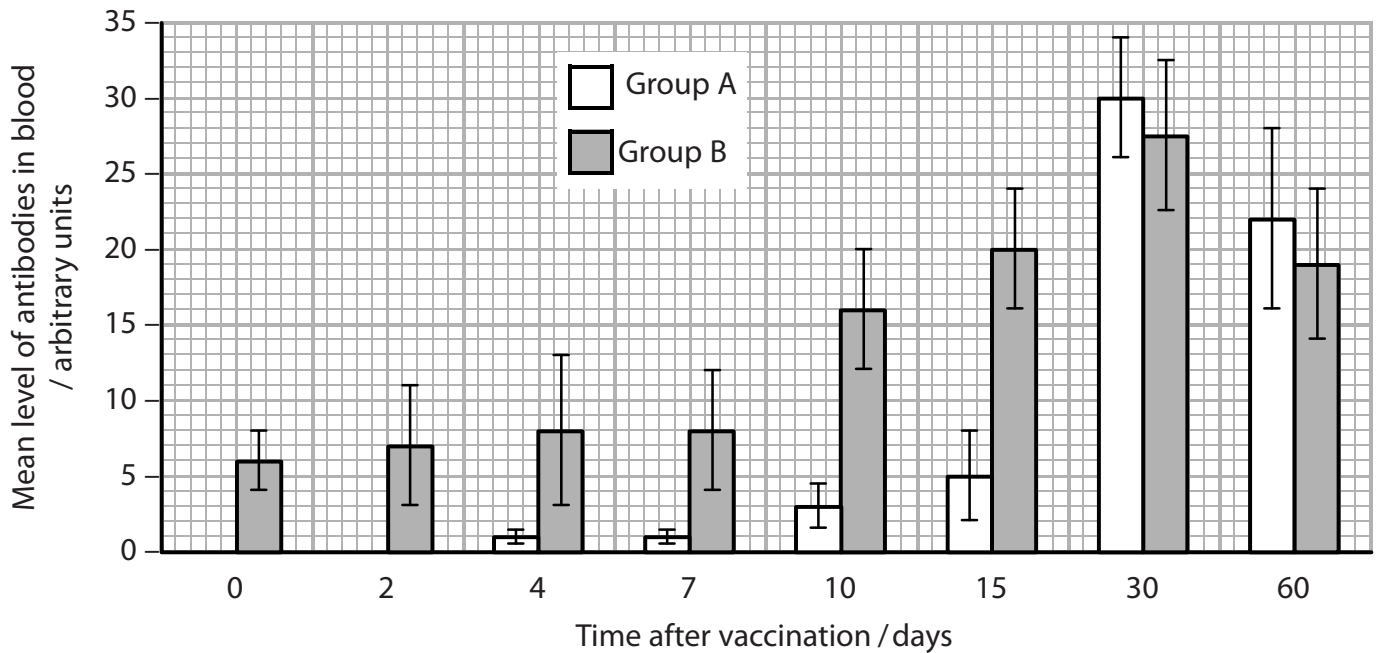


7 Yellow fever is caused by a virus. Infection with this virus causes thousands of deaths every year in people who have not been vaccinated.

The graph below shows the mean levels of antibodies in the blood of two groups of people, group A and group B, after being vaccinated. The same vaccine was used each time.

Group A consisted of eight people. They were given a vaccination against yellow fever and their blood was analysed.

Group B consisted of nine people who had already been vaccinated against yellow fever. They were given a second vaccination and their blood was analysed.



(a) Place a cross ☒ in the box next to the term that describes the type of immunity that results from this vaccination against yellow fever.

(1)

- A artificial active
- B artificial passive
- C natural active
- D natural passive



P 4 4 4 9 2 A 0 2 1 2 8

(b) (i) Compare the changes in the mean levels of antibodies in these two groups of people in the first fifteen days after vaccination.

(2)

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(ii) Explain why the mean levels of antibody in group B are different from group A in the first fifteen days.

(3)

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(c) Using the information in the graph, explain the advantage of vaccinating people twice against yellow fever.

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

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(Total for Question 7 = 11 marks)



8 The decomposition of leaves depends on the content of the leaves, the presence of certain microorganisms and a number of abiotic factors.

Leaves consist of a number of organic molecules, including lignin and cellulose.

(a) Place a cross in the box next to the groups of microorganisms that all cause decomposition.

(1)

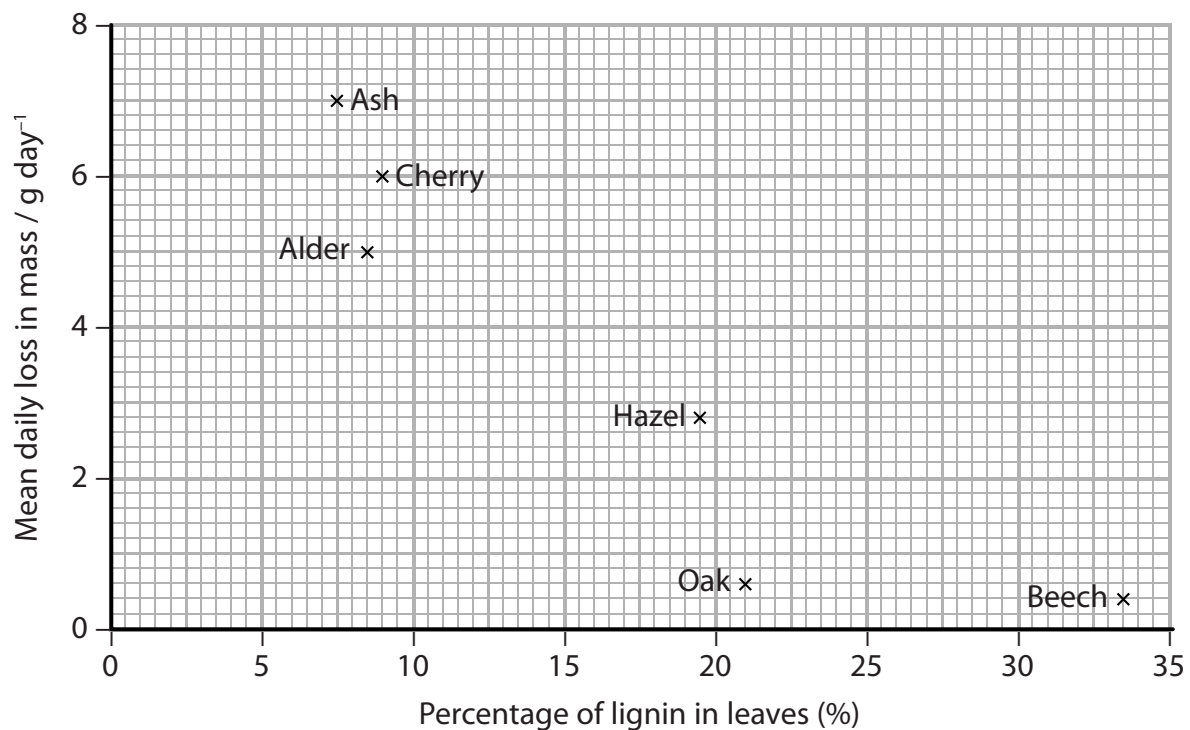
- A bacteria and fungi
- B bacteria and viruses
- C fungi and viruses
- D bacteria, fungi and viruses

(b) An investigation was carried out into the effect of lignin content on the decomposition of leaves from different types of tree.

The lignin content of leaves from an ash tree was determined. A pile of ash leaves was collected and weighed. The leaves were left for 40 days and reweighed. The mean daily loss in mass was calculated.

This was repeated for leaves from five other species of tree. All six piles of leaves had the same starting mass.

The results of this investigation are shown in the graph below.



(i) A student made the following conclusions from the data.

Beech leaves decompose faster than cherry leaves.

Microorganisms are needed for the decomposition of these leaves.

There is a causal relationship between lignin content and decomposition.

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

(1)

A none

B one

C two

D three

(ii) Place a cross in the box next to the term that completes the following statement.

Each pile of leaves had the same mass to ensure the investigation was

(1)

A accurate

B precise

C reliable

D valid



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