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

Friday 13 June 2014 – Afternoon	Paper Reference
Time: 1 hour 30 minutes	**WBI04/01**

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 ▶

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 light-independent reaction of photosynthesis produces GALP (glyceraldehyde 3-phosphate). This product is then used in the synthesis of other molecules, such as DNA.

(a) Describe how GALP is formed in the light-independent reaction.

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(b) Describe the structure of DNA.

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(c) In plants, GALP is converted into other sugars that are used in the synthesis of new biological molecules.

Suggest how GALP contributes to the synthesis of DNA.

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(Total for Question 1 = 11 marks)

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2 The canopy of a forest is made up of branches and leaves of the mature trees. The canopy limits the light reaching the ground.

Scientists from the UK Forestry Commission investigated the growth of tree seedlings under a canopy of Sitka spruce trees.

The species of tree seedlings used were: Noble fir, Silver fir and Sitka spruce.

Three plots, each containing 50 Noble fir seedlings, were planted under the Sitka spruce trees. This was repeated for Silver fir seedlings and Sitka spruce seedlings. This is shown in the diagram below.

One plot containing 50 seedlings ——————   ———— Sitka spruce tree

The canopy above each plot covered between 50% and 70% of the ground.

(a) For each of the statements below, place a cross ⊠ in the box next to the term that completes each statement.

(i) In this investigation, three plots each containing 50 tree seedlings were planted for each species, to ensure that the investigation was

(1)

⊠ **A** accurate

⊠ **B** precise

⊠ **C** reliable

⊠ **D** valid

(ii) In this investigation, the canopy above every plot covered between 50% and 70% of the ground.

This ensured that the investigation was
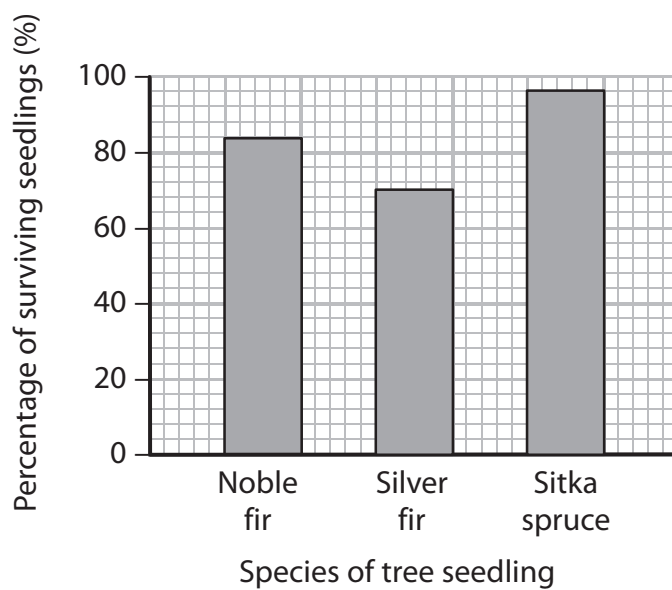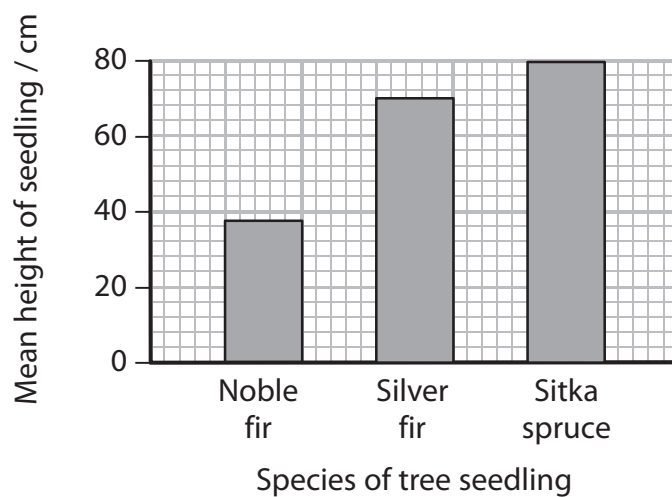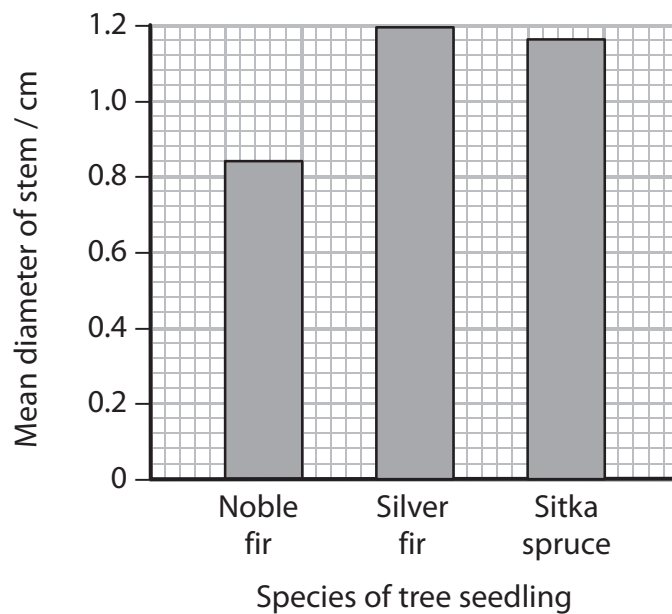
(1)

⊠ **A** accurate

⊠ **B** precise

⊠ **C** reliable

⊠ **D** valid

(b) After four years, the growth and survival of the seedlings were measured and recorded.

The graphs below show the results of this investigation.

(i) Using the information in the graphs, explain why the scientists concluded that the Sitka spruce seedlings grew best.

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(ii) Suggest **two** reasons, other than low light intensity, why the Noble fir seedlings did not grow very well in this investigation.

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(c) Describe an experiment, which could be carried out in a laboratory, to investigate the effect of light intensity on the growth of Noble fir seedlings.

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(Total for Question 2 = 11 marks)

3 Scientists analyse tree ring growth patterns for evidence of global warming.

(a) Place a cross ⊠ in the box next to the term used for the study of tree ring growth patterns.

(1)

- ⊠ **A** dendrochronology
- ⊠ **B** entomology
- ⊠ **C** proteomics
- ⊠ **D** succession

(b) Core samples can be used to study tree ring growth patterns. A core sample is obtained by boring into a living tree and pulling out a sample of wood.

Suggest why this hole is sealed.

(1)

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(c) The diagram below shows a core sample taken from a tree. It shows a tree ring growth pattern.

- ▢ Pith
- ▢ Bark

(i) Draw a line on the diagram to a tree ring representing the most growth in one year.

Label the line M.

(1)

(ii) Place a cross ⊠ in the box next to the age of the tree from which this core sample was taken.

(1)

- ⊠ **A** 29 years
- ⊠ **B** 30 years
- ⊠ **C** 31 years
- ⊠ **D** 32 years

(d) Explain how global warming may affect tree ring growth.

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(e) Suggest why scientists cannot be certain that changes in tree ring growth patterns are caused by global warming.

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(Total for Question 3 = 11 marks)

4 The organic matter in food is decomposed by micro-organisms.

*(a) Describe how micro-organisms decompose organic matter.

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(b) A number of different types of micro-organisms decompose organic matter in food. Micro-organisms grow in different ranges of pH.

The table below shows the pH ranges for the growth of five types of bacteria that can be found in food.

Type of bacteria	pH range
Lactobacillus	3.3 to 10.6
Acetobacter	4.0 to 9.3
Salmonella	4.1 to 9.0
Escherichia	4.2 to 9.0
Bacillus	4.5 to 9.5

(i) Suggest why pH affects the growth of bacteria.

(3)

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(ii) Malt vinegar has a pH of 2.4 and is used in the preservation of food.
Using the information in the table, suggest why malt vinegar can be used in the preservation of food.

(2)

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(iii) Apple vinegar has a pH of 4.25. Using the information in the table, suggest why apple vinegar is less effective than malt vinegar in the preservation of food.

(2)

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(Total for Question 4 = 13 marks)

5 Antibiotics are used to treat bacterial infections because they affect bacterial cells and not the cells of the patient being treated.

(a) Give **two** differences in the structure of a bacterial cell and a cell of the patient.

(2)

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(b) The effect of four different antibiotics on two types of bacteria, type 1 and type 2, was investigated in a school laboratory.

A suspension of bacteria type 1 was spread evenly over solid medium in a Petri dish. Four paper discs were placed on the surface of the medium. Each disc had been soaked in a different antibiotic, P, Q, R or S.

The procedure was repeated for a suspension of bacteria type 2.

The Petri dishes were sealed and then incubated for 48 hours.

(i) Describe how the Petri dishes should be sealed. Give a reason for your answer.

(2)

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(ii) Suggest a suitable incubation temperature to use in this investigation.
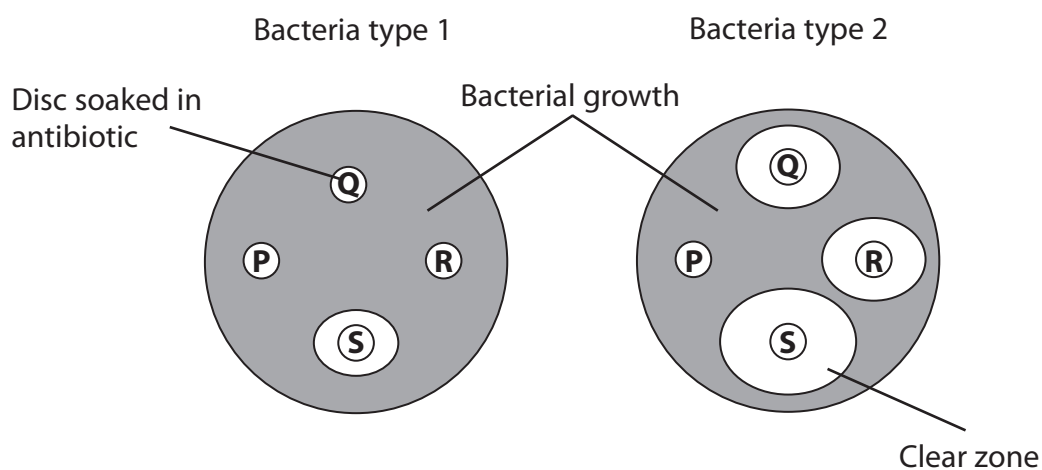Give **two** reasons for your answer.

(3)

Temperature ....

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(iii) The results of this investigation are shown below.

Bacteria type 1   Bacteria type 2

Disc soaked in   Bacterial growth
antibiotic

Clear zone

Describe the effect of antibiotics P, Q and R on these two types of bacteria.

(3)

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(iv) Describe how these results could be used to calculate the difference in the effect of antibiotic S on these two types of bacteria.

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(Total for Question 5 = 13 marks)

6 Lysozyme is an enzyme with an important role in many different living organisms.

(a) Explain the role of lysozyme action in the human body.

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(b) Lysozyme is a globular protein made up of 130 amino acids.

(i) Describe the properties of globular proteins.

(2)

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(ii) Place a cross ⊠ in the box next to the number of mRNA bases needed to code for 130 amino acids.

(1)

⊠ **A** 64

⊠ **B** 130

⊠ **C** 260

⊠ **D** 390

*(iii) Describe the processes involved in the production of the mRNA that codes for lysozyme.

(6)

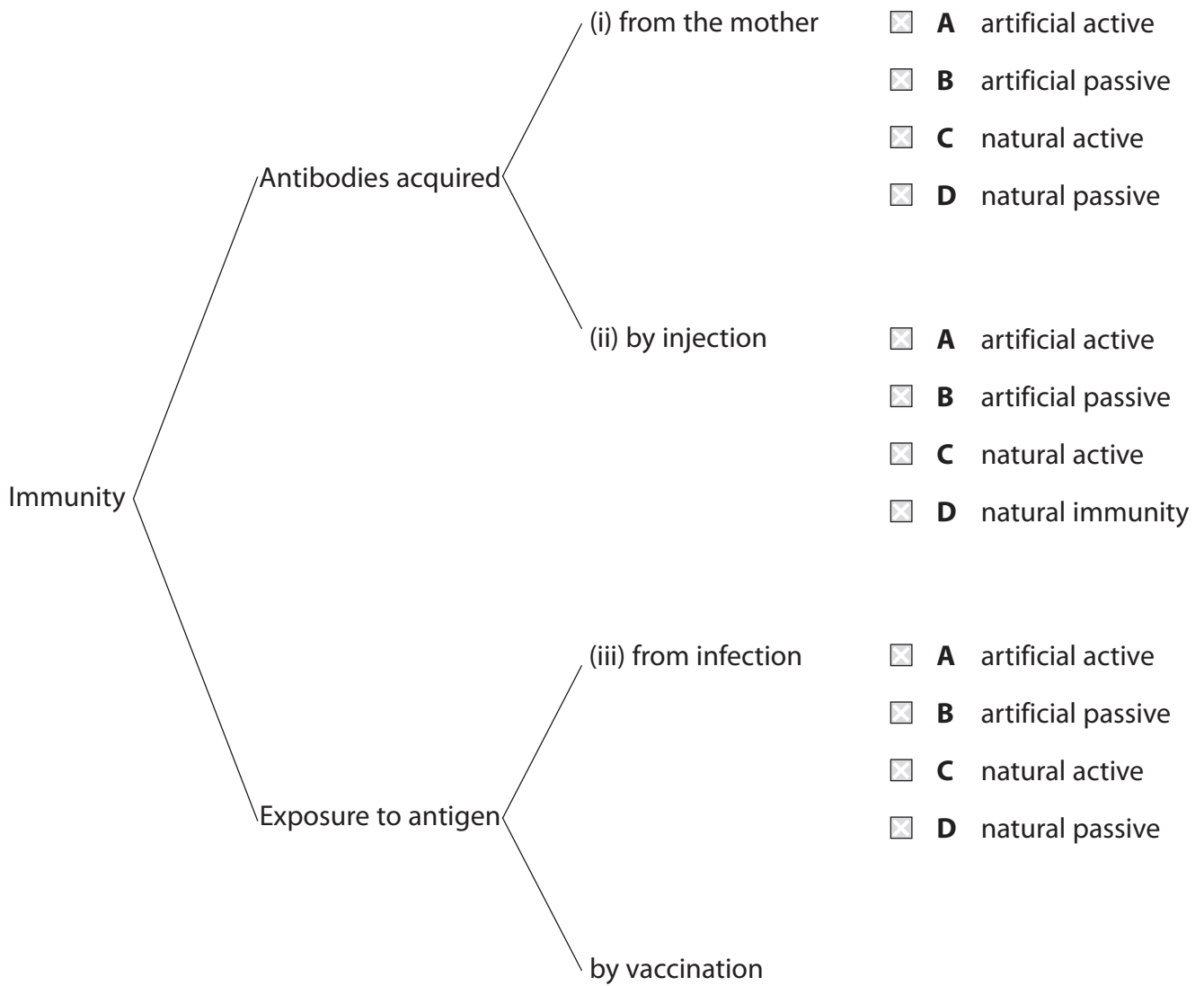(Total for Question 6 = 11 marks)

P 4 4 4 8 8 A 0 1 6 2 4

7 Immunity against micro-organisms can be developed in different ways.

(a) The diagram below shows ways in which immunity develops.

Place a cross ⊠ in the box next to the name of each type of immunity that develops.

(3)

Antibodies acquired

(i) from the mother
- ⊠ **A** artificial active
- ⊠ **B** artificial passive
- ⊠ **C** natural active
- ⊠ **D** natural passive

(ii) by injection
- ⊠ **A** artificial active
- ⊠ **B** artificial passive
- ⊠ **C** natural active
- ⊠ **D** natural immunity

Immunity

Exposure to antigen

(iii) from infection
- ⊠ **A** artificial active
- ⊠ **B** artificial passive
- ⊠ **C** natural active
- ⊠ **D** natural passive

by vaccination

(b) Feline panleukopenia virus (FPV) is a non-enveloped single-stranded DNA virus that infects cats.

(i) Give **two** differences between the structure of FPV and Human Immunodeficiency Virus (HIV).

(2)

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(ii) New FPV particles cannot be made unless the cells of the cat are in S-phase of the cell cycle.

S-phase occurs before mitosis. The DNA is replicated during S-phase.

Suggest why these FPV particles can only be made in S-phase of the cell cycle.

(1)

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(c) Colostrum is the milk that kittens drink from their mother immediately after they are born. Maternal antibodies against FPV can be passed to the kittens from the mother in the colostrum.

The level of antibodies in the kittens halves every 10 days.

These antibodies protect the kittens from FPV for approximately seven weeks.

(i) Estimate the proportion of antibodies remaining in the kittens after seven weeks.

(2)

Answer = ...

(ii) Suggest why these maternal antibodies do not give the kittens **long-lasting** protection against this virus.

(4)

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(Total for Question 7 = 12 marks)

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

8 Evolution of a species can come about through natural selection.

(a) Explain how natural selection can result in evolution.

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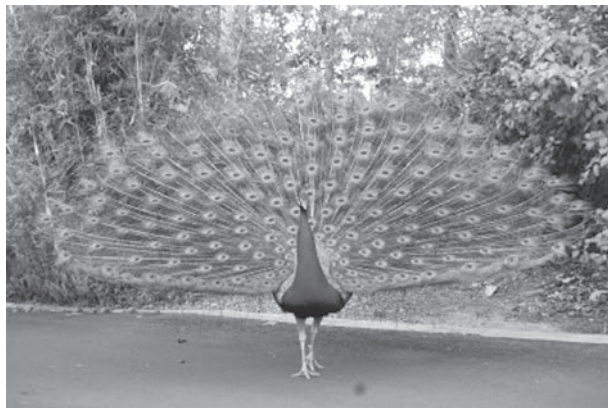
(b) Peafowl is a species of bird. The peacock is the male bird that has a large number of colourful feathers.

The photograph below shows a peacock displaying his feathers.

Magnification ×0.05

(i) Suggest why these colourful feathers have been selected for in the evolution of peacocks.

(2)

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(ii) Suggest why a large number of colourful feathers could be a disadvantage to a peacock.

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(iii) Suggest why the female peafowl (peahen) has smaller, dull-coloured feathers.

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(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 90 MARKS

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