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General Certificate of Education
 June 2004
 Advanced Subsidiary Examination



BIOLOGY (SPECIFICATION A)
Unit 2 Making Use of Biology

BYA2

Tuesday 8 June 2004 Morning Session

No additional materials are required.
 You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

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

- 1 (a) Table 1** shows some of the events which take place in protein synthesis.

A	tRNA molecules bring specific amino acids to the mRNA molecule
B	mRNA nucleotides join with exposed DNA bases and form a molecule of mRNA
C	The two strands of a DNA molecule separate
D	Peptide bonds form between the amino acids
E	The mRNA molecule leaves the nucleus
F	A ribosome attaches to the mRNA molecule

Table 1

- (i) Write the letters in the correct order to show the sequence of events during protein synthesis, starting with the earliest.

..... (2 marks)

- (ii) In which part of a cell does **C** take place?

..... (1 mark)

- (iii) Which of **A - F** are involved in translation?

..... (1 mark)

- (b) **Table 2** shows some mRNA codons and the amino acids for which they code.

mRNA codon	Amino acid
GUU	Valine
CUU	Leucine
GCC	Alanine
AUU	Isoleucine
ACC	Threonine

Table 2

- (i) A tRNA molecule has the anticodon UAA. Which amino acid does the tRNA molecule carry?

..... (1 mark)

- (ii) Give the DNA base sequence that codes for threonine.

..... (1 mark)

2 (a) What is an *antigen*?

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(2 marks)

(b) Blood from a person of blood group A contains A antigens. Explain why a person of blood group B cannot safely be given blood from a person of blood group A.

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(2 marks)

(c) A sample of blood from a crime scene can be analysed to find its blood group. A genetic fingerprint can also be obtained from the sample. Explain why genetic fingerprinting is much more useful than blood grouping in determining whether the blood came from a particular suspect.

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(2 marks)

TURN OVER FOR THE NEXT QUESTION

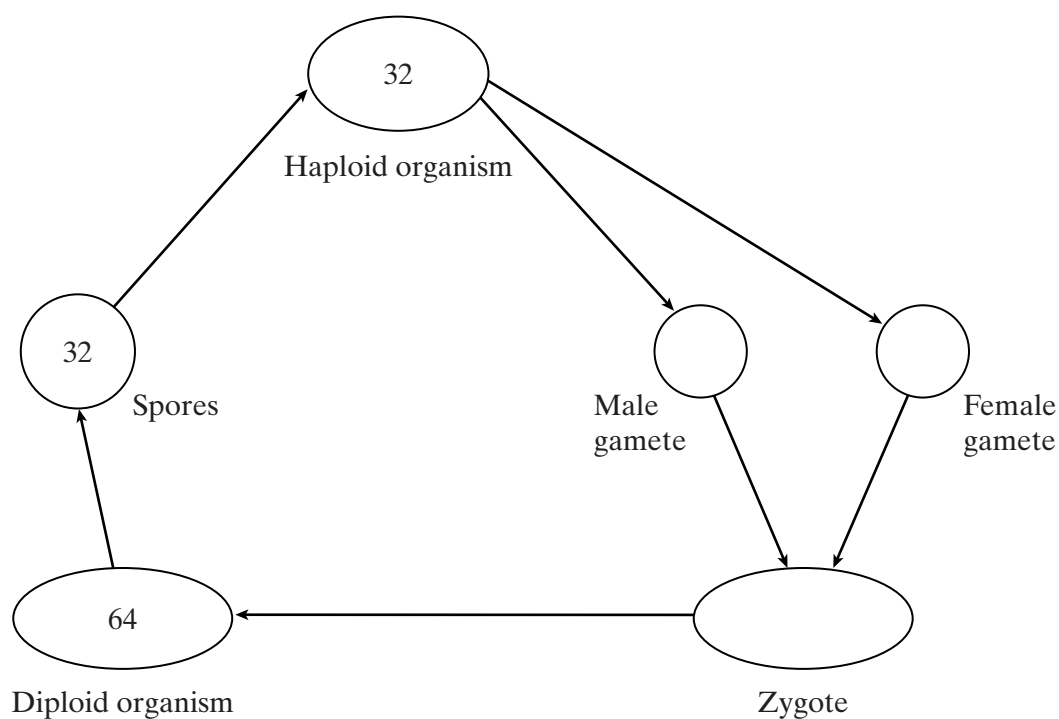
Turn over ►

- 3 (a) Complete the table to describe some of the events during the cell cycle.

Stage of cell cycle	Main event which takes place
Metaphase	
	Chromosomes coil and shorten
	Daughter chromosomes move to poles of the cell
S-phase	
	Nuclear envelope re-forms

(5 marks)

- (b) The diagram shows the life cycle of an organism. The numbers show how many chromosomes are present in one cell at each stage of the life cycle.



- (i) Name the type of cell division that must be involved in producing the spores.

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(1 mark)

- (ii) How many chromosomes are there in a male gamete from this organism?

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(1 mark)

7

- 4 (a) (i) Some human DNA was cut into separate pieces using a restriction enzyme which produced a staggered cut. A scientist wanted to insert these pieces of DNA into plasmids and used the same restriction enzyme to cut the plasmids. Explain why the pieces of human DNA would be able to join to the cut DNA of the plasmids.

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(2 marks)

- (ii) Which other enzyme must the scientist have added to the mixture to form recombinant plasmids?

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(1 mark)

- (b) A plasmid may be used as a vector. Explain what is meant by a *vector*.

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(2 marks)

- (c) Molecular biologists often use plasmids which contain antibiotic resistance genes. Explain the reason for this.

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(2 marks)

7

Turn over ►

- 5 Wood pulp is used to make paper. Xylan is a substance in wood pulp which may discolour paper. Xylanase is an enzyme, used in the paper-making industry, that converts xylan to xylose, removing the need to use substances such as bleach.

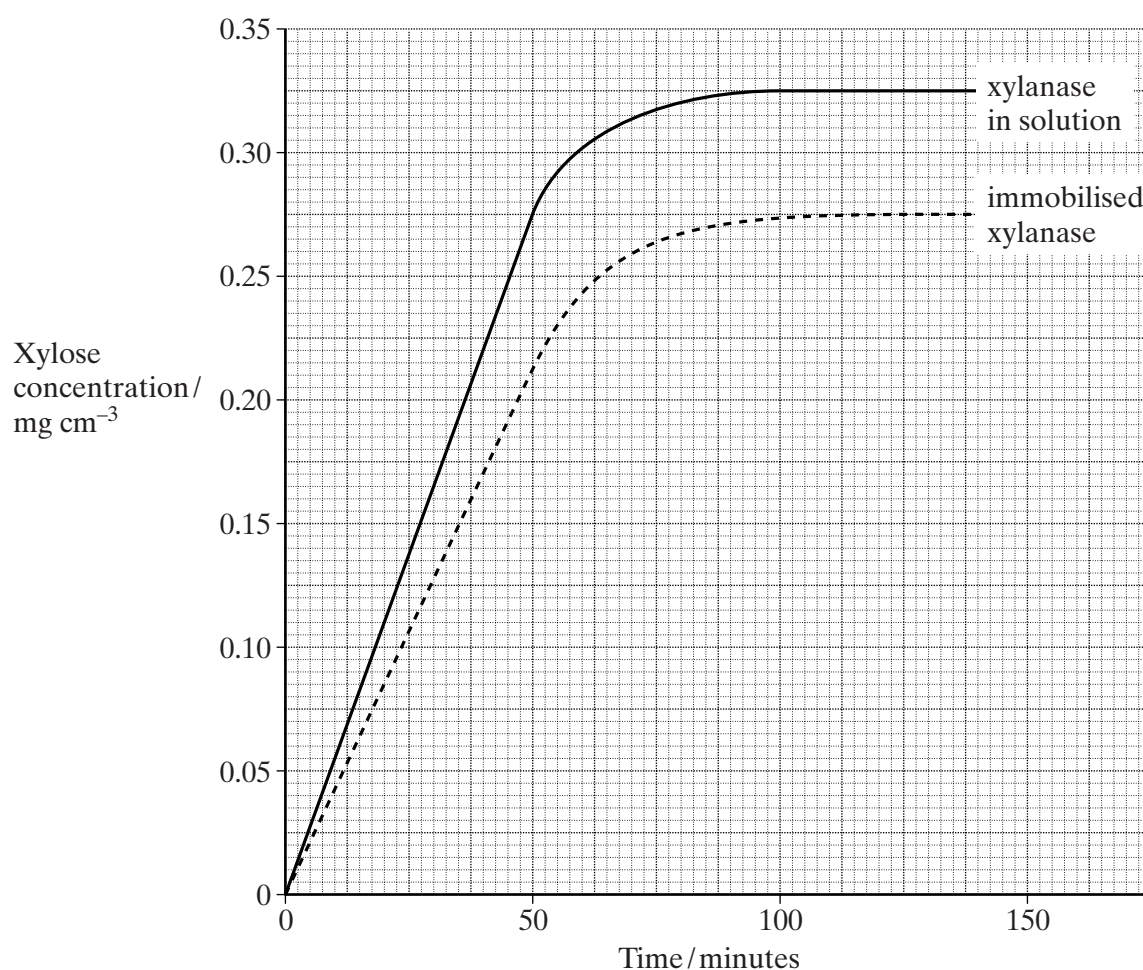
- (a) Treating wood pulp with bleach is cheaper than using xylanase. Suggest an advantage of using xylanase to treat wood pulp.

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(1 mark)

The graph shows the results of an investigation into the effect of immobilising xylanase on the rate of xylose production.



- (b) Explain how you would use the graph to calculate the rate of activity of the immobilised xylanase between 25 and 50 minutes.

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(2 marks)

- (c) (i) Suggest why the rate of reaction is lower when the xylanase is immobilised.

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(2 marks)

- (ii) Give **one** advantage of using immobilised xylanase in the industrial process rather than xylanase in solution.

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(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 6 (a) Give **two** features of sorghum which make it suitable for growing in dry conditions.

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(2 marks)

- (b) The table shows water use by sorghum and two other cereals.

Cereal	Water use/kg water used per kg dry mass produced
Wheat	550
Maize	350
Sorghum	300

- (i) The data were obtained in laboratory conditions. Light intensity was kept constant. Describe and explain how light intensity may affect water use.

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(2 marks)

- (ii) In the investigation, seeds were sown at the same density. Explain why this was necessary.

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(2 marks)

- 7 (a) Fertilisers are added to soils to replace the nutrients lost when crops are harvested. Give **two** advantages of using

- (i) an organic fertiliser such as farmyard manure;

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(2 marks)

- (ii) an inorganic fertiliser.

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(2 marks)

- (b) The table shows the effects of adding manure or inorganic fertiliser to some crops grown in plots.

Crop	Yield of crop/tonnes per hectare		
	Control plot	Farmyard manure only	Inorganic fertiliser only
Sugar beet	3.8	15.6	15.6
Mangold	3.8	22.3	30.9
Wheat	2.1	3.5	3.1

- (i) How should the control plot be treated?

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(2 marks)

- (ii) Suggest why inorganic fertiliser improved the yield of the mangold crop more than the sugar beet crop.

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(1 mark)

Turn over ►

7

8 Read the following passage.

Shark-fin soup is an expensive delicacy. To provide the basic ingredient, fishermen catch the sharks, hack the fins off and throw the dead bodies back into the ocean. But sharks are slow to mature and produce only a few offspring at a time, so they are vulnerable to overfishing. Monitoring the shark-fin trade is difficult, as once a fin has been cut off, it can be extremely difficult to work out precisely from which species it was taken.

The DNA from different species of sharks shows some differences in base sequence. This has enabled a new genetic fingerprinting technique to be developed. This technique would allow conservationists and fisheries managers to assess which of the 400 shark species are most threatened by the trade in shark fins.

10 An identification process has been developed using a range of “primers”. These are short pieces of single-stranded DNA that are complementary to a particular sequence of DNA. Each primer is specific to the DNA of one shark species.

15 The primers are added to DNA taken from a shark’s fin and the polymerase chain reaction is carried out. Only two primers, one at each end of a certain piece of DNA, will bind. The piece of DNA between the primers is replicated by the polymerase chain reaction. The primers that bind are specific to a particular species of shark and the length of the DNA fragment replicated differs for each species. When this DNA is run in an electrophoresis gel it produces a single band, enabling the researchers to identify which species of shark is involved.

Use information from the passage and your own knowledge to answer the questions.

- (a) (i) Explain why the DNA for each species of shark shows differences in base sequence (line 6).

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(2 marks)

- (ii) Each primer is specific to the DNA of one shark species (line 12). Explain why a particular primer will only bind to the DNA of one species.

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(2 marks)

- (iii) The length of the replicated DNA fragment is different for each species. Explain why this is important in identifying the shark species involved.

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(3 marks)

- (b) In conventional DNA fingerprinting, a series of bands is produced on the electrophoresis gel, resembling the rungs of a ladder. When the DNA in this new genetic fingerprinting technique is run in an electrophoresis gel it produces just one of these 'rungs'. Explain the reason for the difference in the number of 'rungs' produced.

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(2 marks)

- (c) Describe the polymerase chain reaction.

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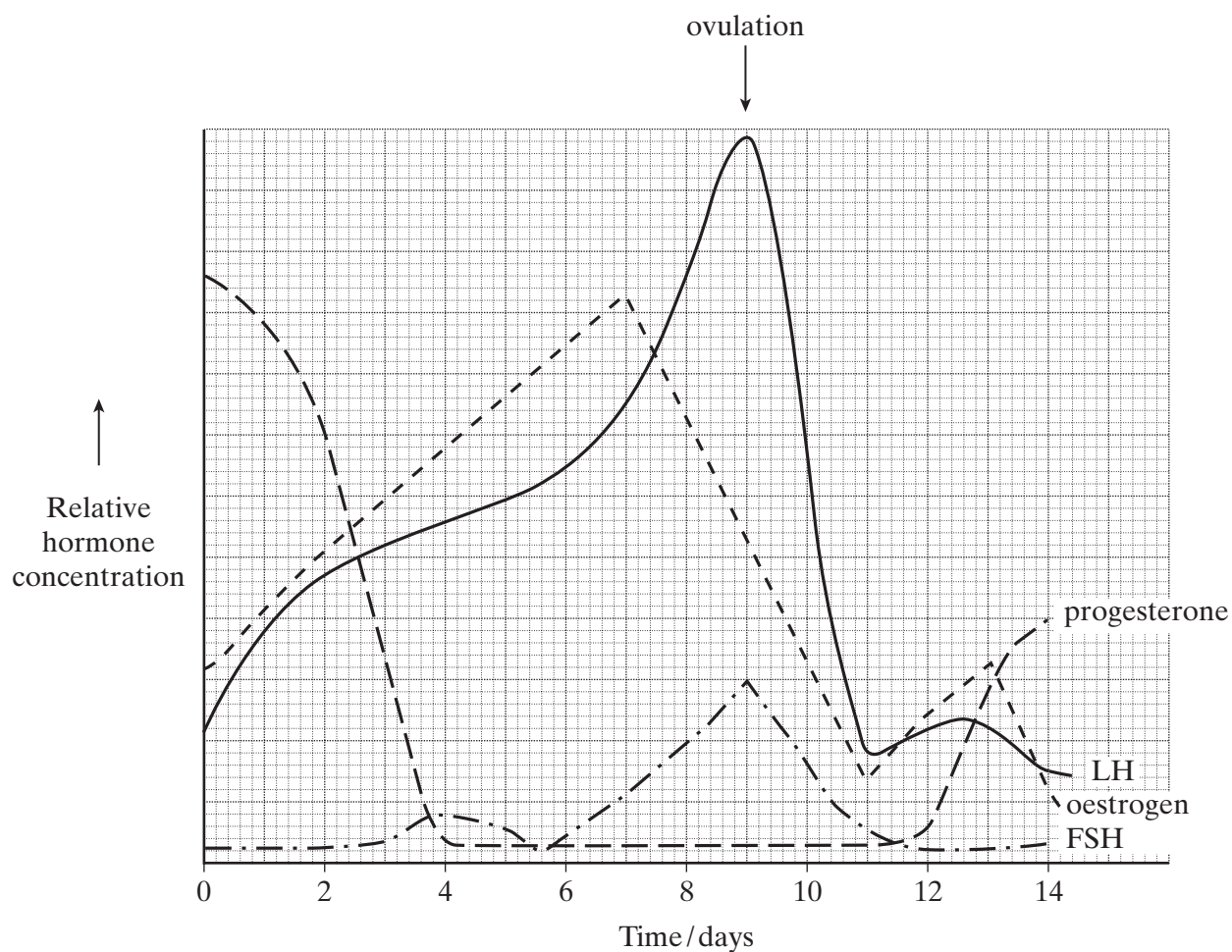
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(6 marks)

Turn over ►

- 9 The graph shows the concentration of four hormones during part of the oestrous cycle of a female pig.



- (a) Use the graph to explain the role of these hormones in controlling the events in the ovary between days 0 and 12.

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(6 marks)

- (b) Progesterone can be used to synchronise oestrus in a group of female pigs. The hormone is given to pigs for two to three weeks.

- (i) Explain how giving progesterone results in synchronisation of oestrus.

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(3 marks)

- (ii) Explain **two** advantages to a farmer of synchronising oestrus in a group of female pigs.

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(2 marks)

QUESTION 9 CONTINUES ON THE NEXT PAGE

Turn over ►

- (c) In an investigation, female large white pigs were divided into two groups. The pigs in one group had their oestrous cycles synchronised with progesterone. The pigs in the second group were used as a control. The table shows the results from the investigation.

	Percentage of pigs becoming pregnant	Percentage of pigs giving birth	Mean number of live piglets per litter
Group given progesterone	92.0	90.8	10.5
Control group	93.8	92.9	9.8

- (i) The pigs in the experimental group were the same breed as the pigs in the control group. Explain why this was important in ensuring that the data were reliable.

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(2 marks)

- (ii) Do these data suggest that giving 100 pigs progesterone would increase the total number of piglets? Use suitable calculations to support your answer.

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(2 marks)

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

