Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	B	I	0	4	/	1	Signature	

Paper Reference(s)

6BI04/1

Edexcel GCE

Biology

Unit 4: The Natural Environment & Species Survival

Sample Assessment Material

Time: 1 hour 15 minutes

Examiner's use only		

Team Leader's use only		

Question Number	Leave Blank
1	
2	
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4	
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6	
7	
8	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Do not use pencil. Use black or blue ink.
Some questions must be answered with a cross in a box (☒). If you change your mind, put a line through the box (☒) and then mark your new answer with a cross (☒).

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 8 questions in this question paper. The total mark for this paper is 90.
There are 20 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
Answers should be given in a correct biological context.

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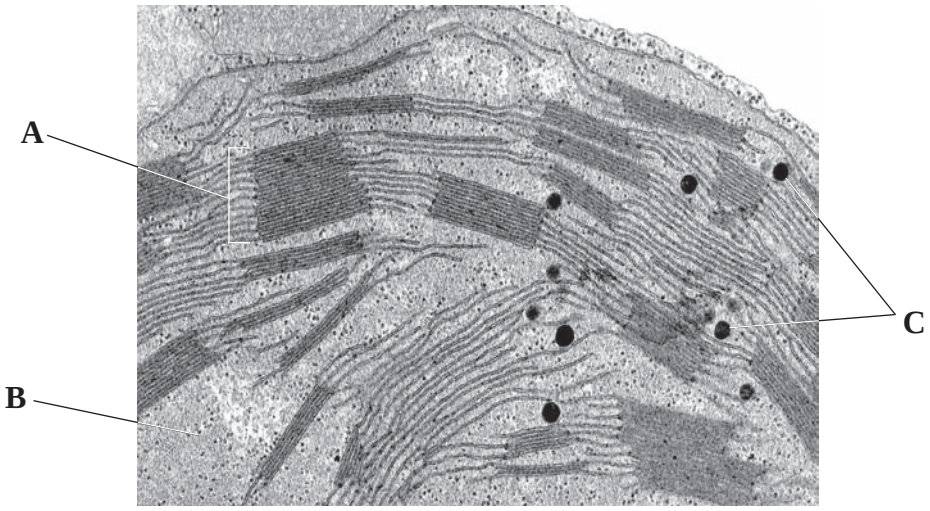
1. (a) The electron microscope image below shows part of a chloroplast.



The table below gives one function of each of the three structures labelled **A**, **B** and **C** on the electron microscope image. Complete the table below by writing in the appropriate letter and the name of each structure.

Function	Label letter	Name of structure
Photophosphorylation		
Stores non-carbohydrate organic material		
Carbon fixation		

(3)

(b) The equation below summarises the process of photolysis of water.

$$2H_2O \rightarrow 4H^+ + 4e^- + O_2$$

(i) Explain what happens to the electrons released by photolysis.

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(2)

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(ii) The electrons are later involved in the reduction of NADP. Explain the importance of reduced NADP in the light-independent reactions of photosynthesis.

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(3)

(c) The rate at which plants produce carbohydrate by photosynthesis is known as gross primary productivity.

Put a cross in the box next to the equation that shows the relationship between gross primary productivity (GPP), net primary productivity (NPP) and respiration (R).

☒ GPP + R = NPP

☒ GPP + NPP = R

☒ GPP = NPP + R

☒ GPP = NPP – R

(1)

Leave blank

(d) The table below shows the net primary productivity in four different ecosystems. The ecosystems in the table are listed in order of increasing distance from the equator, starting with tropical rainforest.

Ecosystem	Net primary productivity / kJ m^{-2} $year^{-1}$
Tropical rainforest	37 800
Temperate forest	25 200
Boreal forest	14 700
Polar tundra	2 400

(i) It is estimated that 85% of the energy available to primary consumers will not be available to secondary consumers. Calculate the energy that will be available to the secondary consumers in the **tropical rainforest**. Show your working.

Answer ..... kJ m^{-2} $year^{-1}$
(2)

(ii) Suggest **two** reasons for the differences in the net primary productivity as the distance from the equator increases.

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(2)

Q1

(Total 13 marks)

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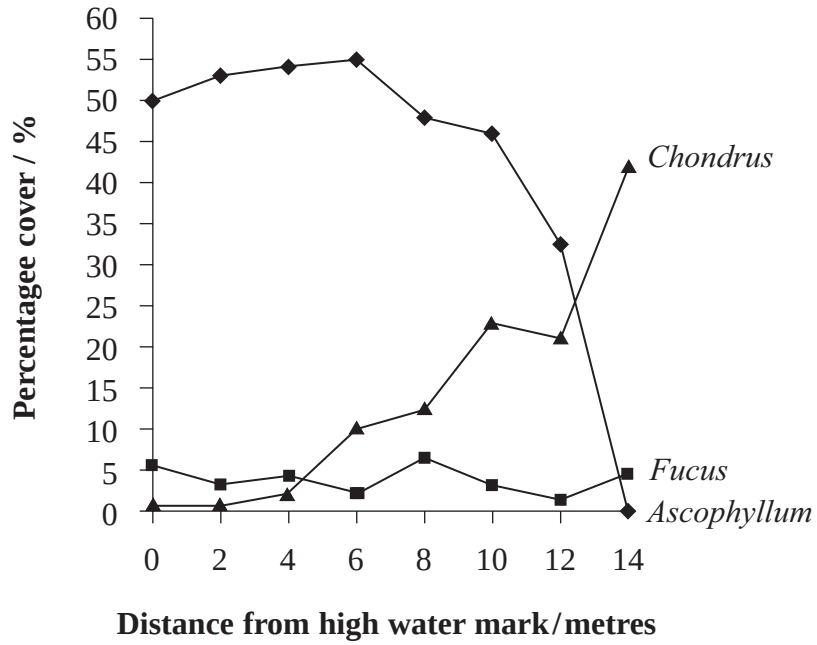
2. A study of the distribution and abundance of three different seaweeds was carried out in the intertidal region of a gently sloping rocky shore. The intertidal region is the area that will be covered by water as the tide comes in and uncovered by water as the tide goes out.

The abundance of each seaweed was found by estimating its percentage cover at regular intervals from the high water mark at the top of the shore to the low water mark lower down the shore.

The results of this study are shown on the graph below.



(a) (i) Put a cross in the box next to the statement that could form part of a valid conclusion from the data shown in the graph.

☒ **A** – *Ascophyllum* grows only in regions that are uncovered by water for long periods of time

☒ **B** – *Fucus* grows better in regions that are never uncovered by water

☒ **C** – *Chondrus* may not be able to compete with *Ascophyllum*

(1)

Leave blank

(ii) With reference to the graph discuss the validity of statements **A**, **B** and **C**.

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(3)

(b) Suggest **two** abiotic factors, other than the length of time the seaweeds are out of water, that could affect the distribution of the seaweeds on this shore.

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(c) Describe a technique that you have used to study the distribution of a named organism within its habitat.

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(4)

Q2

(Total 10 marks)

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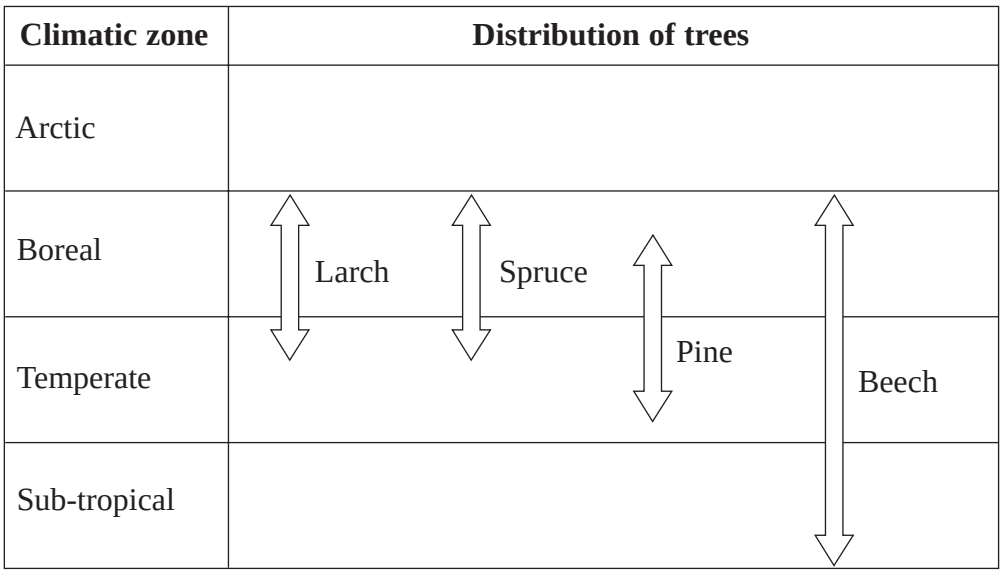
3. A study of tree pollen grains in a peat bog in Finland was carried out. The number of pollen grains of different tree species was recorded at different depths in the peat.

The data for four of these trees are given as a percentage of the total tree pollen sample, in the table below. An estimate of the age of the sample at each depth was also made.

Depth of sample / m	Age / years	Tree pollen grain / %			
		Larch	Spruce	Pine	Beech
0.5	2 850	0	0	53	43
1.0	3 770	0	0	55	40
1.5	5 600	0	0	31	47
2.0	6 390	0	12	15	53
2.5	8 170	5	36	4	48
3.0	8 700	38	36	6	35
3.5	8 780	27	40	3	32
4.0	10 000	10	22	2	40

The diagram below shows the present-day distribution of the four tree species found in the main climatic zones of the northern hemisphere.



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(a) Suggest how pollen grains can provide evidence about which species of tree were growing successfully in Finland as the peat bog was forming.

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(2)

(b) (i) Put a cross in the box next to the species of tree that does not provide evidence about the changes in climate in Finland during the last 10 000 years.

☒ **A** Larch

☒ **B** Spruce

☒ **C** Pine

☒ **D** Beech

(1)

(ii) Explain your answer to (b)(i).

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(2)

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(c) With reference to the present-day distribution of the four tree species and the results of the pollen grain study, suggest in what way the climate in Finland has changed during the last 10 000 years. Give reasons for your answer.

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(5)

(d) Describe how dendrochronology can be used to provide evidence for climate change.

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Q3

(Total 12 marks)

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4. In 1937, a population of sockeye salmon was released into Lake Washington in the USA. Since then, the original stock appears to have split into two different populations which do not interbreed. One group of salmon breeds in the shallow waters of the lake. The other group breeds in a fast-flowing river that flows into the lake.

These two populations of salmon have developed very different physical features. In the river, the male fish are more streamlined than those in the lake. This is thought to enable them to deal with the river's strong current. The females in the river are larger and more muscular than those in the lake population. This allows them to bury their eggs deep into the gravel, which is necessary to stop the eggs being dislodged by the fast water flow.

In addition, scientists have found evidence that the two populations appear to have developed differences between their gene pools. It is suggested that the Lake Washington salmon populations may eventually evolve into two separate species.

(a) State the term used to describe

(i) the separation of one species into two populations that do not interbreed

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(1)

(ii) the formation of two new species from one species

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(1)

(iii) the relative proportion of different forms of a particular gene within a gene pool.

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(1)

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(b) Suggest how the two populations of salmon developed differences in their gene pools.

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(c) Explain how new alleles might appear in the gene pool of a species.

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Q4

(Total 10 marks)

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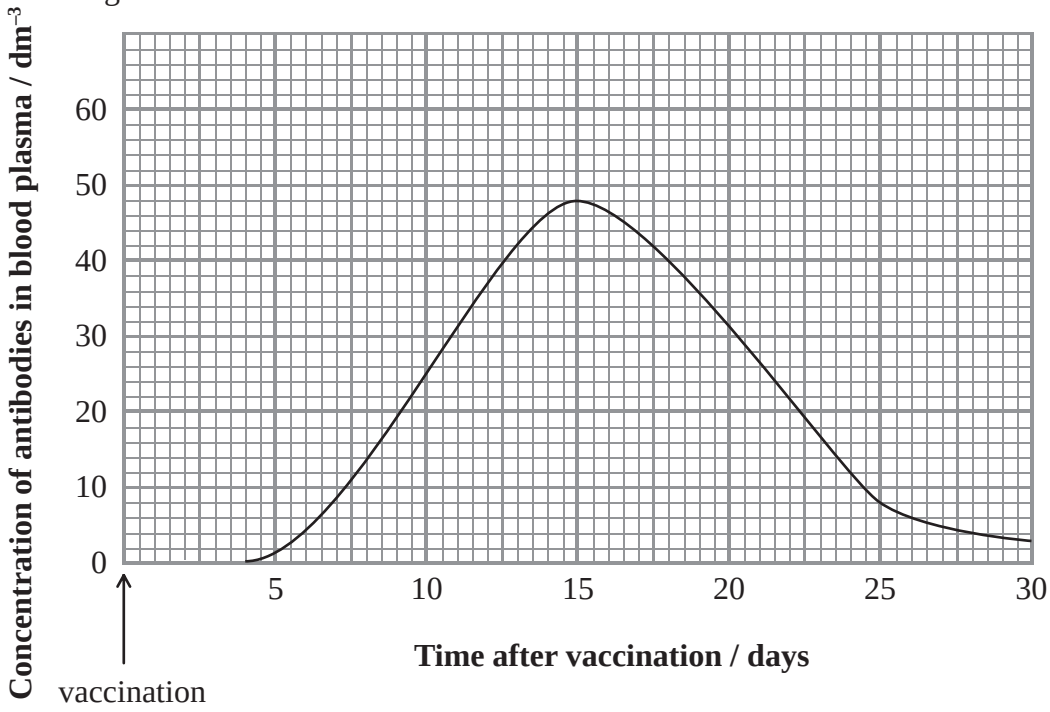
5. Vaccines are widely used to protect individuals from developing the symptoms of a range of bacterial and viral infections. The vaccine contains one or more of the antigens found on the pathogen. One such example is a vaccine for influenza (flu) that contains a cocktail of antigens from viruses that cause this disease.

The graph below shows the changes in concentration of antibody in the blood plasma following vaccination of an individual.



(a) Describe and explain the changes that occur in the concentration of antibodies in the blood plasma following vaccination.

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(b) Mutations frequently occur in the flu virus resulting in a change in the antigens present on its surface.

(i) Explain the meaning of the term **mutation**.

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(2)

(ii) Suggest why the vaccine contains a cocktail of antigens.

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(2)

Q5

(Total 10 marks)

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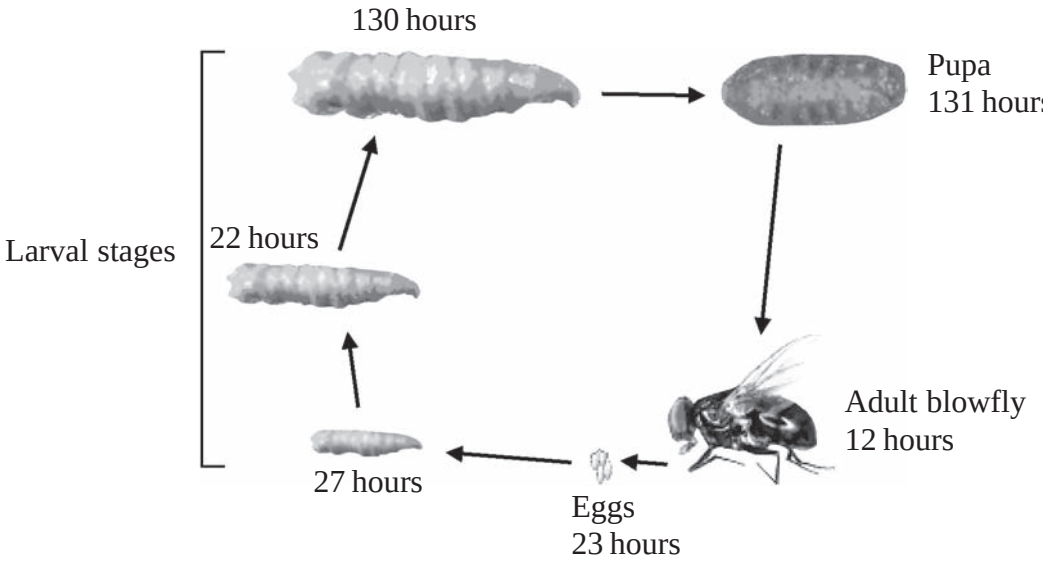
6. (a) Forensic entomology can be used to estimate the time of death of a mammal. Adult female blowflies soon arrive to lay their eggs on the body and the blowfly life cycle follows a precise sequence. The diagram below shows the sequence and times (in hours) for each stage when the surrounding temperature is 21 °C.



(i) Using information in the diagram, calculate the total percentage of the life cycle that a blowfly spends as a larva when the surrounding temperature is 21°C.

Answer ..... %

(2)

(ii) Temperature has an effect on the length of the blowfly lifecycle. Suggest an explanation for the effect of temperature on the length of the blowfly lifecycle.

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(iii) Suggest **two** factors, other than temperature, that may affect the timing of the blowfly lifecycle and lead to an incorrect estimate of the time of death.

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(b) Time of death can also be estimated by studying the degree of rigor mortis in muscles. Describe how rigor mortis in muscles occurs.

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(c) The process of succession occurs in plant communities as well as in a dead body. Compare these two forms of succession.

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(3)

(Total 13 marks)

Q6

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7. Tuberculosis (TB) is caused by the bacterium, *Mycobacterium tuberculosis*.

(a) The table below lists **five** structural features that may be found in bacteria and viruses. Put a cross in the box if the structural feature is present.

Structural feature	Bacteria	Viruses
Mesosome	☒	☒
Capsid	☒	☒
Nucleic acid	☒	☒
Cytoplasm	☒	☒
Ribosome	☒	☒

(5)

(b) The table below shows the number of new TB cases recorded in 1994 and in 2004 from four different geographical regions. These data exclude people who are HIV positive.

Year	Number of new TB cases per 100 000 of the population			
	Africa	Asia	South America	Europe
1994	148	629	98	48
2004	281	535	59	104

(i) Describe the trends shown by the data.

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(ii) HIV positive people were excluded from the data. If they had been included suggest how the data would differ. Give an explanation for your answer.

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(c) TB is increasing in some countries which have well-funded health services. Suggest **two** reasons for this.

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Q7

(Total 12 marks)

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8. Bacteriostatic and bactericidal antibiotics are effective against bacterial cells but leave mammalian cells unharmed.

(a) (i) Distinguish between bacteriostatic and bactericidal antibiotics.

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(1)

(ii) Suggest why mammalian cells are unharmed by antibiotics.

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(2)

(b) Resistance to antibiotics is an increasingly severe problem around the world. More hospital patients are contracting diseases which cannot be cured using available antibiotics.

Suggest ways by which doctors and patients can help to prevent the further spread of antibiotic resistance in bacteria.

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(c) Describe a procedure that you have used to investigate the effect of different antibiotics on bacterial growth.

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(4) **Q8**

(Total 10 marks)

TOTAL FOR PAPER: 90 MARKS

END