Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

Leave blank

General Certificate of Education
January 2002
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION A) BYA2
Unit 2 Making Use of Biology

Thursday 10 January 2002 Afternoon Session

No additional materials are required.
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.

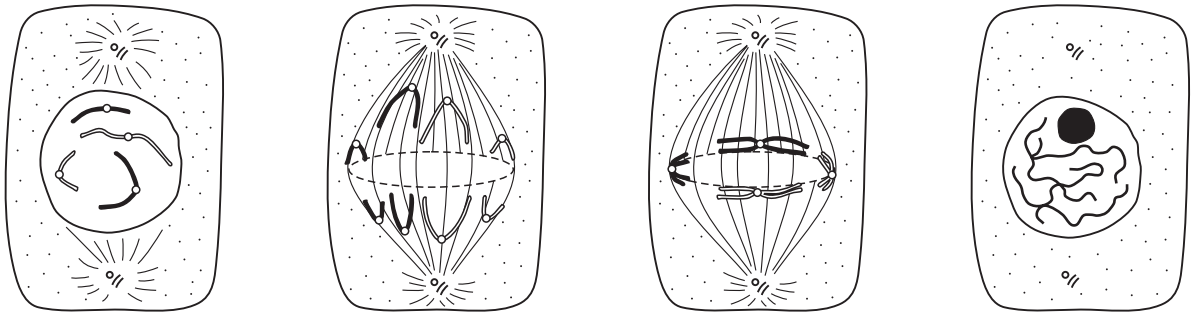
Information

- 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			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 (a) (i) The diagrams show some of the stages of mitosis. Arrange the letters **A - D** to give the correct sequence of stages.



A **B** **C** **D**

Sequence .....

(1 mark)

(ii) Describe the role of the spindle in mitosis.

.....

.....

.....

.....

(2 marks)

(b) Sexual reproduction involves the fusion of gametes. Explain the importance of meiosis in the life cycle of a sexually reproducing organism.

.....

.....

.....

.....

(2 marks)

(c) The table shows the mean mass of DNA in the nuclei of different cells in cattle.

Cell	Mean mass of DNA/ arbitrary units
Sperm cell	3.42
Red blood cell	0.00
Liver cell	7.05

(i) Explain the difference in DNA content between sperm and liver cells.

.....

.....

(1 mark)

(ii) There is no DNA in the red blood cell. Explain why.

.....

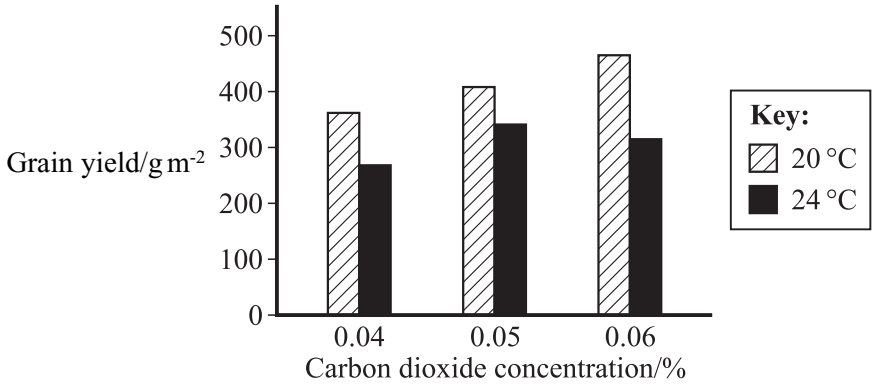
.....

(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

2 (a) The graph shows the effects of carbon dioxide concentration and temperature on grain yield in rice.



(i) Describe and explain the effect of carbon dioxide concentration on grain yield at a temperature of 20 °C.

.....

.....

.....

.....

(2 marks)

(ii) Temperature affects the time taken by insects to complete their life cycles. Use this information to suggest an explanation for the effect of temperature on grain yield in rice.

.....

.....

.....

.....

(2 marks)

(b) A rice plant contains hollow tissue in its stem. Explain **one** way in which this is beneficial to the plant.

.....

.....

.....

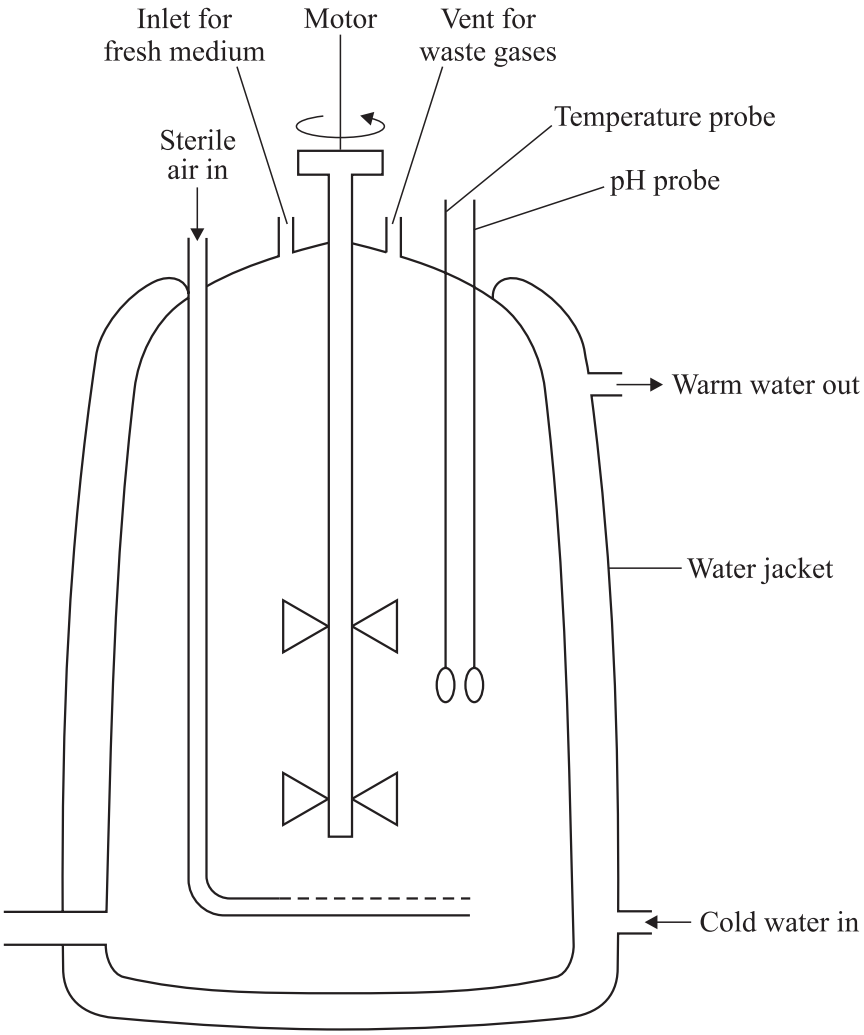
.....

(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

3 The diagram shows a fermenter used to grow large numbers of microorganisms for enzyme production. To achieve rapid growth of these microorganisms, particular conditions are needed.



(a) (i) Explain why the pH of the culture is kept constant.

.....

.....

(2 marks)

(ii) Suggest why a water jacket is necessary.

.....

.....

(2 marks)

(b) Aseptic conditions are used in the production of enzymes. Explain how contamination with other microorganisms might affect the amount of enzyme produced.

.....

.....

.....

.....

(2 marks)

(c) Enzymes produced by microorganisms may be intracellular or extracellular. Explain why intracellular enzymes are usually more expensive to produce commercially.

.....

.....

.....

.....

(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

4 Wheat is a cereal crop grown mainly for grain. Wheat straw consists of dead leaves and stems. An investigation was carried out into the effect of adding nitrogen-containing fertiliser on the yield of wheat.

Mass of fertiliser added/g m^{-2}	**Yield/ g m^{-2}**	
	Grain	Straw
0.0	478	245
6.3	549	284
50.0	622	324

(a) Does adding 50 g m^{-2} of nitrogen-containing fertiliser have a greater effect on the grain or the straw? Use suitable calculations based on the figures in the table to support your answer.

.....

.....

.....

.....

.....

.....

(3 marks)

(b) (i) When 6.3 g m^{-2} of nitrogen-containing fertiliser was added, the ratio of straw to grain was 0.517. Calculate the ratio of straw to grain when 50 g m^{-2} of nitrogen-containing fertiliser was added. Show your working.

(2 marks)

(ii) Suggest why the grain to straw ratio may be important to a farmer.

.....

.....

(1 mark)

(c) Farmers remove weeds from land on which wheat is growing. Suggest why the yield of wheat grain is higher if weeds are removed at the beginning of the growing season than if they are removed later in the growing season.

.....

.....

.....

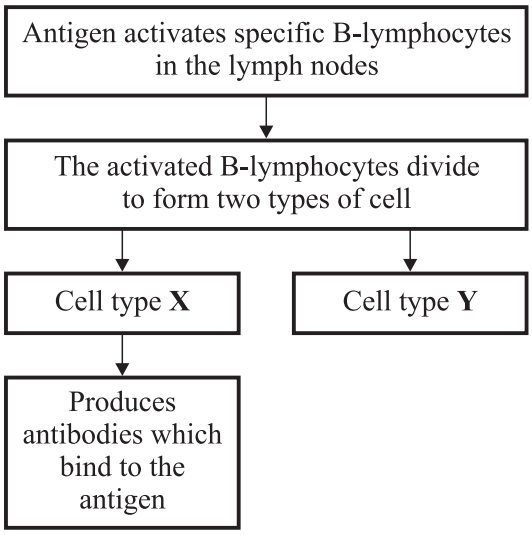
.....

(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

5 The flow chart shows some of the stages involved in the immunological response to an antigen.



(a) What is an antigen?

.....

.....

(1 mark)

(b) Name

(i) Cell type **X** .....

(ii) Cell type **Y** .....

(2 marks)

(c) Explain the importance of cell type **Y** in immunity.

.....

.....

.....

.....

(2 marks)

(d) Influenza and measles are diseases caused by viruses. The viruses have antigens on their surface. Use your knowledge of antigens and antibodies to suggest why a person may have influenza several times, but usually has measles only once.

.....

.....

.....

.....

.....

.....

(3 marks)

8

TURN OVER FOR THE NEXT QUESTION

6 (a) Explain why using enzymes in industrial processes can make the product:

(i) cheaper to produce; .....

.....

.....

(ii) purer. .....

.....

.....

(2 marks)

(b) (i) A DNA molecule can be broken into shorter pieces with restriction enzymes. It can also be broken into shorter pieces by heating it with an acid. Suggest **one** advantage to a genetic engineer of using restriction enzymes rather than acid for this purpose.

.....

.....

(1 mark)

(ii) Glucose is a reducing sugar. It can be detected with a biochemical test such as Benedict's test. It can also be detected by using methods based on enzymes. Suggest an advantage of using an enzyme-based method for measuring the concentration of glucose in a urine sample.

.....

.....

(1 mark)

(c) In some industrial processes, enzymes are immobilised. Explain **two** advantages of immobilising enzymes.

1 .....

.....

2 .....

.....

(4 marks)

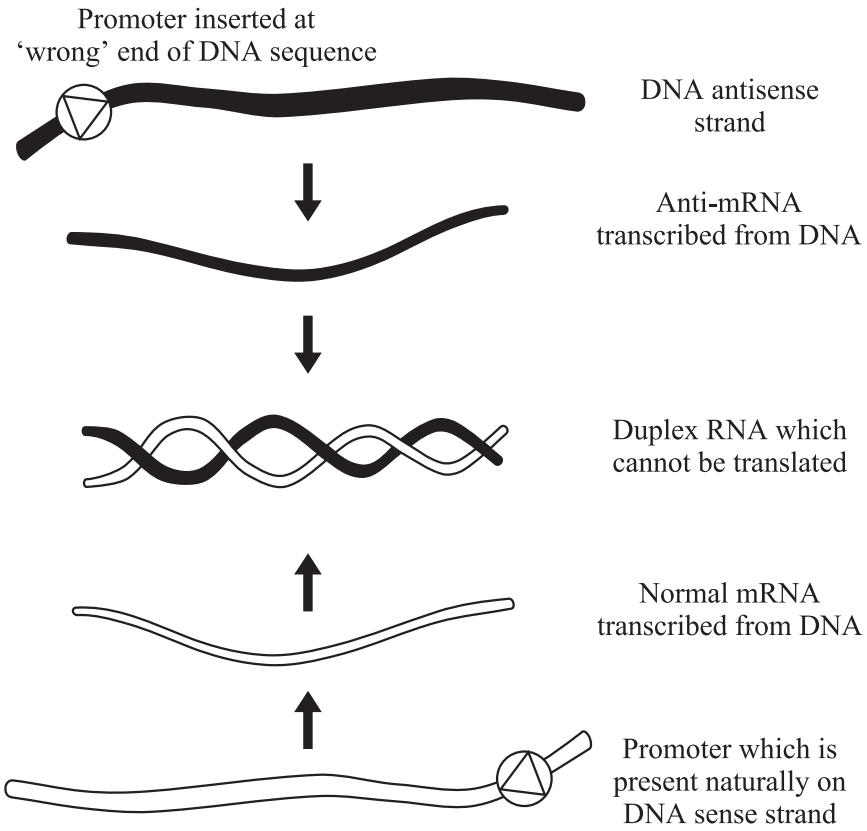
8

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

7 Read the following passage.

When a tomato ripens, it changes colour and develops its flavour. It also becomes softer. It gets softer because it produces an enzyme called polygalacturonase (PG). This enzyme causes the tomato cells to separate from each other. Genetic engineers have developed a way of producing tomatoes which are red and full of flavour but don't go soft and squashy. They have done this by producing tomato plants which produce less PG.
The diagram summarises the process. A molecule of DNA consists of two strands. The sense strand is the strand which is normally transcribed in the production of a protein. The other strand is the antisense strand. The method relies on producing an unreadable mRNA "duplex" by transcribing both the sense strand and the antisense strand of the DNA.



(a) Describe how transcription and translation result in the production of a protein from DNA.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

(b) The table shows the base sequence on part of the DNA sense strand. Complete the table by writing in the base sequence on the mRNA transcribed from:

(i) this part of the DNA sense strand;

(ii) the corresponding part of the DNA antisense strand.

Base sequence on DNA sense strand	A	T	G	G	C	A	T
(i) Base sequence on mRNA transcribed from DNA sense strand							
(ii) Base sequence on mRNA transcribed from DNA antisense strand							

(2 marks)

(iii) Suggest why the promoter is needed.

.....

.....

(1 mark)

(c) (i) Explain why the two mRNA molecules transcribed from the sense and antisense strands of the DNA bind together to form a duplex.

.....

.....

.....

.....

(2 marks)

QUESTION 7 IS CONTINUED ON THE NEXT PAGE

(ii) Give **two** ways in which the structure of the RNA duplex differs from the structure of DNA.

.....

.....

.....

.....

(2 marks)

(iii) The RNA duplex is double stranded. Explain why double stranded RNA cannot be translated to synthesise the enzyme PG.

.....

.....

.....

.....

(2 marks)

15

8 (a) The oestrous cycle in a female mammal is controlled by hormones. Describe the part played by FSH and LH in the control of the oestrous cycle.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5 marks)

(b) The oestrous cycle of female sheep can be synchronised by giving them low doses of progesterone. When the treatment is stopped, the sheep come into oestrus a short time later.

(i) Explain why low doses of progesterone prevent oestrus in sheep.

.....

.....

.....

.....

(2 marks)

(ii) Explain why sheep come into oestrus a short time after progesterone treatment is stopped.

.....

.....

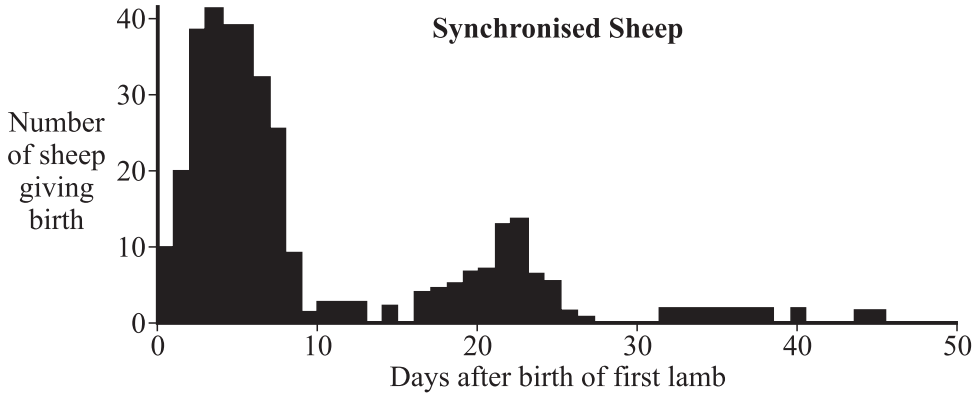
.....

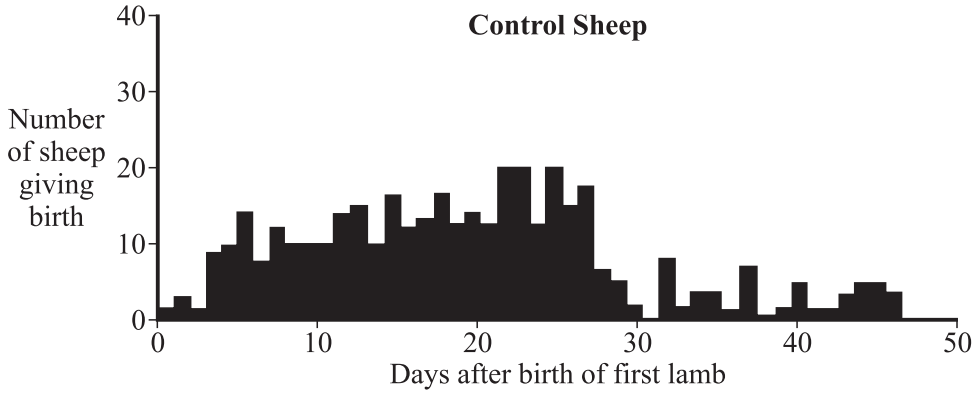
.....

(2 marks)

QUESTION 8 IS CONTINUED ON THE NEXT PAGE

(c) The effect of progesterone treatment on the time when lambs were born was investigated. The graph shows the dates of lambing in a group of sheep in which the oestrous cycles were synchronised and in a control group.





Using information in the graph:

(i) suggest the advantage to a farmer of synchronising oestrous cycles in sheep;

.....

.....

.....

.....

(2 marks)

(ii) estimate the length of an oestrous cycle in sheep. Explain how you arrived at your answer.

.....

.....

.....

(2 marks)

(d) Describe how the control group of sheep should have been treated.

.....

.....

.....

.....

(2 marks)

15

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE