

**GCE**  
**AS and A Level**

# **Human Biology**

**AS exams 2009 onwards**  
**A2 exams 2010 onwards**

## **Unit 5:** **Specimen question paper**

**Version 1.0**



Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

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General Certificate of Education  
Advanced Level Examination



## HUMAN BIOLOGY

The air we breathe, the water we drink, the food we eat

HBIO5

Specimen Paper

<p><b>In addition to this paper you will require</b></p> <ul style="list-style-type: none"> <li>a ruler with millimetre measurements</li> </ul> <p>You may use a calculator</p>
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Time allowed: 2 hours

### Instructions

- Use black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions, but note that Question 11 offers a choice of essays. Question 11 should be answered in continuous prose.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- If you need additional space, you should continue your answers at the end of this book, indicating clearly which question you are answering.

### Information

- The maximum mark for this paper is 95.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.
- Quality of written communication will be assessed in your answer to Question 11.

For Examiner's Use			
Number	Mark	Number	Mark
1		8	
2		9	
3		10	
4		11	
5			
6			
7			
Total (Column 1)			
Total (Column 2)			
Quality of Written Communication			
TOTAL			
Examiner's Initials			

Answer **all** questions in the space provided.

- 1 (a) Explain what is meant by the *Polluter Pays Principle*?

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(2 marks)

- (b) The *waste hierarchy* starts with the statement that,

“Waste should be prevented or reduced at source”.

Give **three** other statements from the *waste hierarchy*.

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(3 marks)

- 2 (a) A person can contract cryptosporidiosis from drinking water. Explain how.

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(2 marks)

- (b) Water from a sewage treatment works was exposed to high energy ultraviolet light before being discharged into the sea. The ultraviolet light killed any remaining bacteria in the water. However, the water authority decided to stop treating the water from the sewage treatment works in the winter, because few people use beaches then.

- (i) Explain **one** environmental advantage of stopping ultraviolet treatment.

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(2 marks)

- (ii) Explain **one** environmental disadvantage of stopping ultraviolet treatment.

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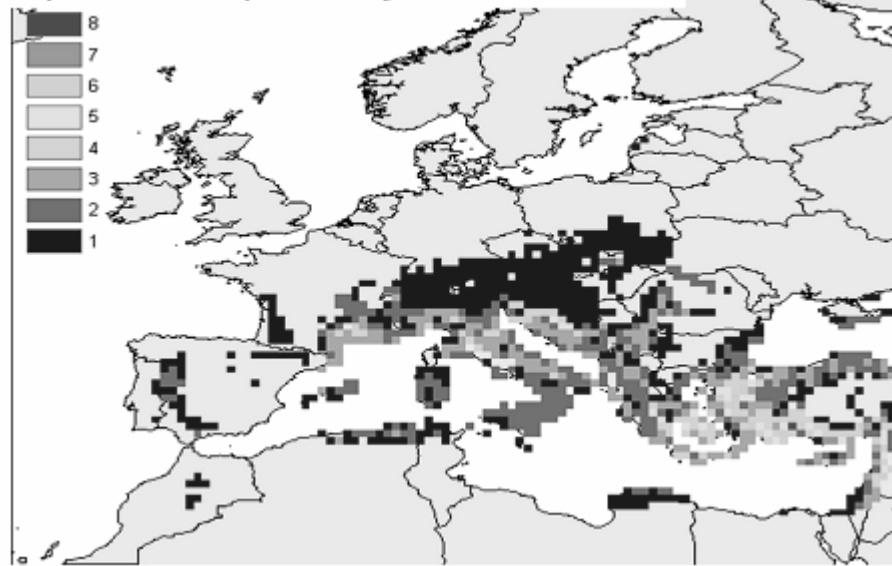
(2 marks)

3 Cyclamens are species of plants. The picture shows one species of cyclamen.



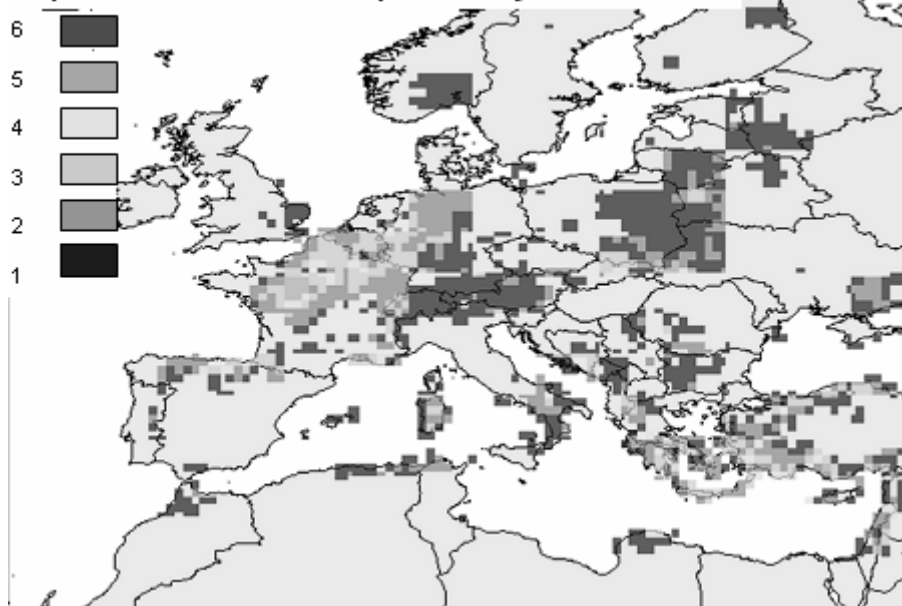
**Map 1** shows the distribution of species of cyclamens in 2006.

**Map 1** Number of species of cyclamen in 2006



**Map 2** shows the predicted distribution of cyclamens in 2050.

**Map 2** Predicted number of species of cyclamen in 2050



- (a) Describe **two** changes in the distribution of cyclamen species from 2006 to 2050.

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(2 marks)

- (b) The changes in the predicted distribution of cyclamens is based on predictions about global warming. Suggest **one** way in which global warming could produce these changes.

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(2 marks)

- (c) You could use quadrats to find the numbers of cyclamen plants in a large area. Describe how.

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(3 marks)

- 4 Pulverised fuel ash (PFA) is a waste product of coal-fired power stations. A large area covered in mounds of PFA was abandoned in the 1960s. After about 5 years, plants called orchids started to grow in large numbers on the site. About 30 years after the mounds were abandoned, they were covered in woodland and the orchids had almost entirely gone.

(a) Succession led to the disappearance of the orchids on the PFA mounds. Explain how.

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*(3 marks)*

(b) Scientists carried out an experiment on the mounds. They removed the woodland and the topsoil from some areas. Then they spread PFA on these areas.

(i) Suggest a possible hypothesis that these scientists were testing in this experiment.

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*(2 marks)*

(ii) Other areas had only the woodland removed and no PFA added. Explain why.

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*(2 marks)*

- 5 Fossil fuels used for transport can be replaced with biofuels. The table gives the percentage of agricultural land needed to replace 10% of the fossil fuels used in different regions with biofuel.

Region	Percentage of agricultural land needed to replace 10% of fossil fuel
USA	30
European Union	72
Brazil	3

- (a) The use of biofuels can reduce global warming. Explain how.

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(2 marks)

- (b) Suggest **two** reasons for the differences in the percentages of land needed in these regions.

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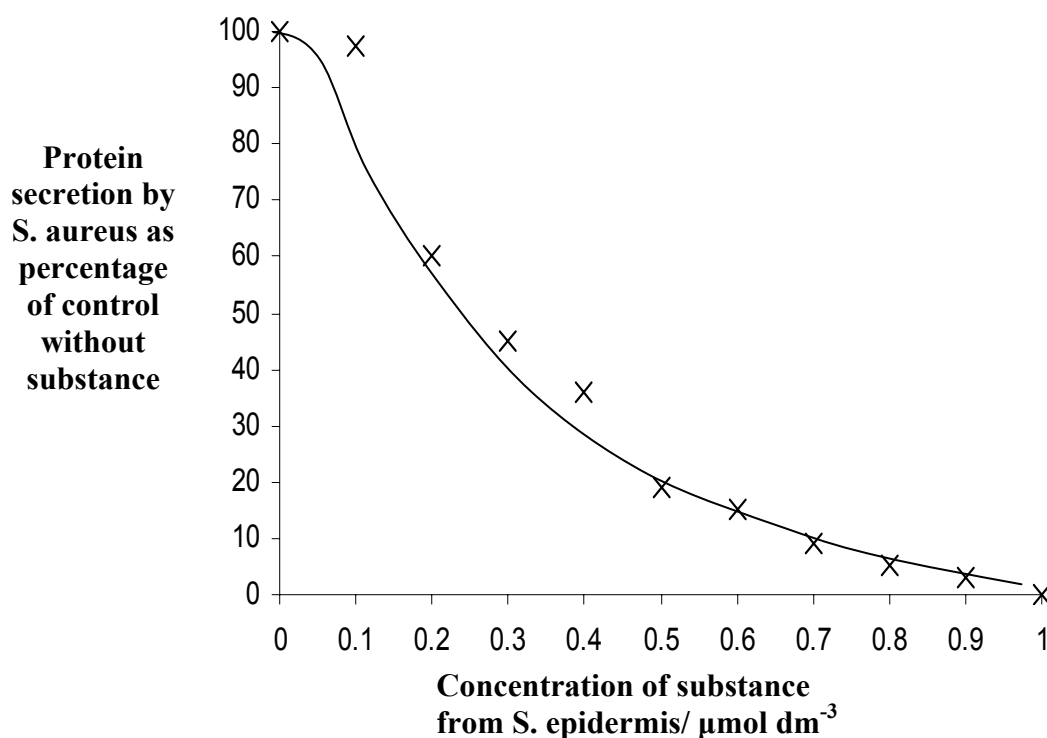
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(2 marks)



- 6 *Staphylococcus epidermis* is a bacterium found on human skin. *Staphylococcus aureus* is also found on the skin and can cause serious infections. Scientists isolated a substance produced by *S. epidermis*. This substance binds to a receptor on the plasma membrane of *S. aureus*. The scientists investigated the effect of the substance on secretion of proteins by *S. aureus*. The graph shows the results.



- (a) Use the graph to suggest how the substance produced by *S. epidermis* inhibits the growth of *S. aureus*.

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(3 marks)

- (b) The secretion of this substance by *S. epidermis* is an adaptation to its niche on the skin. Explain how.

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(3 marks)

- (c) Suggest **one** explanation for the shape of the curve.

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(2 marks)

8

**Turn over for the next question**

- 7 Students investigated a soap manufacturer's claim that washing hands in their soap gets rid of bacteria on the skin. The soap contains a substance called triclosan.

The students investigated the ability of the soap to kill two strains of *Escherichia coli*, A and B.

The students exposed some cultures of the bacterium to solutions of the soap with triclosan.

They exposed other cultures to solutions of triclosan on its own. A range of solutions was used that contained increasing concentrations of triclosan.

In each experiment, the bacteria were exposed to the solutions containing triclosan for 2 hours at 37°C. The students recorded the concentration of triclosan needed to kill 90% of the bacteria.

The table shows the results.

Strain of <i>Escherichia coli</i>	Concentration of triclosan needed to kill 90% of the bacteria/ $\mu\text{g cm}^{-3}$	
	Triclosan solution	Solution of soap containing triclosan
A	6	150
B	32	450

- (a) Describe the results.

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(2 marks)

- (b) The method used did not include a good control. Explain why.

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(2 marks)

(c) Do the results support the claims of the manufacturer? Explain your answer.

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*(2 marks)*

(d) Strain **B** evolved from strain **A**. Suggest how.

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*(2 marks)*

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**Turn over for the next question**

**8** (a) The human gut supports a bacterial community. What is a bacterial community?

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*(3 marks)*

- (b) Probiotic supplements contain bacteria. When the supplements are swallowed, they first enter the stomach. After an average of 20 minutes, they move from the stomach into the intestines.

Scientists grew cultures of the bacteria from three probiotic supplements, **A**, **B** and **C**. In a series of experiments, they added samples from each bacterial culture to an acidic solution they had made. This solution was very similar to the liquid found in the stomach. The scientists recorded the number of bacteria per  $\text{cm}^3$  in the solution at the start of each experiment and after 20 minutes in the solution. The table shows the results.

Supplement	Form in which supplement is swallowed	Bacterium in supplement	Number of bacteria per $\text{cm}^3$ of solution $\times 10^{-3}$	
			At start of experiment	After 20 minutes
<b>A</b>	Capsule	<i>Lactobacillus</i> species	10.35	6.84
<b>B</b>	In yoghurt	<i>Bifidobacterium</i> species	4.58	4.21
<b>C</b>	Capsule	<i>Enterococcus</i> species	3.41	0.0

Probiotic foods are supposed to improve the functioning of the intestines by introducing bacteria. What conclusions can be drawn about the effectiveness of foods **A**, **B** and **C** in achieving this.

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(3 marks)

9 (a) What is an allergen?

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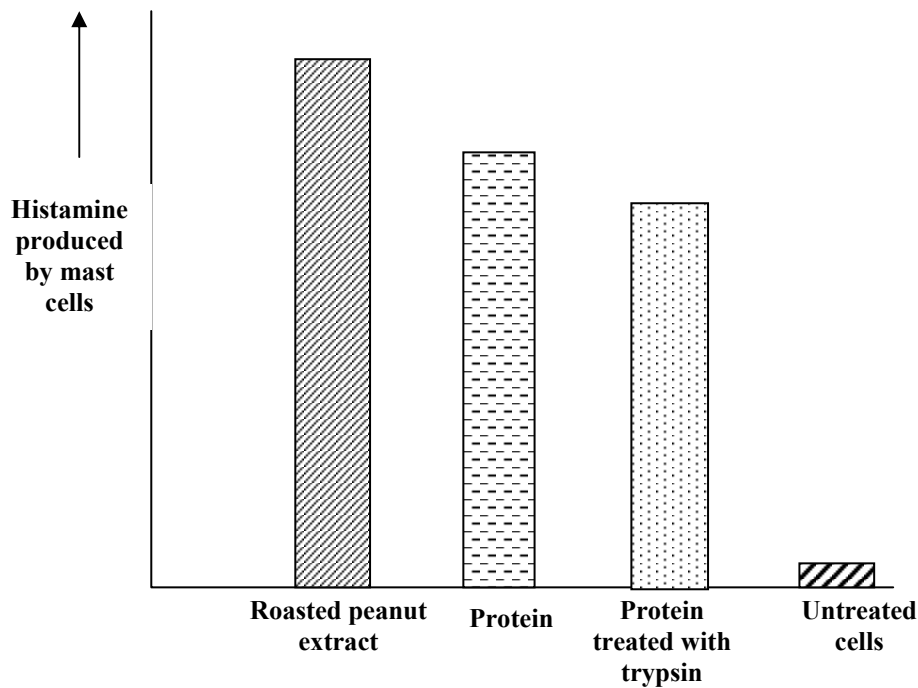
*(2 marks)*

(b) Some people are allergic to peanuts. Scientists investigated the production of histamine by mast cells exposed to;

- an extract of whole peanuts that had been roasted in an oven,
- a protein extracted from uncooked peanuts,
- the same protein treated with trypsin, a protease enzyme.

They also measured histamine production by untreated mast cells to which nothing had been added.

The bar chart shows the results.



What do the results suggest about this protein from peanuts?

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(4 marks)



- 10 (a) The spread of Japanese knotweed in Britain threatens to reduce the numbers of many species of animals. Give **one** reason why.

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(2 marks)

- (b) A council used a new method to control Japanese knotweed. The method involved spraying a herbicide called glyphosate on knotweed. Each treatment killed 95% of knotweed in an area. The spray treatment was used once each year for three years. The cost of each treatment was 12 pence per  $\text{m}^2$ . An area of 30 hectares was treated; one hectare equals 10 000  $\text{m}^2$ .

- (i) What was the cost of the spray treatment? Show your working.

£.....2 marks)

- (ii) This method of control requires each area to be treated for three years. Explain why.

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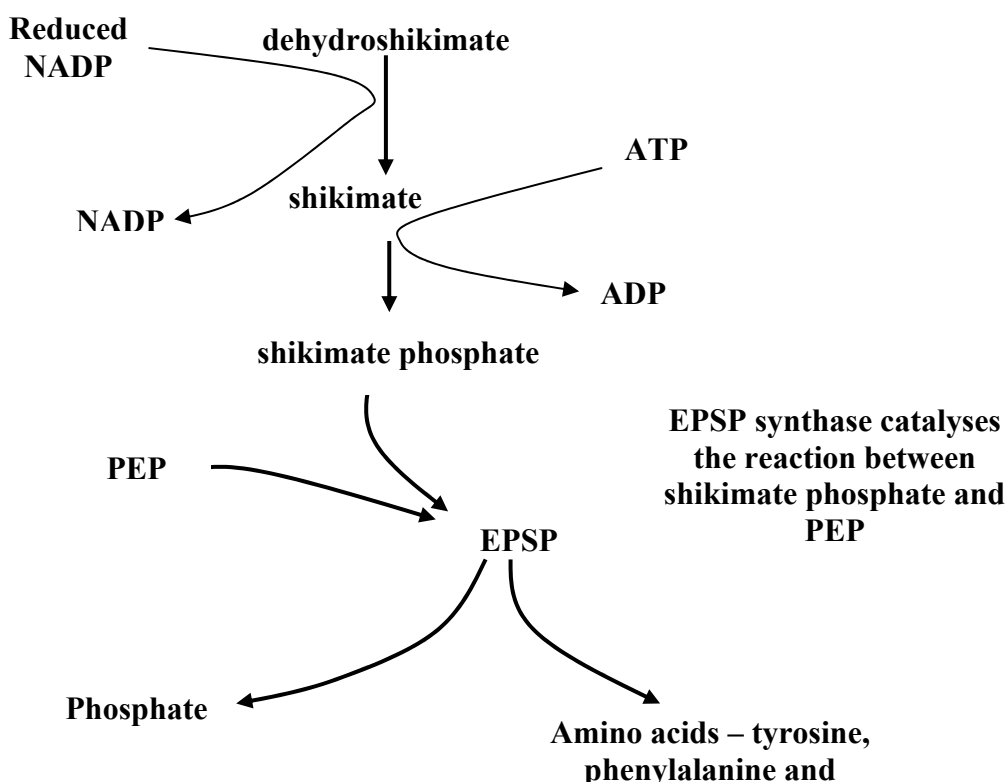
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(2 marks)

- (c) Glyphosate inhibits the enzyme EPSP synthase. **Figure 1** shows the metabolic pathway which involves this enzyme.



Glyphosate causes large amounts of shikimate phosphate to accumulate in plant cells.

- (i) Use the information given to suggest two ways in which glyphosate could kill plants.

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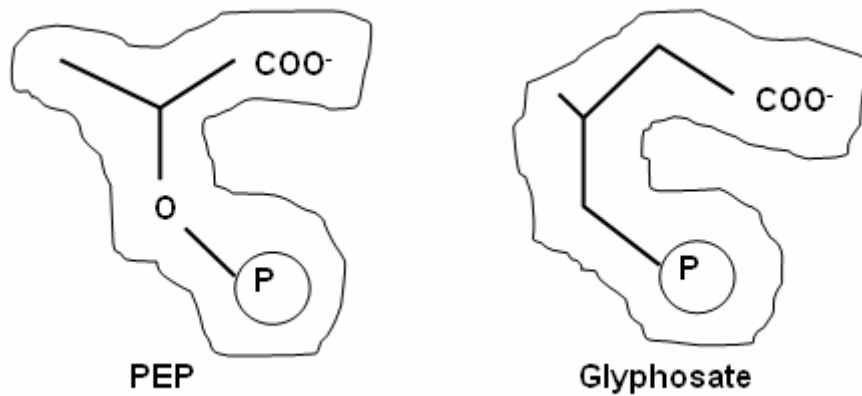
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(4 marks)

- (ii) PEP is the substrate of EPSP synthase. **Figure 2** shows diagrams of the structures of PEP and glyphosate.



Glyphosate inhibits EPSP synthase. Suggest how.

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(2 marks)

11 Write an essay on **one** of the topics below.

**EITHER**

(a) Proteins and people

(25 marks)

**OR**

(b) Human impacts on biodiversity.

(25 marks)

*In the answer to this question you should bring together relevant principles and concepts from different parts of the specification.*

*Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.*

*The essay should be written in continuous prose.*

*The maximum number of marks that can be awarded is:*

<i>Scientific content .....</i>	<i>16</i>
<i>Breadth of knowledge.....</i>	<i>3</i>
<i>Relevance .....</i>	<i>3</i>
<i>Quality of Written Communication .....</i>	<i>3</i>

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