

**ADVANCED GCE
BIOLOGY**

Environmental Biology

WEDNESDAY 18 JUNE 2008

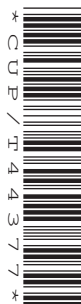
2805/03

Afternoon

Time: 1 hour 30 minutes

Candidates answer on the question paper

Additional materials: Electronic calculator
Ruler (cm/mm)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **90**.
- 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	10	
2	14	
3	16	
4	18	
5	20	
6	12	
TOTAL	90	

This document consists of **19** printed pages and **1** blank page.

Answer **all** the questions.

- 1 Satellite images, taken in December 2005, show a complete absence of ozone over the North Pole.

(a) Explain briefly what has caused the loss of ozone over the North Pole.

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(b) Suggest **one** measure that could be taken to prevent any further loss of ozone.

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(c) Many biological molecules, such as DNA and proteins, are carbon-based. These molecules may contain single carbon-carbon bonds and double carbon-carbon bonds, as shown in Table 1.1. The table also shows the energy required to break each type of carbon-carbon bond.

Table 1.1

bond	bond energy / kJ mol ⁻¹
C–C	346
C=C	615

Table 1.2 shows the energy associated with three different wavelengths of light.

Table 1.2

light	wavelength / nm	energy per mol of photons / kJ
ultra violet	300	400
visible–blue	400	270
visible–red	700	170

Using the information in Table 1.1 and Table 1.2:

- (i) explain why visible light is **not** harmful to living organisms;

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- (ii) explain why the loss of ozone is so harmful to living organisms.

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[Total: 10]

- 2 Fig. 2.1 shows a sand dune ecosystem. Between the ridges, known as dunes, are lower regions, which if wet, are known as slacks.

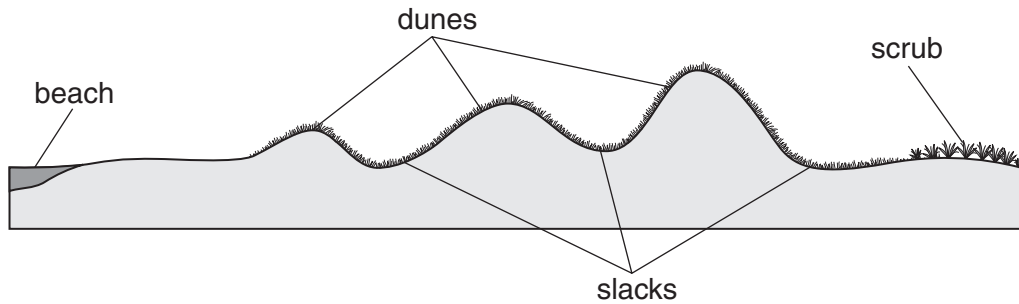


Fig. 2.1

A group of students investigated the distribution and abundance of several plant species. They compared dunes with slacks using the same number of randomly-placed quadrats in each of the two locations. The chi-squared test was used to analyse their data.

Table 2.1 shows the results obtained for marram grass, *Ammophila arenaria*, and the calculated chi-squared data.

The students' hypothesis was that there was no difference between the numbers of marram grass plants in the dunes and slacks.

Table 2.1

	dune	slack
observed data / number of plants	25	3
expected data / number of plants	14	14
$(O-E)^2 / E$	8.64	8.64

- (a) Use the formula below to calculate the chi-squared value.

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Answer = [1]

- (b) Using the data in Table 2.2, state **and** explain whether the students' hypothesis was supported or not.

Table 2.2

distribution of χ^2 values

degrees of freedom	probability, p				
	0.10	0.05	0.02	0.01	0.001
1	2.71	3.84	5.41	6.64	10.83
2	4.61	5.99	7.82	9.21	13.82
3	6.25	7.82	9.84	11.35	16.27
4	7.78	9.49	11.67	13.28	18.47

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(c) The students also investigated the number of species in the two locations.

They knew that the size of the quadrat chosen might have an effect on their overall results. They carried out a preliminary study in the sand dune ecosystem to find out how many species were present in different sized quadrats.

Fig. 2.2 shows the results of their investigation.

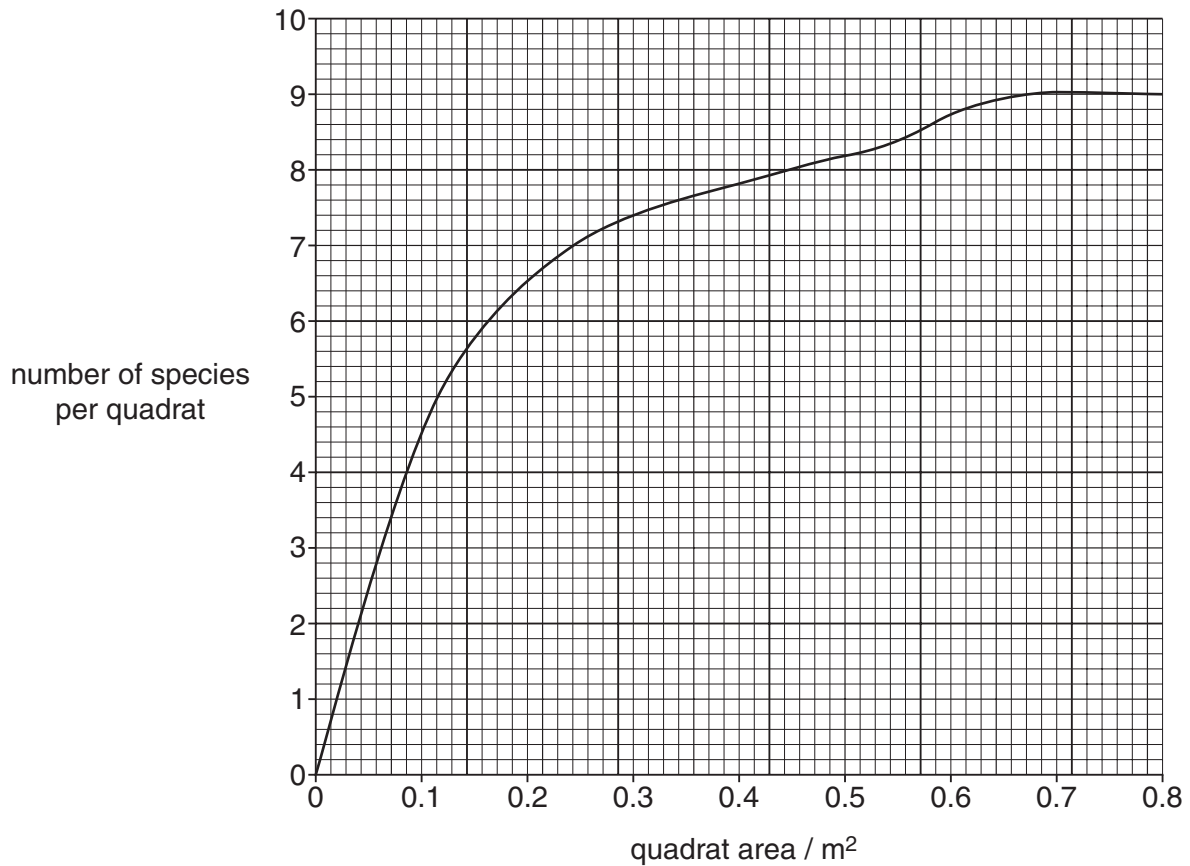


Fig. 2.2

Using the information in Fig. 2.2, describe the relationship between number of species recorded and the quadrat area.

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- (d) The sand dune ecosystem investigated by the students is grazed by sheep and cattle as part of the local management plan. Grazing maintains dune pasture, encourages biodiversity and prevents a climax community from becoming established.

- (i) State the term that refers to a plant community that is maintained by such management.

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- (ii) State **two** methods of management that could be used to prevent a sand dune ecosystem reaching a climax community **other** than by grazing.

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- (iii) Explain why grazing or other continued disturbance of ecosystems may allow greater biodiversity than in those that are left untouched.

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[Total: 14]

- 3** Table 3.1 shows the total amount of waste that was sent to landfill sites from three London regions in 2004. The table also shows the future permitted landfill limits for 2010 and 2013.

Annual waste production in all three London regions is predicted to increase beyond the 2004 level.

Table 3.1

	landfill waste in 2004 / tonnes	landfill limit in 2010 / tonnes	landfill limit in 2013 / tonnes
East London	298 042	211 793	141 069
North London	311 253	358 996	239 117
West London	500 870	329 450	219 437

- (a)** Comment on the implications of the future limits, shown in Table 3.1, for local authorities of the three regions in London.

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- (b)** In this question, one mark is available for the quality of the use and organisation of scientific terms.

Landfill sites are lined prior to being filled with rubbish. As rubbish degrades it produces gases and liquids. The gases can be burnt to generate electricity, but the liquids need to be treated before they enter water systems because they may contain heavy metals or polychlorinated biphenyls (PCBs).

Describe **other** ways in which these liquid pollutants may enter ecosystems **and** explain their effects on those ecosystems.

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Quality of Written Communication [1]

(c) Explain how the effects of liquid pollutants may be reduced.

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[Total: 16]

11
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- 4 The Broads is an Environmentally Sensitive Area (ESA). It extends over 43 200 hectares of river valley, marsh and fen in Norfolk and north Suffolk. Approximately 75% of The Broads ESA is agricultural land.

The national importance of this area for nature conservation is recognised by various statutory designations. The National Nature Reserves within The Broads ESA include 32 Sites of Special Scientific Interest (SSSI), one area designated as a Special Protection Area and one Ramsar site.

A Ramsar site is an area of wetland that is conserved under international law.

- (a) Explain **two** implications for farmers working within an ESA.

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- (b) Suggest reasons why the application of nitrate fertilisers could be an environmental problem in The Broads ESA.

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- (c) Explain **two** ways in which SSSIs differ from ESAs as a way of protecting the environment.

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(d) State **two other** ways in which wildlife is protected by legislation in the United Kingdom.

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(e) The Royal Society for the Protection of Birds (RSPB) has worked hard to help one of the UK's rarest birds, the bittern, to increase its population in The Broads.

Describe ways in which voluntary organisations, such as the RSPB, work to conserve rare species.

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(f) A possible method that could be used to increase the bittern population is to provide a captive breeding programme and use this to restock wildlife areas.

Suggest the possible **disadvantages** of such a programme as a way of increasing the bittern population.

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 [5]

[Total: 18]

[Turn over]

- 5 In some parts of the world, the long-finned pilot whale, *Globicephala melaena*, is hunted for its meat. However, population data suggests that these whales are not threatened with extinction and so this species has a low risk status on the CITES species data base. *G. melaena* can grow up to 5 m in length.

Fishermen on the Faroe Islands, a group of islands in the North Atlantic Ocean, have always caught pilot whales to feed their communities. Fig. 5.1 shows the numbers of pilot whales caught by fishermen from the Faroe Islands from 1950 to 2000.

The line labelled **S** shows the sustainable catch for these whales as set by the authorities on the Faroe Islands in 1950.

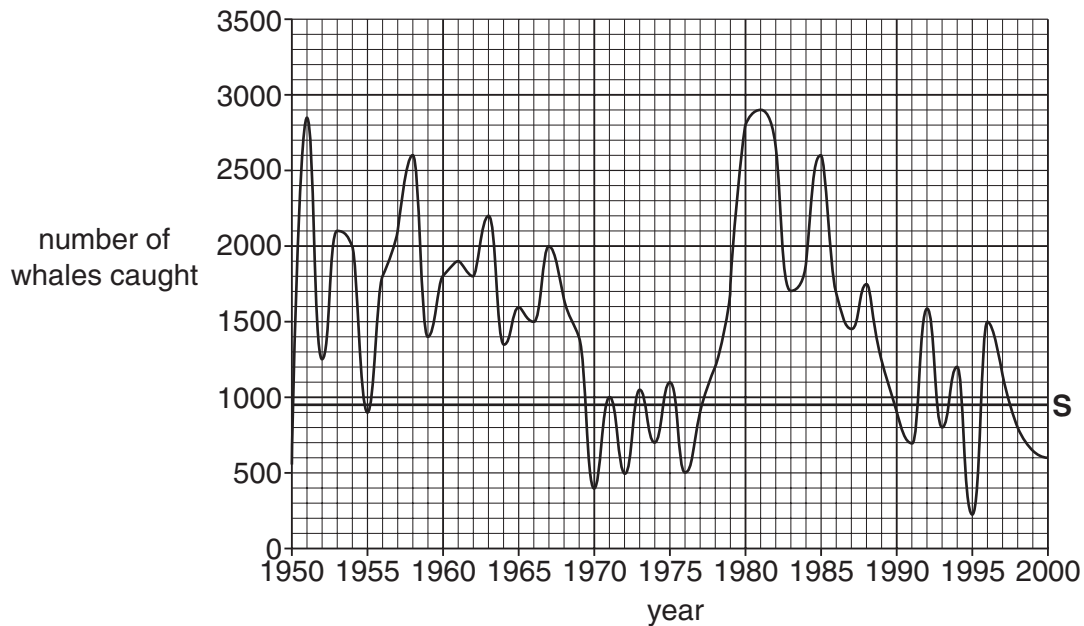


Fig. 5.1

- (a) Using the data in Fig. 5.1, describe the changes in the number of whales caught between 1950 and 2000.

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- (b) Suggest the factors that authorities on the Faroe Islands would have taken into account when setting the figure for the sustainable catch for pilot whales.

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- (c) Some countries kill whales to investigate the age structure of whale populations. To reduce the number of whales killed for this research, students at the Oregon State University (USA) and the Southern Cross University Whale Research Centre (Australia) have developed a method to estimate the age of whales.

The initial stage of the method involved collecting small samples of living tissue from whales and setting up tissue cultures.

The length of the chromosomes in the cells of these cultures is related to the age of the whales from which the tissues were taken.

The tissues of older whales generally have shorter chromosomes than those of younger whales.

Use the information above to suggest how the students might have estimated the age structure of a whale population.

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- (d) Many whale species depend on fish as a food source.

Explain how you could estimate the population size of a fish species.

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Describe, using named examples, how fish stocks are conserved so that a sustainable resource can be maintained.

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[Total: 20]

- 6** Sheep farming in the UK has traditionally provided the economy with revenue through the sale of meat and wool. Sheep, however, are prone to many skin diseases and the use of pesticides in sheep dips is accepted as a method of treating and preventing these diseases.

Sheep dips containing organophosphates or synthetic pyrethroid pesticides can lead to pollution. In 2005, 26 million litres of pyrethroid pesticide-based sheep dip were used in the UK. It is estimated that only a few drops of synthetic pyrethroids carried on the fleece of sheep are needed to kill all the invertebrates for up to 10 km downstream.

- (a)** Suggest why invertebrates living in streams are susceptible to the effects of small quantities of pollutant from sheep dip.

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- (b)** An alternative method of preventing skin diseases in sheep is to use vaccination.

What are the advantages of this alternative?

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- (c) Pyrethroids have been shown to interfere with the random assortment of chromosomes during meiosis.

Explain the possible effects pyrethroid interference may have on the production of gametes.

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- (d) Pesticides have been used in agriculture for a long time.

Explain how pesticides can act as a selective force on invertebrate species.

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[Total: 12]

END OF QUESTION PAPER

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