



22056011

**BIOLOGY  
STANDARD LEVEL  
PAPER 2**

Wednesday 11 May 2005 (afternoon)

1 hour 15 minutes

Candidate session number

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**INSTRUCTIONS TO CANDIDATES**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

**SECTION A**

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

1. Lectins are proteins that some plants synthesise and store in their cells. Lectins have properties that make plant tissues unpalatable to insects and nematode worms. Crop plants that do not naturally produce lectins have been genetically modified to produce them. For example, genes coding for two types of lectin have been transferred to potatoes (*Solanum tuberosum*). One of the genes (GNA) was obtained from snowdrop plants (*Galanthus nivalis*) and the other (Con A) from jackbeans (*Canavalia virosa*). To obtain a series of genetically modified varieties, gene transfer was carried out repeatedly on one type of potato (Désirée). The lectin content of the leaves and the level of control of aphids and nematodes were measured in each genetically modified potato variety. The table below shows the results. The figures for control are the percentage reduction in the number of aphids and nematodes that fed on the plants, compared with the unmodified potato plants.

<b>Genetically modified potato varieties</b>	<b>Lectin content / % of total soluble leaf protein</b>	<b>Aphid control / %</b>	<b>Nematode control / %</b>
GNA pBG650	0.600	13	22
GNA 2#28	0.600	49	17
GNA 71	0.320	29	38
GNA 74	0.340	42	22
Con A 31	0.024	48	0
Con A 4	0.044	41	37

[Source: Griffiths, Geoghegan and Robertson, *Journal of Applied Ecology*, (2000), 37, pages 159–170]

- (a) Compare the lectin content of the GNA varieties with the Con A varieties. [1]

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- (b) Identify, with a reason, the most promising variety for control of both aphids and nematodes. [2]

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*(Question 1 continued)*

- (c) Discuss the relationship between the lectin content of the different varieties and the level of control of aphids and nematodes.

[2]

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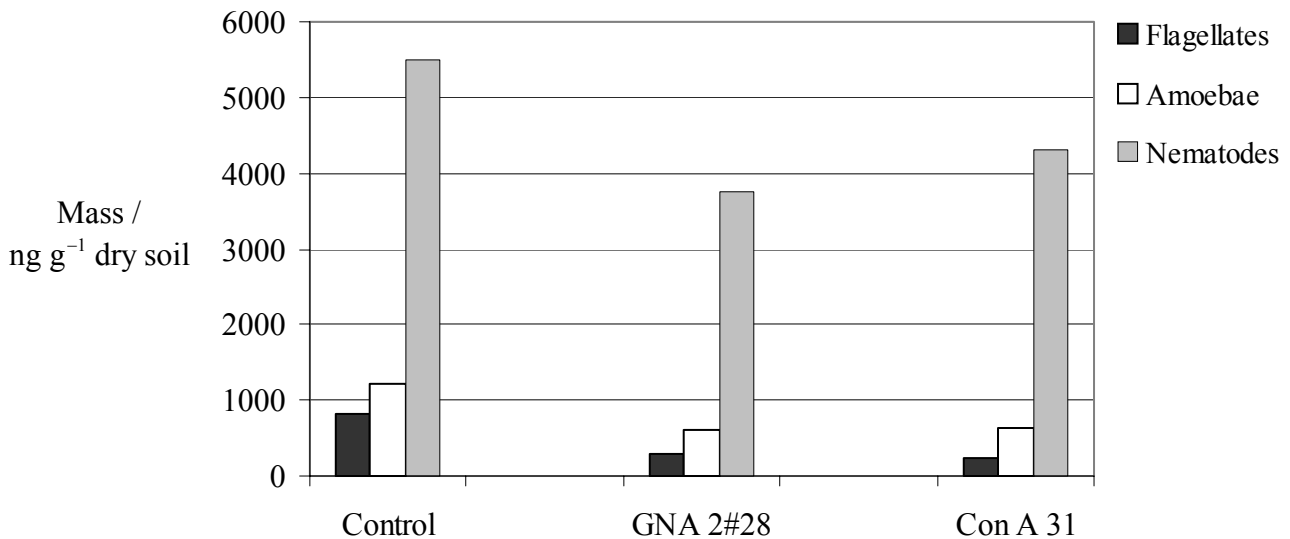
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(Question 1 continued)

The use of genetically modified crop varieties is controversial and some biologists have suggested that other species might be harmed. Trials have been done to test whether lectin-producing plants affect species other than the pests of the crops. In one of these trials, replicate 5 g samples of sandy loam soil were mixed with 1 g samples of coarsely chopped leaves from genetically modified Désirée potato plants. Control experiments were also set up in the same way using chopped leaves from Désirée potato plants that were not genetically modified. After fourteen days, nematodes feeding on soil bacteria and two types of protozoa (flagellates and amoebae) were extracted from the leaf-soil mixtures. The amounts of these three different species were determined.

Mean results for the two genetically modified varieties used in the trials and control results are shown in the bar chart below.



[Source: Griffiths, Geoghegan and Robertson, *Journal of Applied Ecology*, (2000), 37, pages 159–170]

- (d) The mean mass of flagellates in the GNA 2#28 trial was 63 % lower than the control. The mean mass of amoebae in the GNA 2#28 trial was 51 % lower than the control.

Calculate how much lower the mean mass of nematodes in the GNA 2#28 trial was than the control. Show your working.

[2]

Answer .....

(This question continues on the following page)

*(Question 1 continued)*

- (e) Using the data in the bar chart, discuss whether the effects of the genetically modified potato plants are more significant on protozoa or on nematodes. [3]

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2. Living organisms produce a wide variety of organic compounds.

(a) Define the term *organic*. [1]

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Organic compounds are made of chemical elements, which are therefore essential to living organisms.

(b) State the **three** most commonly occurring elements. [1]

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(c) Some organic compounds contain other elements. State **one** substance, or group of substances, that contains

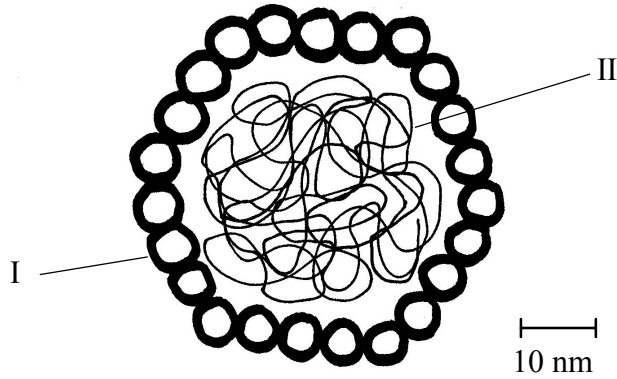
(i) nitrogen. [1]

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(ii) phosphorus. [1]

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3. The drawing below shows the structure of a virus.



(a) Identify structures labelled I and II. [2]

I: .....

II: .....

(b) Use the scale bar to calculate the maximum diameter of the virus. Show your working. [2]

Answer: .....

(c) Explain briefly why antibiotics are effective against bacteria but not viruses. [3]

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*(Question 3 continued)*

(d) Explain how antibiotic resistance develops in bacteria.

[3]

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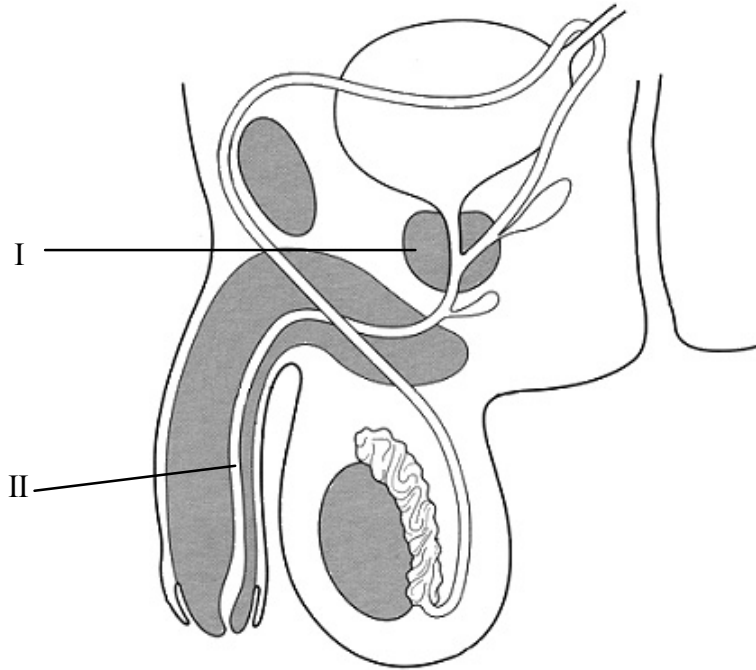
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4. The diagram below shows the male reproductive system.



[Source: Adapted from J Vellacott and S Side, *Understanding Advanced Human Biology*, (1998), Hodder and Stoughton, page 281]

(a) State the names of I and II. [2]

I: .....

II: .....

(b) Discuss the ethical issues of family planning and contraception. [4]

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**SECTION B**

Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers on the answer sheets provided. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

5. (a) Many processes in living organisms, including ventilation and gas exchange, involve moving materials. State the differences between ventilation and gas exchange in humans. [4]
- (b) Outline the events that occur within the heart, which cause blood to move around the body. [6]
- (c) Explain how vesicles are used in cells, including the way in which they form and are reabsorbed. [8]
6. (a) Living organisms use DNA as their genetic material. Explain how DNA is replicated within the cells of living organisms. [8]
- (b) Outline DNA profiling (genetic fingerprinting), including **one** way in which it has been used. [5]
- (c) Karyotyping involves arranging the chromosomes of an individual into pairs. Describe **one** application of this process, including the way in which the chromosomes are obtained. [5]
7. (a) Ecologists sometimes investigate one population and at other times do research into a whole community. Define the terms *population* and *community*. [4]
- (b) Describe **one** technique that ecologists use to estimate accurately the size of a population of animals, including details of any calculations that need to be done. [6]
- (c) Explain how energy enters a community, flows through it and is eventually lost. [8]
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