

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
 June 2005
 Advanced Subsidiary Examination



BIOLOGY (SPECIFICATION A)
Unit 2 Making Use of Biology

BYA2

Monday 6 June 2005 Morning Session

In addition to this paper you will require:

- a ruler with millimetre measurements.

You may use a calculator.

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.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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9			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

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

- 1 (a) The table describes some reproductive hormones in a female mammal. Complete the table by adding the name of the hormone which matches each description.

Hormone	Description
	Produced by the corpus luteum
	Produced by the pituitary gland and stimulates growth of the corpus luteum
	Produced by the developing follicle

(3 marks)

- (b) Menopause is the time when women stop ovulating and the menstrual cycle stops. There are very few follicles remaining in the ovaries of a woman at menopause. Explain why the FSH concentration in the blood rises at menopause.

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(3 marks)

6

2 Traditionally, ‘stone washed’ jeans were produced by placing freshly dyed jeans into a large washing machine with stones added. The abrasive stones removed some of the dye from the surface of the jeans to produce a faded appearance. A new technique has replaced stone washing. This uses the enzyme cellulase to produce the faded look.

(a) Suggest **one** advantage of using enzymes to produce the ‘stone washed’ appearance.

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(1 mark)

(b) The gene for the cellulase enzyme was first isolated from a fungus. It was then introduced into bacteria. The modified bacteria were used in the commercial production of the enzyme. Describe how

(i) the gene for the cellulase enzyme could be isolated from the DNA of the fungus;

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(1 mark)

(ii) the isolated gene could be inserted into a bacterium;

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(3 marks)

(iii) large quantities of pure cellulase enzyme could be obtained from the bacteria.

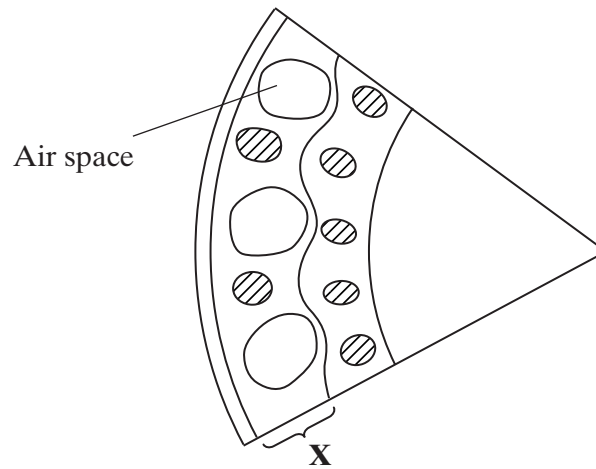
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(2 marks)

Turn over ►



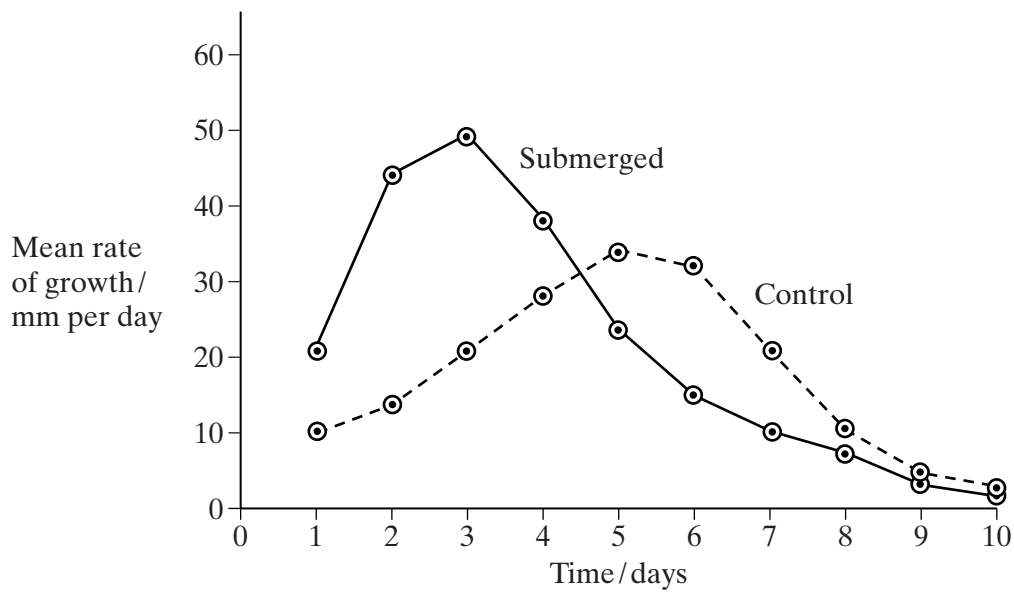
3 The diagram represents a section through the stem of a rice plant.



(a) Name tissue X.

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(1 mark)

(b) A laboratory investigation was carried out into the growth of rice seedlings. The graph shows the growth of rice seedlings submerged in water, compared with the growth of a control group. The data are the mean values for 20 plants.



(i) Suggest how the control seedlings would have been treated.

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(2 marks)

(ii) The submerged seedlings grew throughout the whole period of the investigation. Explain how rice is able to tolerate long periods of submergence.

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(3 marks)

(iii) After five days, the submerged plants grew more slowly than the control plants. Suggest a reason for this.

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(1 mark)



TURN OVER FOR THE NEXT QUESTION

Turn over

4 A student investigated the stages of mitosis in a garlic root. The root tip was placed on a microscope slide with a stain. A cover slip was placed on top and the root tip was firmly squashed.

(a) Explain why

(i) a root tip was used;

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 (1 mark)

(ii) a stain was used;

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 (1 mark)

(iii) the root tip was firmly squashed.

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 (1 mark)

(b) The student examined the cells in the garlic root tip under the microscope, and obtained the following data.

Stage	Number of cells
Interphase	872
Prophase	74
Metaphase	18
Anaphase	10
Telophase	8

(i) Calculate the percentage of these cells in which the chromosomes are visible and would consist of a pair of chromatids joined together. Show your working.

Answer
 (2 marks)

(ii) A different set of results was obtained when the count was repeated on another occasion with a different garlic root tip. Give **two** reasons for the difference in results.

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(2 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over 

- 5 (a) Nucleic acids, such as DNA, are polymers, made up of many repeating monomer units. Name the monomer from which nucleic acids are made.

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(1 mark)

- (b) The table shows the percentage of different bases in the DNA of some organisms.

Organism	Percentage of each base			
	Adenine	Guanine	Cytosine	Thymine
Human	31.2	18.8	18.8	31.2
Cow	27.9	22.1	22.1	27.9
Salmon	29.4	20.6	20.6	29.4
Rat	28.6			
Virus	24.7	24.1	18.5	32.7

- (i) Calculate the missing figures for rat DNA and write them into the table.
(2 marks)

- (ii) The virus has single-stranded DNA as its genetic material. Explain the evidence from the table which suggests that the DNA is single-stranded.

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(2 marks)

- (iii) The virus DNA and messenger RNA are both single-stranded. Give **two** other structural similarities between the virus DNA and messenger RNA.

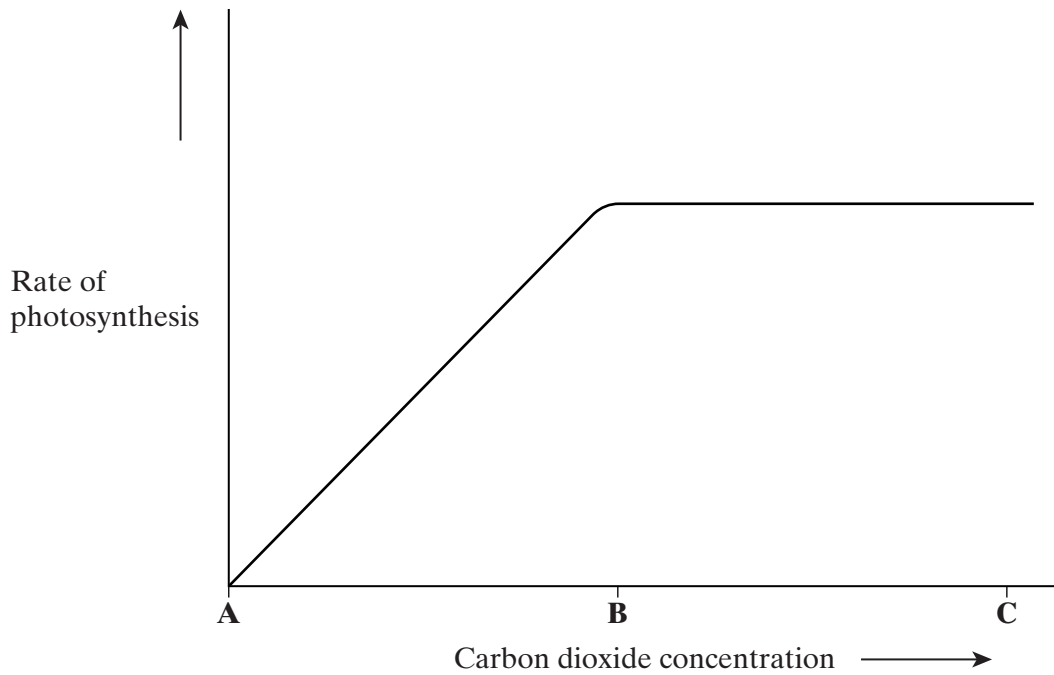
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(2 marks)

6 An investigation was carried out to find the effect of increasing carbon dioxide concentration on the rate of photosynthesis in a particular type of plant. The graph shows the results.



(a) (i) In this investigation, temperature was kept constant. Explain why.

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 (1 mark)

(ii) Suggest suitable units for measuring the rate of photosynthesis in this investigation.

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 (2 marks)

(b) (i) Give the evidence from the graph that carbon dioxide is limiting the rate of photosynthesis between **A** and **B**.

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 (1 mark)

(ii) Explain the shape of the curve between **B** and **C**.

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 (2 marks)

Turn over ►

- 7 (a) The table shows the mRNA codons for some amino acids.

Codon	Amino acid
CUA	Leucine
GUC	Valine
ACG	Threonine
UGC	Cysteine
GCU	Alanine
AGU	Serine

- (i) Give the DNA sequence coding for cysteine.

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(1 mark)

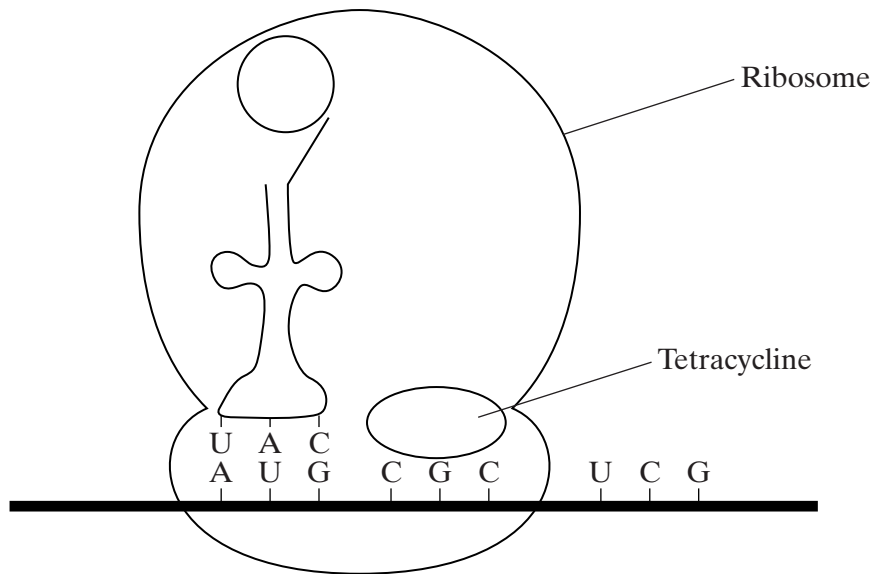
- (ii) Name the amino acid coded by the tRNA anticodon UCA.

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(1 mark)

- (b) A particular gene is 562 base-pairs long. However, the resulting mRNA is only 441 nucleotides long. Explain this difference.

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(1 mark)

(c) Tetracycline binds to bacterial ribosomes. This is shown in the diagram.



Protein synthesis in bacteria is similar to that in eukaryotic cells. Explain how tetracycline stops protein synthesis.

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(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

8 Read the following passage.

DNA tests were used to confirm the identity of deposed Iraqi leader Saddam Hussein, after his capture in December 2003. DNA tests were carried out to prove the suspect was not one of the many alleged “look alikes” of the former leader.

5 Firstly, the DNA was extracted from the mouth of the captured man using a swab. Great care was taken to check that the swab did not become contaminated with any other DNA. DNA extracted from the swab was then subjected to a standard technique called the polymerase chain reaction (PCR), which takes a couple of hours. Lastly, the sample was “typed” to give the genetic fingerprint. This was produced within 24 hours of Saddam Hussein’s capture. Tests for use in criminal cases often take much longer because samples are very small or
10 contaminated.

It appears that Hussein’s genetic fingerprint was already stored away for comparison. This was obtained from personal items such as his toothbrush. DNA from the toothbrush would have been subjected to PCR before a DNA fingerprint could have been obtained.

Source: adapted from SHAONI BHATTACHARYA, *New Scientist* 15 December, 2003

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

- (a) Describe how the technique of genetic fingerprinting is carried out and explain how it can be used to identify a person, such as Saddam Hussein.

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(6 marks)

(b) Explain how DNA could be present on a toothbrush (line 12).

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(2 marks)

(c) (i) Explain why the polymerase chain reaction was used on the sample of DNA from the toothbrush (lines 12-13).

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(2 marks)

(ii) Explain **one** way in which the polymerase chain reaction differs from DNA replication in a cell.

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(2 marks)

(d) Tests for use in criminal cases often take much longer because samples are very small or contaminated (lines 8-10). Explain why it takes longer to obtain a genetic fingerprint if the sample is

(i) very small;

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(1 mark)

(ii) contaminated.

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(2 marks)

Turn over 

- 9 (a) The table shows the effect of different concentrations of inorganic nitrogen fertiliser on the yield of spinach plants.

Nitrogen fertiliser applied/kg ha ⁻¹	40	110	160	210	260	310	360
Yield/tonnes ha ⁻¹	8	13	18	22	24	26	26

- (i) Describe and explain the effect of adding inorganic nitrogen fertiliser on the yield of spinach.

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(2 marks)

- (ii) Give **two** advantages of using an inorganic fertiliser, rather than manure.

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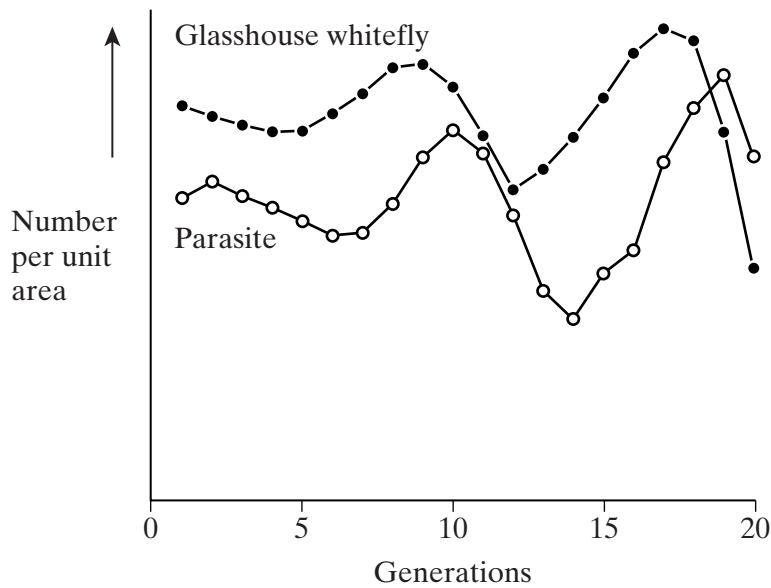
(2 marks)

- (b) Fertilisers may leach out of farmland into freshwater streams and lakes. Explain how this can be harmful to the environment.

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(6 marks)

A laboratory investigation was carried out into the relationship between a population of glasshouse whitefly and its wasp parasite. The results are shown in the graph.



- (c) (i) Explain the changes which took place in both populations between generations 6 and 13.

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(3 marks)

- (ii) The wasp parasite could be used as a biological control agent for the glasshouse whitefly. What is *biological control*?

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(2 marks)

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE