Surname				Other	Names			
Centre Number				Candida	ate Number			
Candidate Signature								

For Examiner's Use

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.

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.

For Examiner's Use					
Question	Mark	Question			
1		9			
2					
3					
4					
5					
6					
7					
8					
Total (Co	lumn 1)	→			
Total (Co	lumn 2) _	\rightarrow			
TOTAL					
Examine	r's Initials				

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	ser-ser-ser-ser
CAC ACA CAC ACA CAC	his-thr-his-thr-his
CAA CAA CAA CAA	gln-gln-gln-gln
AAC AAC AAC AAC	asn-asn-asn-asn
ACC ACC ACC ACC	thr-thr-thr-thr
ACA CAC ACA CAC ACA	

AC	A CA	C ACA CAC ACA
(a)		plete the table to show the sequence of amino acids produced from the final [A base sequence.] (1 mark)
(b)	Use 1	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.
		(2 marks)
(c)		genetic code is described as non-overlapping and degenerate. ain the evidence from the table that this code is
	(i)	non-overlapping,
	(ii)	degenerate.

received bypass surgery. One group of patients received beta blockers before surgery, while

2 A study was carried out on patients who had suffered a myocardial infarction and then

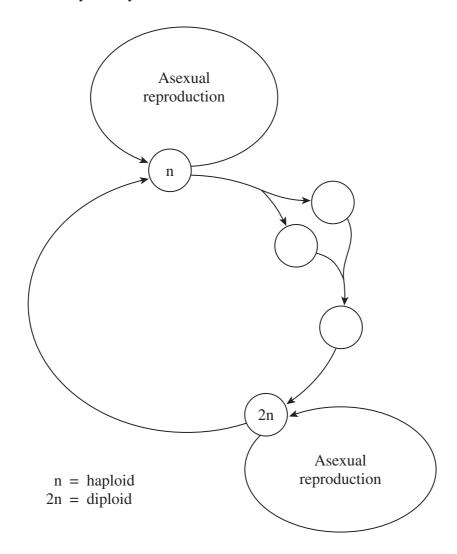
	qual-sized group did not. The patients who received beta-blockers had a higher rate of val after surgery.
(a)	Beta blockers reduce hypertension. Explain how.
	(3 marks)
(b)	Reducing hypertension improved the rate of survival among the patients who received beta-blockers. Suggest why.
	(3 marks)

Turn over for the next question

3	/ \	D '1	.1 1	C .1	C 11 '			• . •
3 (a)	Describe	the role	of the	tollowing	structures	1n	mitosis
•	(4)	Describe	uic roic	OI HIL	10110 111115	buactares	111	1111100010

(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)	Nam	e the two enzymes which are used in a glucose test strip.
		1	
		2	(2 marks)
	(b)	color	st strip to detect the presence of heroin has been made. Two enzymes and a urless dye are fixed into the test strip. The first enzyme converts heroin into thine. The second enzyme breaks down morphine, releasing a substance which es 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.
			(2 marks)
		(ii)	Explain why the colourless dye is needed in this test strip.
			(1 mark)

Turn over for the next question

(2 marks)

5			er is a fatal disease of monkeys and humans in parts of Africa. Scientists has a new vaccine which seems to protect monkeys from the disease.	ave
	the g	gene ii	found the gene for a surface glycoprotein on the Lassa fever virus. They i nto a harmless virus. This modified harmless virus had the glycoprotein on dwas used as a vaccine.	
	(a)		cribe the role of the following enzymes in producing the modified harmless d as a vaccine.	s virus
		(i)	Restriction endonuclease	
		(ii)	DNA ligase	
				3 marks)
	(b)	impo	glycoprotein was present on the surface of the modified harmless virus. It ortant that the glycoprotein was on the surface of this virus, not inside it. lain why.	is
		•••••		 2 marks)
		cont mon The	entists injected four monkeys with this new Lassa fever vaccine and injected trol monkeys with a saline solution. After 28 days, the scientists gave all sinkeys the Lassa fever virus. four monkeys that had been given the Lassa fever vaccine remained health two control monkeys became ill with Lassa fever.	ix
	(c)	The	control monkeys were injected with a saline solution. Explain why.	
		•••••		•••••
		•••••		•••••
		•••••		•••••

(d)	The scientists waited 28 days before giving the monkeys the Lassa fever virus. Explain why.
	(1 mark)
(e)	The four monkeys given Lassa fever vaccine remained healthy. Explain why.
	(3 marks)

Turn over for the next question

6	(a)	Cigarette smoking can lead to the formation of tumo	ours. Describe how.
			(4 marks)
((b)	The graphs show the number of cigarettes smoked a a number of years.	nd lung cancer deaths for men over
		Graph 1	Graph 2
		12-l *	200+
		10-	×
Mean n	uumb	× ^	150-
of cigar	rettes	lung cancer	100-
smoked day	ı per	per 100 000 4-	
		2-	50-
		1920 Jaho 1920 Jaho 1940	0 316 376 376 376 376 376 376 376 376 376
		Year	Year
		There is now compelling evidence that smoking causes possible to conclude that smoking causes lung cancer graphs alone. Give three reasons why.	
		1	
		2	
		3	
			(3 marks)

		1. DNA sample cut into fragments	
		•	
	2.	DNA fragments separated by electrophoresis through an agarose gel	
		•	
	3	3. DNA fragments treated with alkali to make them single-stranded	
		\	
		4. Single-stranded DNA transferred to a nitrocellulose membrane	
		\	
	5.	DNA probe added to the membrane, then any excess probe washed off	
(a)		a fragments are made single-stranded in stage 3. must this be done?	
(b)	A Dì	NA probe is added in stage 5. Explain how the DNA probe	(1 mark
(0)	(i)	binds to a specific gene,	
			(2 marks
	(ii)	enables scientists to detect a specific gene.	

8 Read the following passage.

Scientists have discovered a new technique for detecting disease-causing microorganisms. This technique could lead to faster and cheaper diagnosis of diseases such as salmonella food poisoning. The scientists point out, however, that this new technique is no substitute for following the basic rules of hygiene.

They developed a biosensor that they claim is accurate enough to identify different strains of these disease-causing microorganisms in a blood or food sample. In this new technique, the sample to be tested is placed in a test tube. It is then treated with an enzyme which breaks down the cells of the microorganisms and releases their genetic material. Then a test strip is put in the mixture and left for a few minutes. If a particular microorganism is present, a red line appears on the strip.

10

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The technique works because the test strip is impregnated with pieces of single-stranded DNA. These bind to the mRNA of the disease-causing microorganism. The test strip also contains a colourless dye. If the mRNA is present, it sticks to the DNA on the test strip and the colourless dye turns red.

Adapted from an article by Gaia Vince in New Scientist, 18th July 2005

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

(a) ((1)	Describe how Salmonella enters the human body and how it causes the symptoms of food poisoning.
		(6 marks)

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

Question 8 continues on the next page

(c)	Give two chemical differences between the single-stranded DNA on the biosensor armRNA.	ıd
	1	
	2	
		· • • • •
	(2 mar	ks)

15

There are no questions printed on this page

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They studied 7000 studied a second g	children who lived in	ing in northern Ethiopia villages within 3 km of s second group lived in	ı. f a lake. They als
They studied 7000	O children who lived in group of children. This Number of cases	villages within 3 km of s second group lived in s of malaria per 100	ı. f a lake. They als
They studied 7000 studied a second gethe nearest lake.	O children who lived in group of children. This Number of cases children	villages within 3 km of second group lived in sof malaria per 100 per month	f a lake. They also villages 8–10 km
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They studied 7000 studied a second gethe nearest lake.	O children who lived in group of children. This Number of cases children Villages within	s of malaria per 100 per month Villages 8–10 km	a. f a lake. They also villages 8–10 km
They studied 7000 studied a second gthe nearest lake. Time of year	Number of cases children Villages within 3 km of a lake	s of malaria per 100 per month Villages 8–10 km from the nearest lal	n. f a lake. They also villages 8–10 km Risk rati
They studied 7000 studied a second gothe nearest lake. Time of year Jan–Feb	Number of cases children Villages within 3 km of a lake	s of malaria per 100 per month Villages 8–10 km from the nearest lal 0.7	Risk rati

(c)	(i)	Explain how the risk ratio was calculated.
		(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.
		(2 marks)
(d)		percentage of children with malaria living in villages within 3 km of a lake was ys higher than in villages 8–10 km from a lake. Explain why.
	•••••	
	•••••	
		(3 marks)
(e)	In th B . F	antry A and country B are both in Africa and have a similar climate and geography. The year 2000, country A had a much higher number of cases of malaria than country and the year people died of malaria in country A than in country B . The year than the year people died in country A .
	•••••	
	•••••	(1 mark)

END OF QUESTIONS

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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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