Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2002
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

HUMAN BIOLOGY (SPECIFICATION A) BYA3
Unit 3 Pathogens and Disease

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			
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7			
8			
9			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 A yeast culture was made by mixing a suspension of yeast cells with sucrose solution. This culture was put in a flask. A student investigated the population growth of the yeast cells. The number of yeast cells was counted at the start of the investigation and at 24 hour intervals for the next ten days. The flask was kept in an incubator at a temperature of 15 °C.

(a) (i) Suggest how entry of bacteria into the flask containing the yeast culture could be prevented.

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(1 mark)

(ii) Explain why it was important to prevent bacteria entering the flask.

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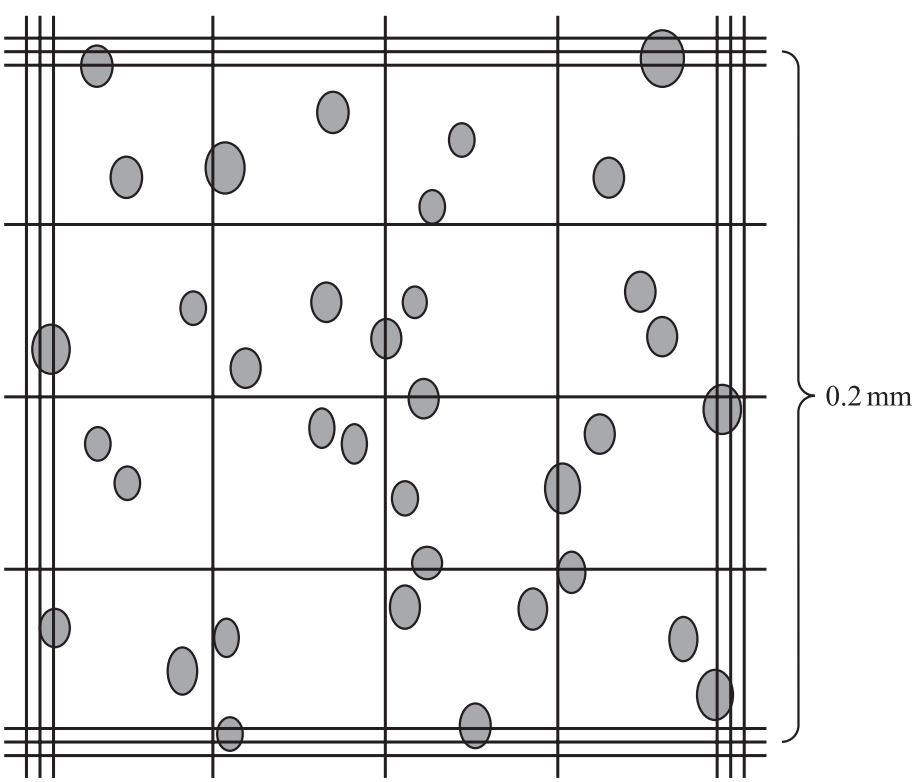
(1 mark)

A drop of the yeast culture was removed from the flask and placed on a haemocytometer. The haemocytometer was then placed on the stage of a microscope. Part of the grid on the haemocytometer is shown in the diagram.



(b) (i) How many yeast cells would be recorded as present in the 0.2 mm square?

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(1 mark)

(ii) Explain why a more accurate estimate of the population of yeast cells might be obtained if:

1. the culture was shaken before the sample was removed;

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2. a large number of samples were taken.

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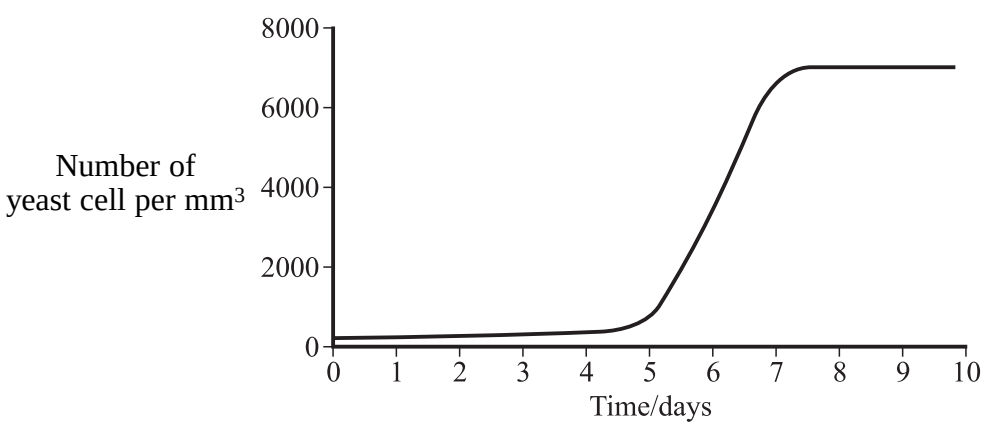
(2 marks)

(c) The graph shows the results of the investigation.



The yeast culture in this investigation was kept at 15 °C. Sketch a curve on the graph to show the population growth curve if the culture had been kept at 25 °C.

(2 marks)

7

2 Immunity can be either active or passive.

(a) The table shows some statements, which may be related to active immunity, to passive immunity or to both. Complete the table by placing a tick in the box if the statement is true or a cross in the box if the statement is not true.

Statement	**Active immunity**	**Passive immunity**
Antibodies produced if the body is re-infected by the same pathogen.		
An antibody reacts with an antigen.		
Antibodies received in breast milk.		
Attenuated microorganisms used in the vaccine.		

(4 marks)

(b) If a pregnant woman becomes infected with the *Rubella* virus in the early stages of pregnancy, her developing embryo may become deaf, blind or brain damaged.

Explain why it is recommended that:

(i) girls are vaccinated against *Rubella* when they are young;

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(ii) young boys are also vaccinated against *Rubella*.

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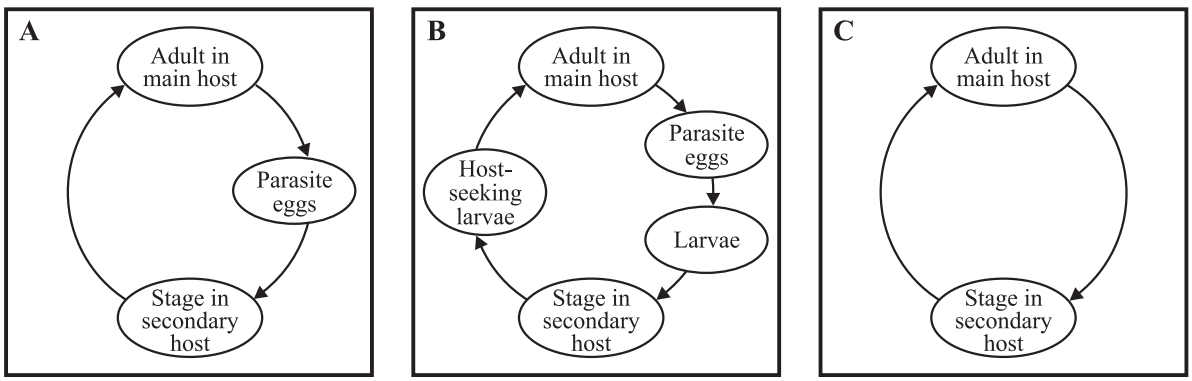
(2 marks)

6

3 A parasite is an organism that lives in or on another living organism. Two diseases of humans, which are caused by parasites, are schistosomiasis and malaria.

(a) The diagrams show three different parasite life cycles.



Complete the table.

Disease	Diagram representing life cycle of parasite (A, B or C)	Main host	Secondary host
Schistosomiasis		Human	
Malaria		Human	

(4 marks)

(b) Describe how the parasite that causes schistosomiasis gets into a human.

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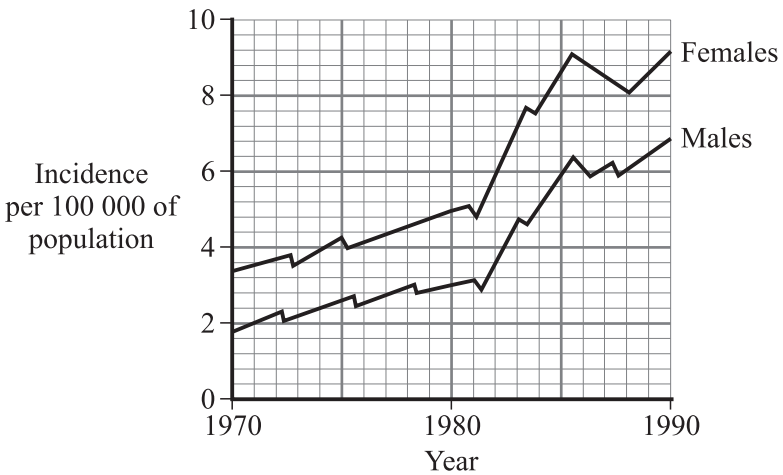
(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

4 Melanoma is a malignant skin cancer. The graph shows the incidence of melanoma in the UK between 1970 and 1990.



(a) Explain what is meant by *malignant*.

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(2 marks)

(b) (i) Over the period shown, the incidence of melanoma has increased. Give **two** other conclusions that can be drawn from the graph, about the incidence of melanoma.

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(2 marks)

(ii) In a population of 1 million people where half were male and half were female, how many people developed melanoma in 1980? Show your working.

Answer = ...

(2 marks)

(iii) Melanoma is more common in fair-skinned people living in sunny parts of the world than in the UK. Explain why.

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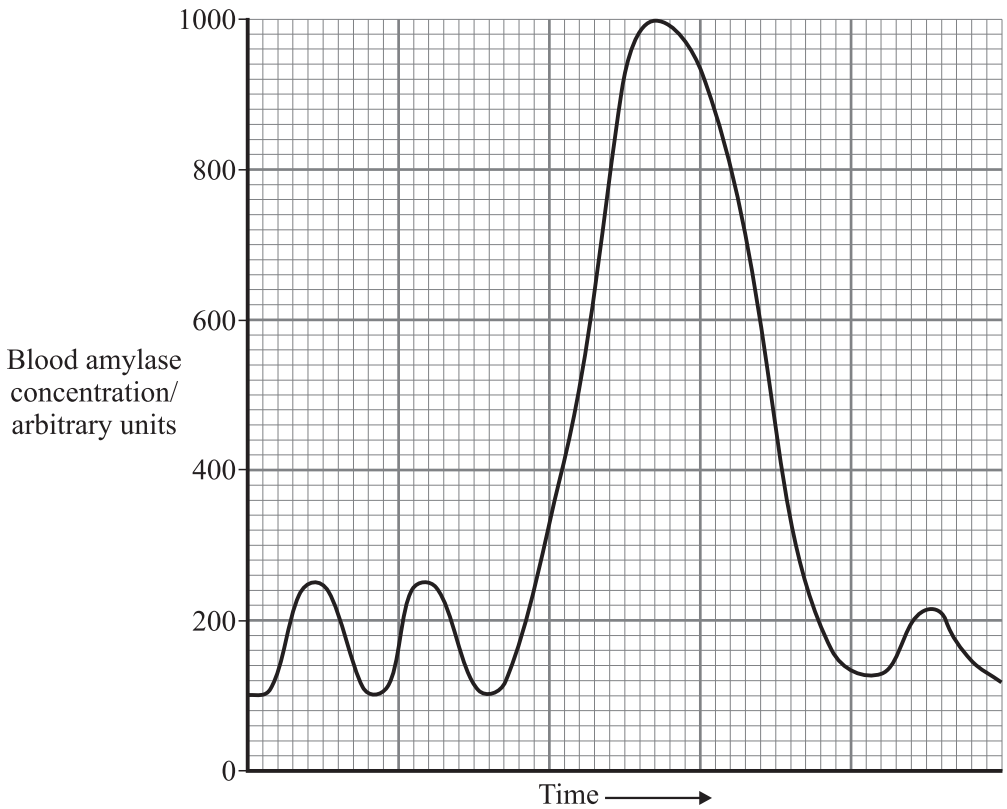
(2 marks)

8

TURN OVER FOR THE NEXT QUESTION

5 Amylase is an enzyme that is normally found in low concentrations in blood. The concentration of this enzyme provides an indication of whether a patient has suffered an attack of pancreatitis. The graph shows the blood amylase concentration in a patient before, during and after an attack of pancreatitis.



(a) (i) Use the graph to suggest the range of blood amylase concentration in a healthy person.

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(1 mark)

(ii) Calculate the maximum percentage increase in blood amylase concentration in this attack of pancreatitis. Show your working.

Answer = ...

(2 marks)

(b) (i) Explain why the blood amylase concentration increases during an attack of pancreatitis.

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(ii) During an attack of pancreatitis, the concentration of amylase in the urine also rises. Suggest **one** advantage of measuring urine amylase concentration rather than blood amylase concentration.

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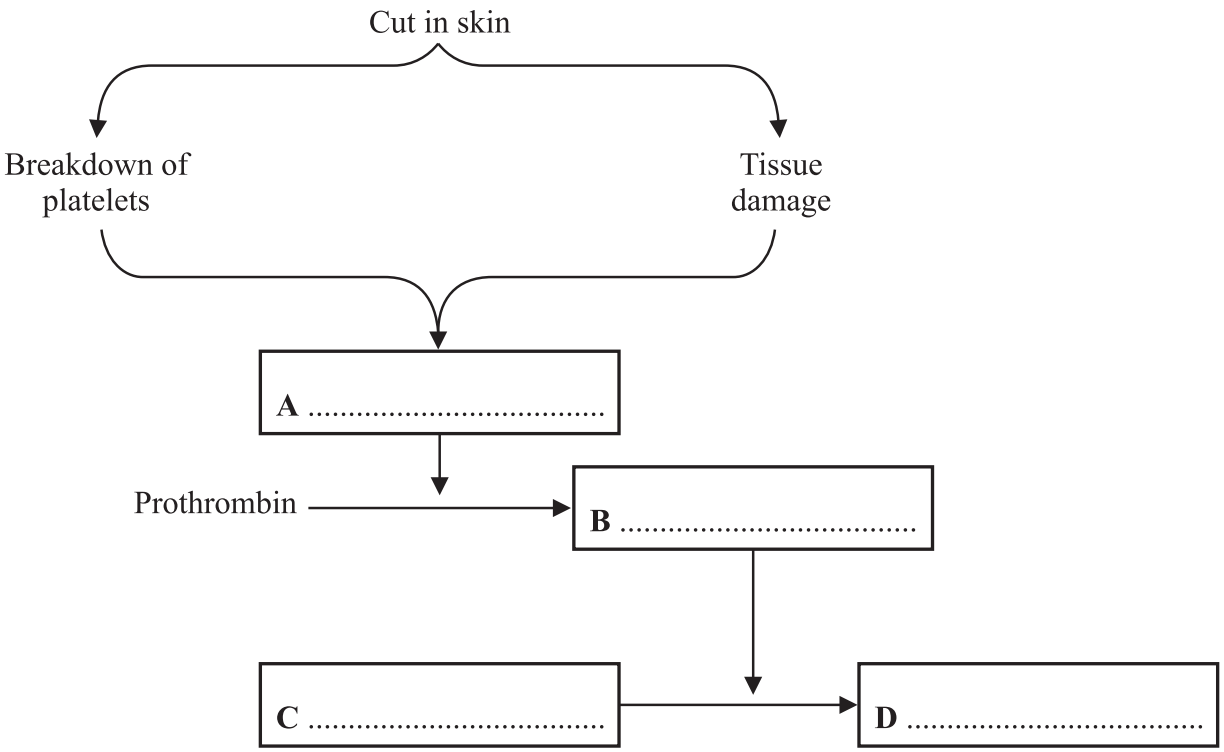
(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

6 The diagram summarises some of the events that occur during the clotting of blood.



(a) Complete the diagram by naming:

Substance **A**;
Substance **B**;
Substance **C**;
Substance **D**.

(3 marks)

(b) During menstruation, blood is released when the lining of the uterus is shed. The blood has a low concentration of calcium ions. Explain how this affects the blood's ability to clot.

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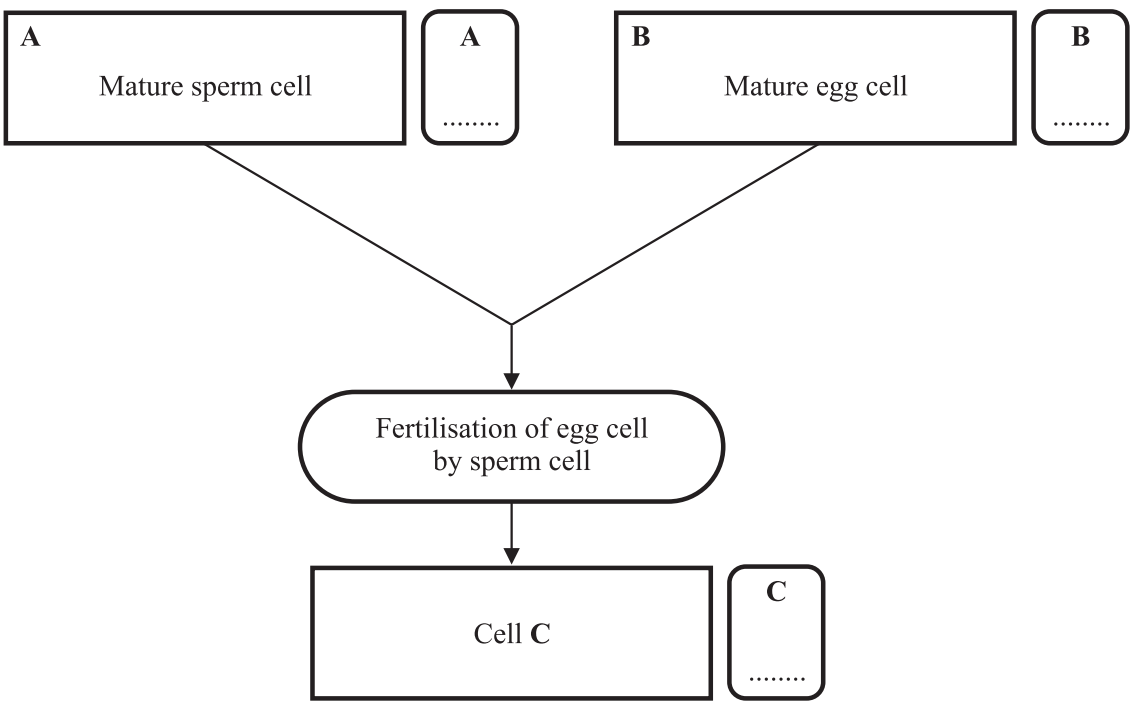
(3 marks)

6

7 A human body cell contains 23 pairs of chromosomes. The diagram shows the events of fertilisation.



(a) Complete boxes **A** to **C** to show the number of chromosomes present in the relevant cells.

(2 marks)

(b) Name **Cell C**.

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(1 mark)

(c) Complete the table, which describes events that take place at various stages in the cell cycle.

Stage	Description of events
Anaphase	
	DNA replication occurs
Prophase	
	Division of cytoplasm

(4 marks)

7

8 Read the following passage.

Scientists have recently determined the complete base-pair sequence of human DNA. They have found that only parts of the DNA molecule, called exons, are involved with the synthesis of proteins.

In order to find out what a particular part of the DNA molecule does, the DNA molecule must first be broken up into fragments. This is done by the use of restriction enzymes. These fragments can then be separated by electrophoresis. To help study the function of a particular DNA fragment, several copies of the fragment are required.

A plasmid from a bacterial cell can be used as a vector. The plasmid is removed from the bacterial cell to allow the insertion of the DNA fragment. The vector is replaced inside the bacterial host cell. Both the host cell and vector are then allowed to multiply under appropriate conditions. After multiplication, the vectors are removed from the host cell so that the copies of the DNA fragment can be extracted for further study.

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

(a) (i) What is an intron?

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(1 mark)

(ii) Give **one** example of a base-pair found in DNA.

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(1 mark)

(b) (i) Describe how a DNA fragment is inserted into a plasmid.

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(2 marks)

(ii) A DNA fragment can be inserted into a plasmid because the plasmid also contains DNA. Suggest why the functioning of the plasmid DNA may be altered by the insertion of a DNA fragment.

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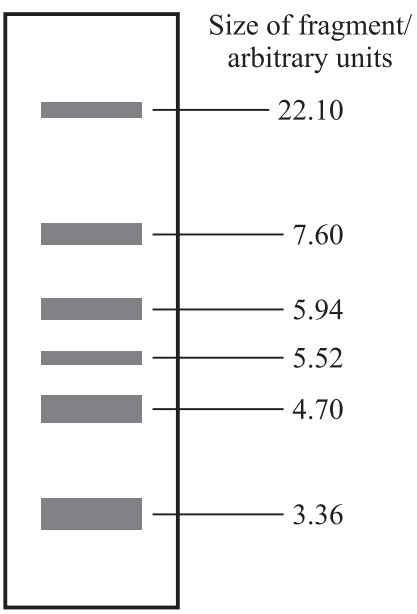
(1 mark)

(c) The DNA molecule was split into fragments using the restriction enzyme *Eco*R1. Electrophoresis was used to separate these fragments of DNA. The diagram shows the result.



(i) Add an arrow to the diagram to show the direction in which the fragments moved during electrophoresis. Explain your answer.

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(1 mark)

(ii) How many times does the sequence of bases recognised by the enzyme *Eco*R1 occur in this section of DNA?

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(1 mark)

QUESTION 8 CONTINUES ON THE NEXT PAGE

(iii) The fragments of the DNA molecule contain genes. How can a DNA probe be used to show which fragment contains a particular gene?

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(2 marks)

(d) A gene codes for the production of a specific protein. DNA extracted from a vector can be introduced into a different host cell where it can be transcribed and translated into a protein. Describe the processes of transcription and translation.

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(6 marks)

9 The table shows some information about the incidence of high blood pressure and heart attacks in the UK.

Sex	Condition	Percentage of people affected in each age group						
		16-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years
Male	high blood pressure	0.5	1.5	3.5	6.0	17.0	22.5	18.5
	heart attack			0.1	0.2	1.1	2.4	3.2
Female	high blood pressure	0.7	1.6	3.8	7.8	20.5	27.9	26.9
	heart attack			0.1	0.3	0.6	0.7	1.8

(a) Use the pattern of data in the table to describe:

(i) **two** similarities between males and females;

1 .....

.....

2 .....

.....

(ii) **two** differences between males and females.

1 .....

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2 .....

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(4 marks)

(b) Explain how high blood pressure can be reduced by the use of beta blockers.

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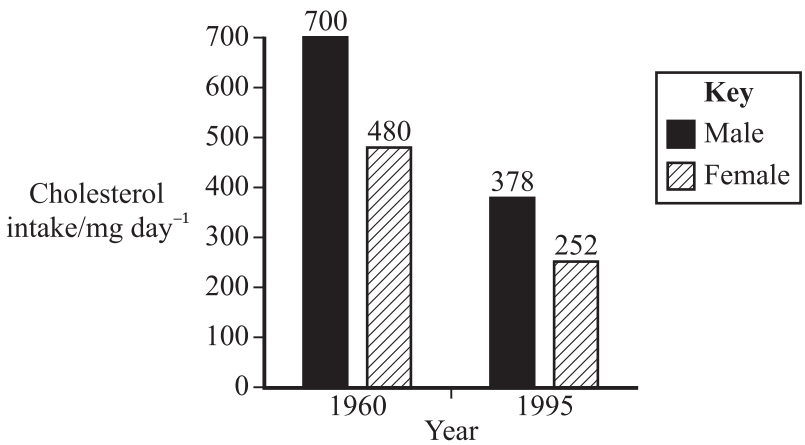
(3 marks)

QUESTION 9 CONTINUES ON THE NEXT PAGE

(c) People have been advised to reduce their cholesterol intake as a part of a healthy life style. The graph shows information about mean daily intake of cholesterol.



Calculate which group, male or female, shows the greater percentage reduction in cholesterol intake between 1960 and 1995. Show your working.

(2 marks)

(d) Explain how smoking and a high blood cholesterol concentration increase the risk of developing coronary heart disease.

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(6 marks)

END OF QUESTIONS