

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use
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General Certificate of Education  
 June 2007  
 Advanced Subsidiary Examination



**HUMAN BIOLOGY (SPECIFICATION A)**  
**Unit 3 Pathogens and Disease**

**BYA3**

Monday 4 June 2007 9.00 am to 10.30 am

**For this paper you must have:**

- a ruler with millimetre measurements.

You may use a calculator.

For Examiner's Use			
Question	Mark	Question	Mark
1		9	
2			
3			
4			
5			
6			
7			
8			
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.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

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

- 1 The table shows some mRNA base sequences and the amino acid sequences that would be produced from them.

mRNA base sequence	Amino acid sequence
AGU AGU AGU AGU AGU	ser-ser-ser-ser-ser
CAC ACA CAC ACA CAC	his-thr-his-thr-his
CAA CAA CAA CAA CAA	gln-gln-gln-gln-gln
AAC AAC AAC AAC AAC	asn-asn-asn-asn-asn
ACC ACC ACC ACC ACC	thr-thr-thr-thr-thr
ACA CAC ACA CAC ACA	

- (a) Complete the table to show the sequence of amino acids produced from the final mRNA base sequence. (1 mark)

- (b) Use the information in the table to give

- (i) **one** sequence of DNA bases that codes for the amino acid ser,

.....  
 .....

- (ii) **one** anticodon for the amino acid ser.

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 .....

(2 marks)

- (c) The genetic code is described as non-overlapping and degenerate. Explain the evidence from the table that this code is

- (i) non-overlapping,

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 .....

- (ii) degenerate.

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(4 marks)

2 A study was carried out on patients who had suffered a myocardial infarction and then received bypass surgery. One group of patients received beta blockers before surgery, while an equal-sized group did not. The patients who received beta-blockers had a higher rate of survival after surgery.

(a) Beta blockers reduce hypertension. Explain how.

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(3 marks)

(b) Reducing hypertension improved the rate of survival among the patients who received beta-blockers. Suggest why.

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(3 marks)

6
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**Turn over for the next question**

**Turn over ►**

3 (a) Describe the role of the following structures in mitosis

(i) Centromere .....

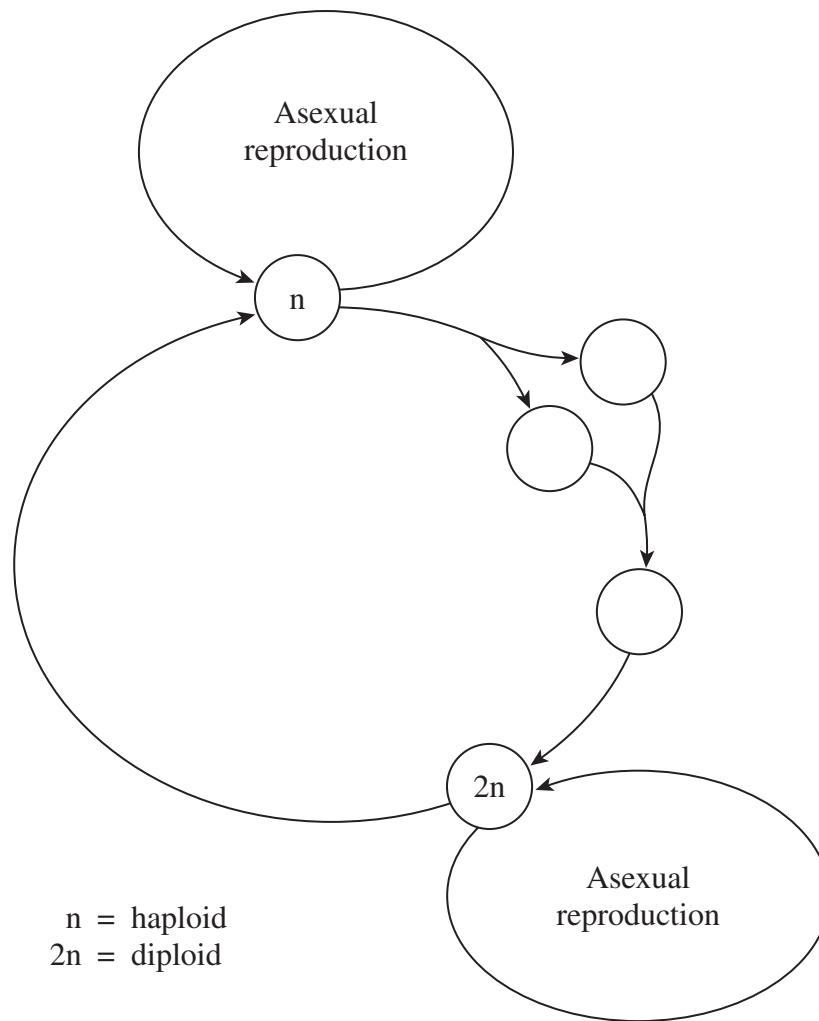
.....

(ii) Spindle fibres .....

.....

(2 marks)

(b) Yeast is a single-celled organism. It can reproduce sexually or asexually. The diagram shows the life cycle of yeast.



(i) The diagram shows some haploid stages and some diploid stages. Complete the diagram to show the stages that are haploid and the stages that are diploid. Write 'n' in the appropriate circle to show a haploid stage and '2n' to show a diploid stage.

(1 mark)

(ii) Write 'X' on the appropriate arrow to show the stage in which yeast divides by meiosis.

(1 mark)

4 (a) Name the **two** enzymes which are used in a glucose test strip.

1 .....

2 .....

(2 marks)

(b) A test strip to detect the presence of heroin has been made. Two enzymes and a colourless dye are fixed into the test strip. The first enzyme converts heroin into morphine. The second enzyme breaks down morphine, releasing a substance which causes the colourless dye to turn red.

(i) This test strip will detect morphine or heroin in a sample, but not any other substance. Explain why.

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(2 marks)

(ii) Explain why the colourless dye is needed in this test strip.

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(1 mark)

5
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**Turn over for the next question**

**Turn over ►**

5 Lassa fever is a fatal disease of monkeys and humans in parts of Africa. Scientists have developed a new vaccine which seems to protect monkeys from the disease.

Scientists found the gene for a surface glycoprotein on the Lassa fever virus. They inserted the gene into a harmless virus. This modified harmless virus had the glycoprotein on its surface and was used as a vaccine.

(a) Describe the role of the following enzymes in producing the modified harmless virus used as a vaccine.

(i) Restriction endonuclease .....

.....

(ii) DNA ligase .....

.....

(3 marks)

(b) The glycoprotein was present on the surface of the modified harmless virus. It is important that the glycoprotein was on the surface of this virus, not inside it. Explain why.

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(2 marks)

Scientists injected four monkeys with this new Lassa fever vaccine and injected two control monkeys with a saline solution. After 28 days, the scientists gave all six monkeys the Lassa fever virus.

The four monkeys that had been given the Lassa fever vaccine remained healthy. The two control monkeys became ill with Lassa fever.

(c) The control monkeys were injected with a saline solution. Explain why.

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(2 marks)

- (d) The scientists waited 28 days before giving the monkeys the Lassa fever virus. Explain why.

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(1 mark)

- (e) The four monkeys given Lassa fever vaccine remained healthy. Explain why.

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(3 marks)

**11**

**Turn over for the next question**

**Turn over ►**

6 (a) Cigarette smoking can lead to the formation of tumours. Describe how.

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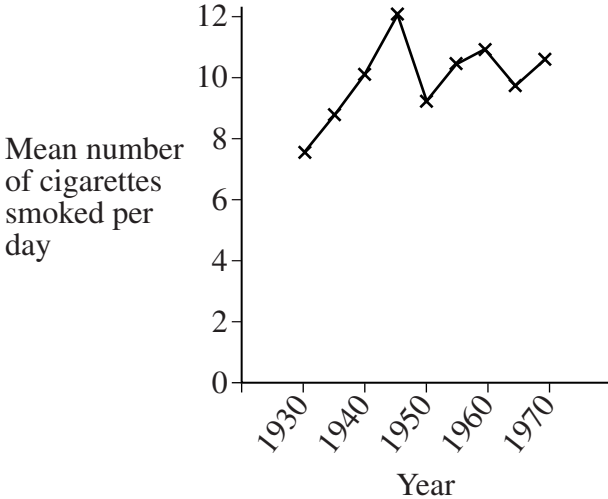
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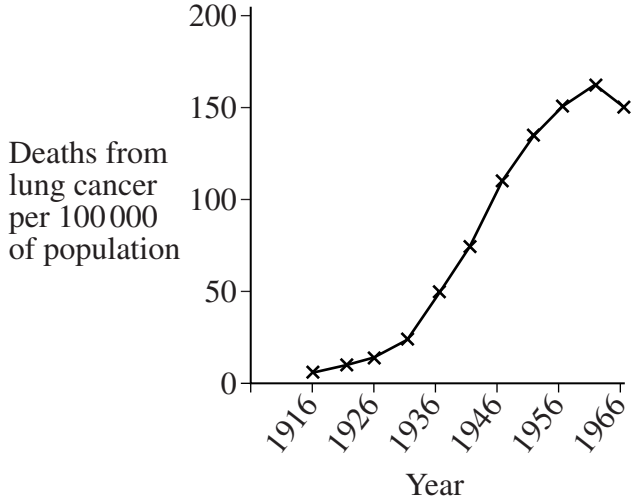
(4 marks)

(b) The graphs show the number of cigarettes smoked and lung cancer deaths for men over a number of years.

Graph 1



Graph 2



There is now compelling evidence that smoking causes lung cancer. However, it is not possible to conclude that smoking causes lung cancer from the evidence in the two graphs alone.

Give **three** reasons why.

1 .....

.....

2 .....

.....

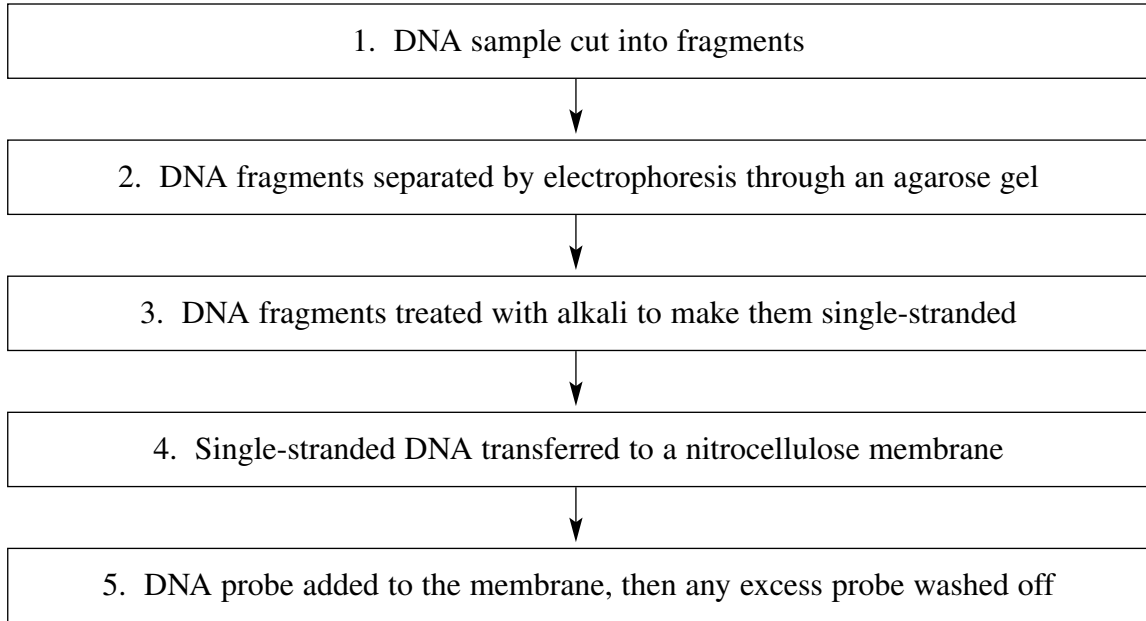
3 .....

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(3 marks)



7 DNA may be analysed to detect whether someone carries a particular gene. The flow chart shows some of the stages in this analysis.



(a) DNA fragments are made single-stranded in stage 3. Why must this be done?

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(1 mark)

(b) A DNA probe is added in stage 5. Explain how the DNA probe

(i) binds to a specific gene,

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(2 marks)

(ii) enables scientists to detect a specific gene.

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(2 marks)

Turn over ►



- (ii) Suggest **two** basic rules of hygiene that could prevent transmission of salmonella food poisoning (lines 3–4).

Explain how each reduces the probability of spreading salmonella food poisoning.

1 .....

.....

.....

2 .....

.....

.....

(3 marks)

- (b) (i) The mRNA from a disease-causing microorganism binds to one of the pieces of DNA on the test strip (lines 13–14).

Explain what causes the mRNA to bind to the DNA.

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(2 marks)

- (ii) A different sequence of DNA is needed for each disease-causing microorganism being tested for. Explain why.

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(2 marks)

**Question 8 continues on the next page**

**Turn over ►**

(c) Give **two** chemical differences between the single-stranded DNA on the biosensor and mRNA.

1 .....

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2 .....

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*(2 marks)*

**15**

**There are no questions printed on this page**

**Turn over ►**



(c) (i) Explain how the risk ratio was calculated.

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*(1 mark)*

(ii) Some people wanted to use the risk ratio to advise on appropriate sites for new villages. Would the risk ratio be useful for this? Explain your answer.

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*(2 marks)*

(d) The percentage of children with malaria living in villages within 3 km of a lake was always higher than in villages 8–10 km from a lake. Explain why.

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*(3 marks)*

(e) Country **A** and country **B** are both in Africa and have a similar climate and geography. In the year 2000, country **A** had a much higher number of cases of malaria than country **B**. However, fewer people died of malaria in country **A** than in country **B**. Suggest why fewer people died in country **A**.

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*(1 mark)*

**END OF QUESTIONS**

**There are no questions printed on this page**

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Question 5. Information taken from New Scientist, 28/6/05.

Question 8. Adapted from: GAIA VINCE, New Scientist, 18/7/05.

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