Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

Monday 12 January 2015 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
WBI04/01

You must have:
Calculator

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.*

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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1/1/1/1/1/C2

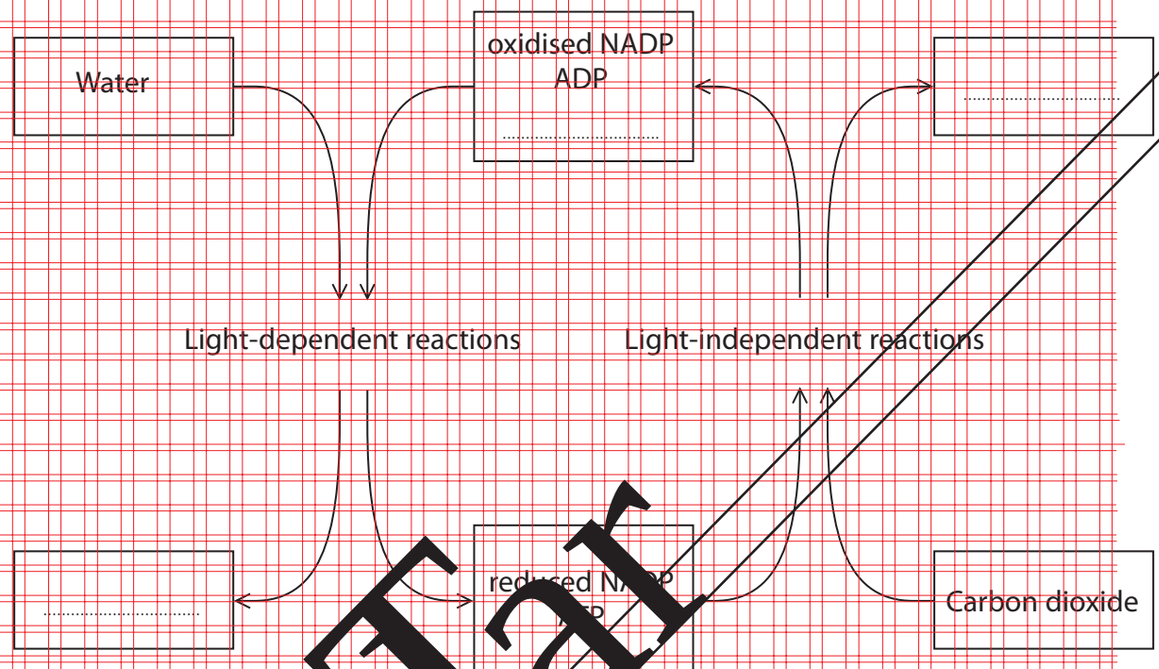
P 4 5 0 3 1 A 0 1 2 4

PEARSON

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 The diagram below shows some of the steps involved in photosynthesis.



(a) Complete the diagram by writing the correct word or words on the dotted lines.

(3)

Exemplar

*(b) Describe the roles of the thylakoid membranes in the production of ATP in the light-dependent reaction.

(6)

(Total for Question 1 = 9 marks)

Example

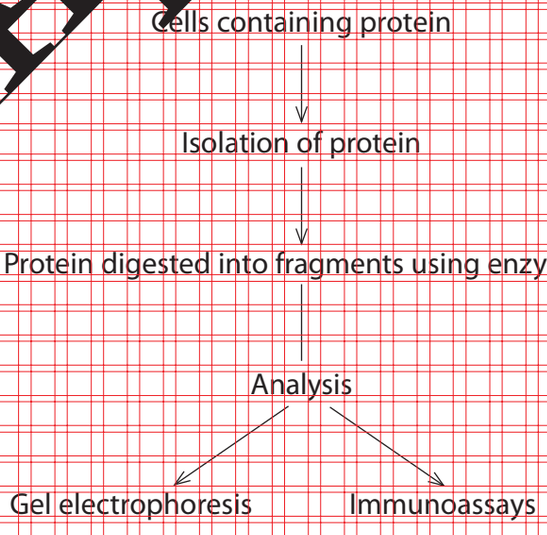
2 Proteomics can be used to study gene expression and to analyse the structure of proteins.

(a) Describe the structure of proteins.

(4)

(b) The diagram below shows some of the steps involved in proteomics.

The analysis uses gel electrophoresis and immunoassays. Immunoassays identify protein fragments using antibodies.



Draft

(i) Enzymes can be used to produce protein fragments from the isolated protein.

Put a cross ☒ in the box next to the description that completes the following statement.

Enzymes are

(1)

☒ **A** fibrous proteins that decrease activation energy

☒ **B** fibrous proteins that increase activation energy

☒ **C** globular proteins that decrease activation energy

☒ **D** globular proteins that increase activation energy

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

Enzymes digest proteins into fragments using

(1)

☒ **A** condensation reactions

☒ **B** esterification reactions

☒ **C** hydrolysis reactions

☒ **D** polymerisation reactions

(iii) Using your knowledge of gel electrophoresis in the analysis of DNA, suggest how gel electrophoresis could be used to analyse the protein.

(3)

DRAFT

(iv) Immunoassays use antibodies to identify the protein fragments.

Suggest why antibodies are suitable molecules for identifying protein fragments.

(2)

(c) Gene expression can be analysed by isolating and studying mRNA.

However, the structure and number of mRNA molecules do not always correspond to the proteins in the cell.

Suggest why the mRNA molecules do not always correspond to the proteins in the cell.

(2)

(Total for Question 2 = 13 marks)

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3 Global warming is having a number of effects on the environment.

*(a) Describe how global warming may be caused.

(5)

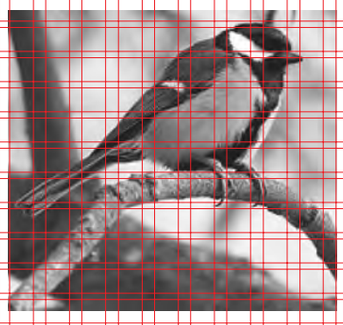
(b) Some scientists predict that by the year 2100 mean global temperatures could increase by 11?

Explain how scientists have made this prediction.

(2)

Example

(c) The photograph below shows a European great tit.



Magnification ×0.3

European great tits are predators of winter moth caterpillars. Winter moths lay eggs that hatch into caterpillars that feed on the leaves of trees in the spring season. Research has shown that European great tits now lay their eggs two weeks earlier than in 1970.

Suggest why this may be an advantage for European great tits.

(3)

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(d) The European blackcap is another species of bird that breeds in the UK, which has also changed its behaviour in response to global warming.

The majority of these birds fly long distances from Europe to North Africa. Recent studies have shown that some of these birds have now stopped making this migration and are breeding more successfully.

Suggest why this change in behaviour has resulted in more successful breeding of this species.

(3)

(Total for Question 3 = 13 marks)

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4 Hospitals have developed codes of practice to reduce the spread of infections.

Appropriate hand washing is one measure that helps to reduce the spread of infection.

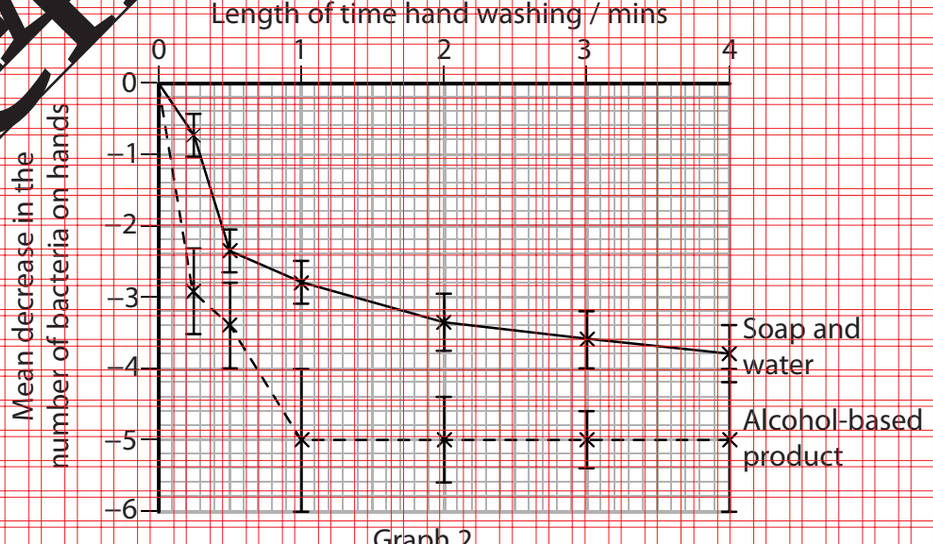
Two studies compared the effectiveness of hand washing products.

In study 1, four hand washing products were tested. One of these products was an alcohol-based product. Graph 1 shows the mean decrease in number of bacteria on hands in this study.

Graph 1

In the second study, hands were washed for different lengths of time using soap and water, or an alcohol-based product.

Graph 2 below shows the results of this study.



Graph 2

Exemplar

(a) It has been claimed that using alcohol-based products is the most appropriate way to wash hands because these products:

- require less washing time
- act faster
- irritate hands less
- are more effective than other hand washing products.

Using the information in Graph 1 and Graph 2, comment on each of the claims made about alcohol-based products.

(4)

(b) Comment on the reliability of the data in Graph 1 and Graph 2.

(3)

Exemplar

(c) Both graphs show the mean decrease in the number of bacteria on hands.
Suggest how this could have been determined.

(2)

(d) Describe **three** procedures, other than hand washing, that hospitals use to reduce the spread of infection.

(3)

(Total for Question 4 = 12 marks)

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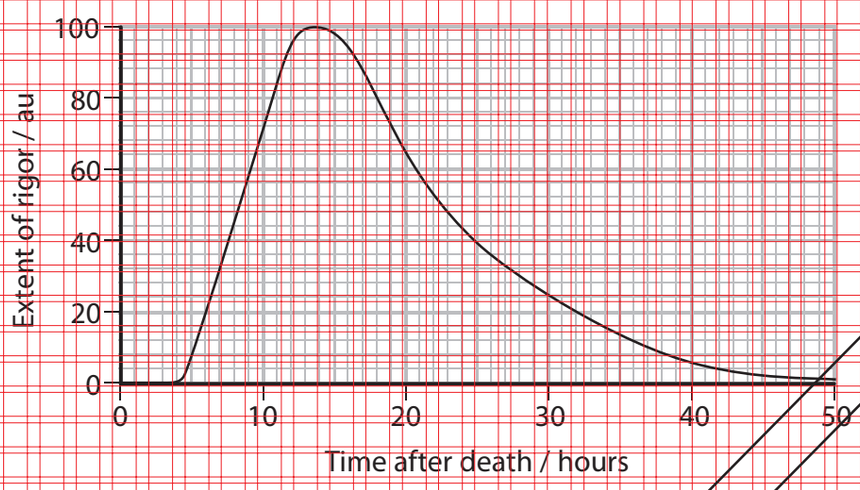
Example

5 The time of death of a person can be estimated using a number of different methods. One of these methods uses the degree of muscle contraction (rigor).

The graph below shows the extent of rigor in the muscles of a human body after death.



(a) Using the information in the graph, describe the relationship between time after death and the extent of rigor.

(3)

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(b) A pathologist examined a dead body. She immediately measured the body temperature by inserting a temperature probe into the liver.

The temperature probe read 34°C. She used this reading to estimate that death had occurred eight hours previously.

Explain why the pathologist inserted the temperature probe into the liver immediately.

(4)

(c) On further examination of the dead body, it was found that the extent of rigor was [illegible]. The pathologist concluded that the body had been stored in a different place before being discovered.

Explain why the pathologist came to this conclusion.

(3)

(Total for Question 5 = 10 marks)

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6 Net primary productivity is affected by a number of environmental factors.

(a) Explain the meaning of the term **net primary productivity**.

(2)

(b) Name **two** inorganic ions and explain why each of these ions will affect the net primary productivity.

(4)

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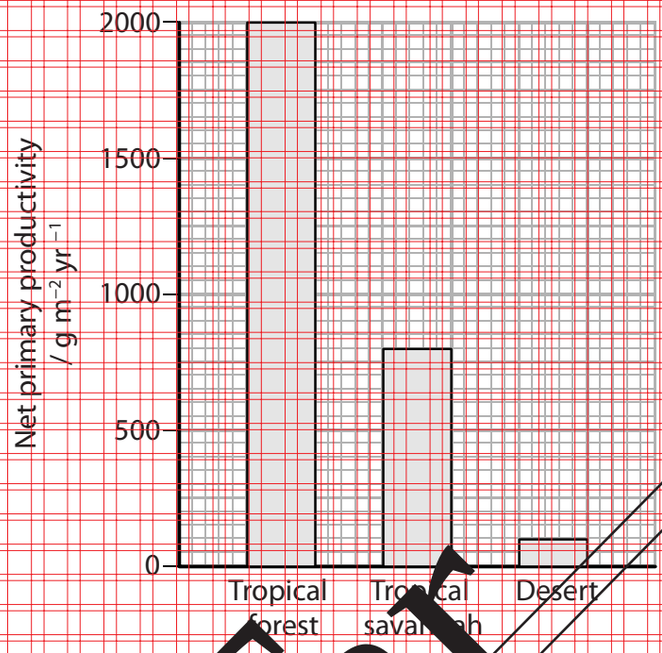
(c) Tropical forests have high average temperatures and rainfall. Tropical savannahs have high average temperatures and long, dry periods. Deserts have a wide range of temperatures and are very dry areas.

The graph below shows the net primary productivity of these environments.



Describe the differences in net primary productivity in these environments.

Suggest reasons for the differences.

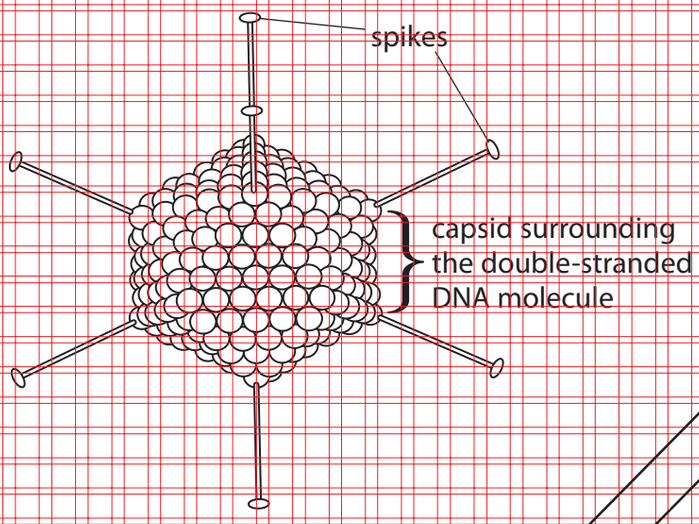
(4)

EXEMPLAR

(Total for Question 6 = 10 marks)

7 Adenoviruses can cause infections of the respiratory tract.

The diagram below shows the structure of an adenovirus.



(a) (i) Using the information in the diagram and your own knowledge, describe how the structure of the adenovirus is different from the structure of the Human Immunodeficiency Virus (HIV).

(3)

Draft

(ii) The DNA of the adenovirus carries genes. Suggest what these genes code for.

(2)

(b) When the adenovirus infects someone for the first time, an immune response occurs and the person develops immunity.

T killer cells are involved in the immune response to the adenovirus.

(i) Put a cross ☒ in the box next to the term that completes the following statement.

The type of immunity that develops the first time the adenovirus infects a person is called

(1)

☒ **A** artificial active immunity

☒ **B** artificial passive immunity

☒ **C** natural active immunity

☒ **D** natural passive immunity

(ii) Put a cross ☒ in the box next to the cell that presents antigen to T killer cells.

(1)

☒ **A** B lymphocyte

☒ **B** macrophage

☒ **C** T helper cell

☒ **D** virus-infected host cell

DRAFT

(iii) Put a cross ☒ in the box next to the name of the chemical that T helper cells produce to activate the T killer cells.

(1)

☒ **A** chromatin

☒ **B** cysteine

☒ **C** cytokine

☒ **D** cytosine

(iv) Put a cross ☒ in the box next to the term that completes the following statement.

Once activated, the T killer cells divide by

(1)

☒ **A** exocytosis

☒ **B** meiosis

☒ **C** mitosis

☒ **D** phagocytosis

(v) Describe the role of T killer cells in the immune response to a viral infection.

(4)

(Total for Question 7 = 13 marks)

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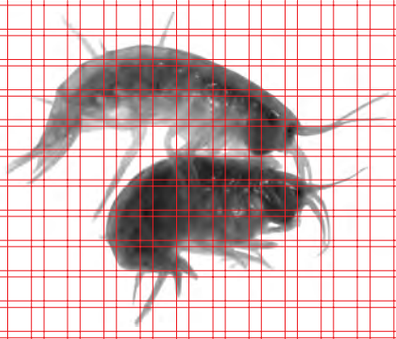
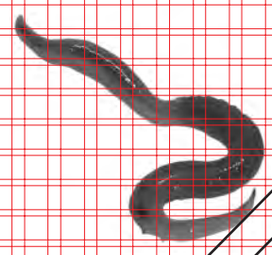
8 Pollution of rivers and streams can affect the concentration of oxygen dissolved in the water. As a result, the biodiversity in the water may change.

Freshwater shrimps require high oxygen concentrations. Bloodworms can survive in low oxygen concentrations.

The photographs below show two freshwater shrimps and a bloodworm.



Magnification ×3



Magnification ×2

(a) The table below shows the concentration of oxygen dissolved in the water of a shallow river, downstream from a source of pollution.

Distance from source of pollution / m	Oxygen concentration / au
5	6.0
10	5.9
15	5.6
20	5.1
25	4.0
30	2.7
35	1.5
40	0.8
45	0.2

Exemplar

(i) Describe how the oxygen concentration of water could be measured.

(2)

(ii) Put a cross ☒ in the box next to the percentage that completes the following sentence.

The overall percentage decrease in the concentration of dissolved oxygen is

(1)

☒ **A** 3.3%

☒ **B** 6.2%

☒ **C** 96.7%

☒ **D** 103.4%

(iii) Suggest why the oxygen concentration of the water may increase again further downstream.

(1)

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(b) Freshwater shrimps require high oxygen concentrations. Bloodworms can survive in low oxygen concentrations.

(i) Suggest how the distribution of the freshwater shrimps and bloodworms, in this shallow river, could be investigated practically.

(4)

(ii) Suggest why bloodworms can survive in polluted water but the freshwater shrimps cannot.

(2)

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 90 MARKS

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Preliminary

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