

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY

2805/03

Environmental Biology

Friday

24 JUNE 2005

Afternoon

1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number										
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TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu	Max.	Mark
1	15	
2	19	
3	15	
4	15	
5	13	
6	13	
TOTAL	90	

This question paper consists of 17 printed pages and 3 blank pages.

Answer all the questions.

- 1 Venus, the nearest planet to Earth, is almost identical to Earth in size and geological make-up. Recent research suggests that Venus might once have been Earth's twin planet, complete with rivers, deep oceans and possibly teeming with life.

It is thought that, around 500 000 years ago, a surge of volcanic eruptions caused mass global warming, destroying the climate of Venus. The rising heat caused billions of tonnes of carbon dioxide to be released from the rocks and vegetation.

Today, the atmosphere of Venus is 10 times thicker than the Earth's atmosphere and most of it is carbon dioxide.

Table 1.1 compares some features of the Earth with Venus.

Table 1.1

	Earth	Venus
mean diameter / miles	7 928	7 523
mean distance from the sun / $\times 10^6$ miles	93	67
mean surface temperature / $^{\circ}\text{C}$	15	464
length of day / hours	24	2800

- (a) Use the information in the above passage and Table 1.1 to explain why the type of life found on Earth could not exist on Venus.

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(b) Global warming is a result of the so-called 'greenhouse effect'.
Life on Earth depends upon there being some greenhouse effect, though there is now considerable concern that the Earth is experiencing an 'enhanced greenhouse effect'.

(i) Explain how the volcanic eruptions might have caused a greenhouse effect on Venus.

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(ii) Outline three human activities that are responsible for an increase in greenhouse gases.

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(iii) Describe possible consequences of global warming.

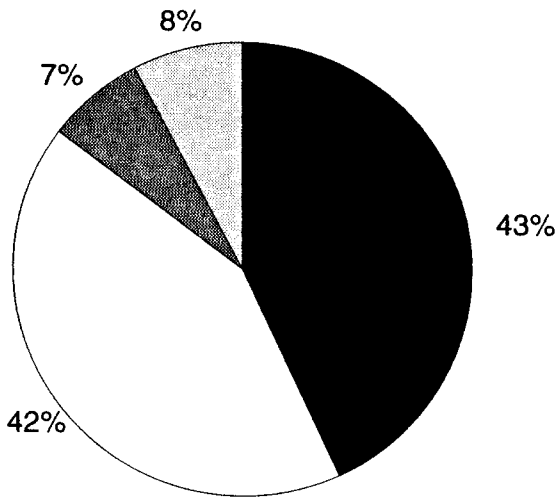
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[Total: 15]

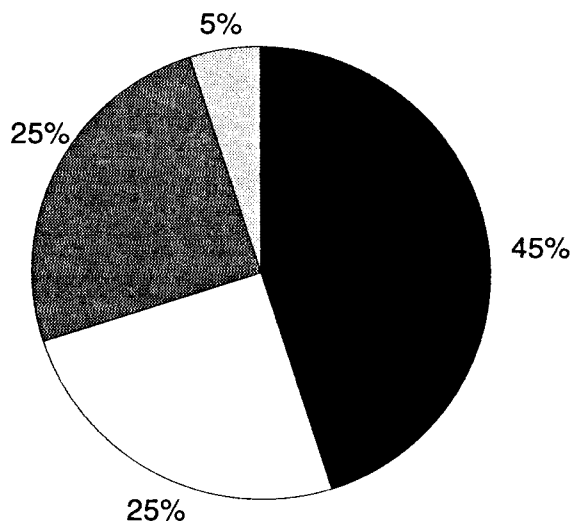
2 A group of students was investigating the distribution of plant species from the side of a river up to a nearby area of moorland. At various points along a transect, they took samples of soil, which were later analysed in the laboratory.

Fig. 2.1 shows the results of the analysis of the samples from each end of the transect.

A – side of river



B – moorland



key:

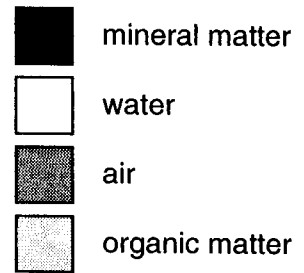


Fig. 2.1

(a) Suggest **two** reasons why the percentage of water in the sample of soil shown in Fig. 2.1 A is greater than that in Fig. 2.1 B.

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2[2]

- (c) David Bellamy, the president of Plantlife, describes peat bogs as 'the jewel of Britain's habitats'.

'You walk with a spring in your step – the peat underfoot is nine-tenths water – to the tireless song of a hovering skylark, on an undulating carpet of green, shot through with red, pink, burnished gold and orange, yellow and white flowers that thrive here. There are hundreds of insect species in the pools and on the plants and an abundance of round-leaved sundew, one of several carnivorous plants that get their nutrients (especially nitrogen compounds) from the insects they trap in their sticky leaves.'

Explain:

- (i) why very wet soils are usually nitrogen-deficient and how the sundew is at a competitive advantage in such soils;

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- (ii) why, in addition to nitrogen-deficiency, many plants cannot grow successfully in very wet soils.

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[Total: 19]

- 3 A group of students carried out an investigation into the growth of the Scotch Thistle, *Onopordum acanthium*, in two different sites, **A** and **B**.

At each site, 15 plants were selected and their heights measured and recorded. These are summarised in Table 3.1.

Table 3.1

height of plants / mm		
site A		site B
	462	267
	484	295
	396	254
	421	147
	437	116
	365	189
	409	274
	427	196
	439	322
	416	168
	387	244
	488	267
	463	298
	472	321
	399	227
mean	431	239
standard deviation (s.d.)	37	63

- (a) Describe how the students would have ensured that they measured a **representative** sample of thistles.

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(b) Explain what is meant in Table 3.1 by:

(i) *mean*;

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(ii) *standard deviation*.

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(c) The figure for s.d. at site B is greater than the figure for site A. Explain what this means.

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(d) In order to draw a statistically valid conclusion from their results, the students carried out a *t*-test.

Before calculating a *t* value, they had to state a Null Hypothesis.

(i) State what the Null Hypothesis would be in this investigation.

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The calculation gave a value for t of 9.64.

Table 3.2 shows critical t values at different levels of significance and degrees of freedom.

The number of degrees of freedom for a t -test is two less than the total number of samples.

Table 3.2

		level of significance (p)			
		0.10	0.05	0.01	0.001
degrees of freedom	14	1.76	2.15	2.98	4.14
	16	1.75	2.12	2.92	4.02
	18	1.73	2.10	2.88	3.92
	20	1.73	2.09	2.85	3.85
	22	1.72	2.07	2.82	3.79
	24	1.71	2.06	2.80	3.75
	26	1.71	2.06	2.78	3.71
	28	1.70	2.05	2.76	3.67
	30	1.70	2.04	2.75	3.65

- (ii) Using Table 3.2, state the conclusion that would be drawn from the calculation of a t value of 9.64 and explain how you reached this conclusion.

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[Total: 15]

- 5 (a) Table 5.1 compares the mean protein yields of two cereal crops, with that of two legume crops.

Table 5.1

	crop	mean protein yield / kg ha ⁻¹
cereal	maize	146
	sorghum	91
legume	soybean	509
	groundnut (peanut)	227

Explain how soybean and groundnut produce a significantly higher mean protein yield than either maize or sorghum.

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- (b) Outline **three** disadvantages of organic farming.

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- 6 *Cryptosporidium parvum* is a protist, high levels of which were found in the drinking water supply in an area of Glasgow in August, 2002.

This parasite causes the condition in humans known as cryptosporidiosis, characterised by diarrhoea, nausea, vomiting and loss of weight.

Fig. 6.1 shows a photomicrograph of an oocyst, a stage in the life cycle of *Cryptosporidium*.

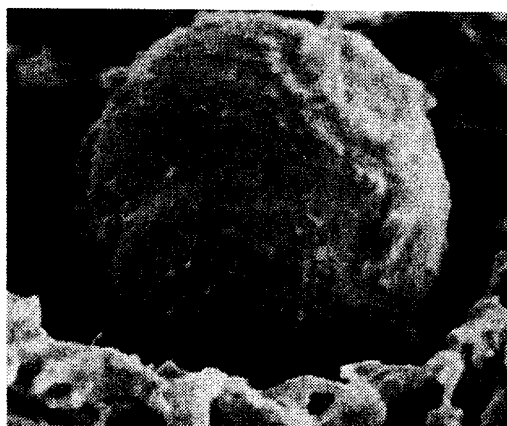


Fig. 6.1

- (a) The actual diameter of the oocyst is 5 μm . Calculate the magnification of this micrograph. Show your working.

Answer = [2]

- (b) *C. parvum* is a single-celled pathogenic organism, classified as a protist.
- (i) Suggest a feature of *C. parvum* that classifies it as a protist and **not** a bacterium.

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 [1]

- (ii) State why *C. parvum* is described as pathogenic.
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 [1]

(c) *C. parvum* is commonly found in the intestines of cattle and sheep. A simplified life cycle is shown in Fig. 6.2.

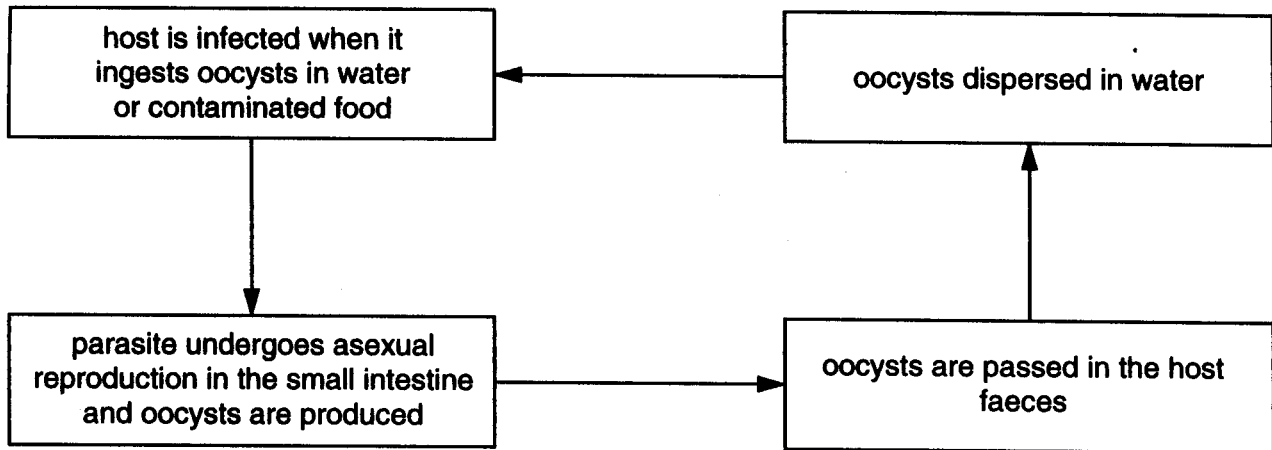


Fig. 6.2

Normal water treatment includes a stage of disinfection. This does not always kill the oocysts of *C. parvum*.

(i) State **two** ways in which disinfection of drinking water is normally carried out in water treatment plants.

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- 2 [2]

(ii) Using Fig. 6.2, suggest how the water supplies of Glasgow may have become contaminated in 2002.

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- [3]

(d) Some people are at greater risk of *Cryptosporidium* infection than others.

Suggest **two** groups of people who might be more susceptible.

- 1
- 2 [2]

Question 6 continues on page 18

(e) As well as pathogens, levels of many other potentially poisonous substances are monitored during the water treatment process.

List **two** such substances.

1

2 [2]

[Total: 13]

END OF QUESTION PAPER