

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education
June 2003



**HUMAN PHYSIOLOGY AND HEALTH
HIGHER TIER**

3417/H

H

Thursday 19 June 2003 9.00 am to 11.00 am

In addition to this paper you will require:

a ruler.

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 2 hours

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.
- Do all rough work in the question paper. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 120.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in all your answers.

Advice

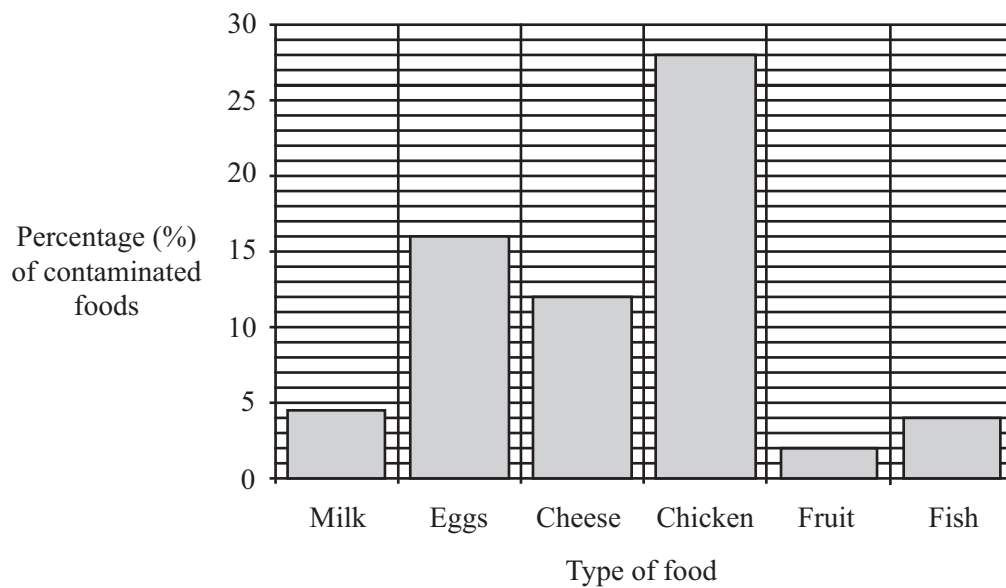
- In all calculations, show clearly how you work out your answer.

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

- 1 (a) Name the type of organism which causes food poisoning.

.....
(1 mark)

- (b) Fifty samples of each of six fresh foods were tested for the presence of organisms that cause food poisoning. The chart shows the percentage of foods that were contaminated.



- (i) Which type of food is most likely to cause food poisoning?

.....
(1 mark)

- (ii) Calculate the number of samples of eggs that were contaminated. Show your working.

.....
(2 marks)

(c) Pasteurisation is one method used to preserve milk.

(i) Describe how this process is carried out.

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(4 marks)

(ii) Name **one** other method used to preserve milk.

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(1 mark)

9

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

2 (a) There are two types of respiration that occur in the body, aerobic respiration and anaerobic respiration.

(i) State **two** ways in which they are similar.

1

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(2 marks)

(ii) State **one** way in which they are different.

.....

(1 mark)

(b) Give **two** ways in which the body uses energy released during respiration.

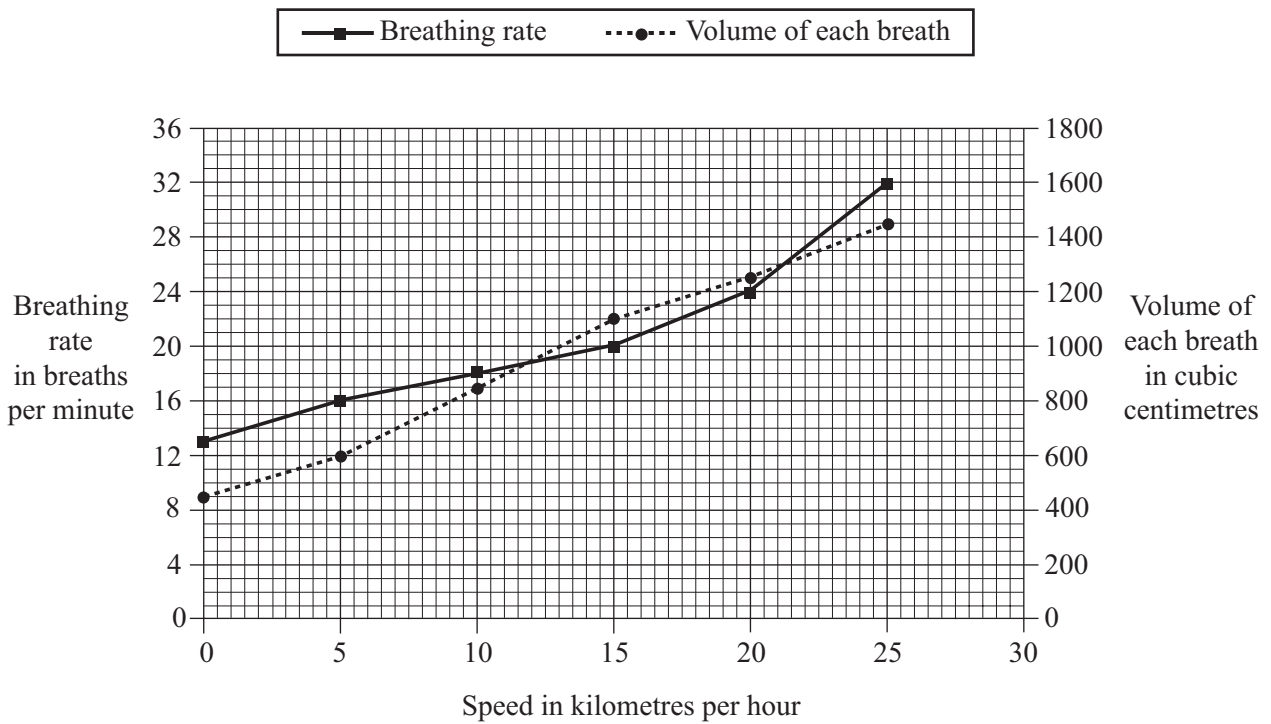
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(2 marks)

(c) When a person runs faster, they breathe faster and the volume of each breath increases. The graph shows these changes.



- (i) How many breaths per minute were taken when the person was running at 10 kilometres per hour?

..... breaths per minute
(1 mark)

- (ii) What was the volume of each breath when the person was running at 15 kilometres per hour?

..... cubic centimetres
(1 mark)

- (iii) Calculate the volume of air entering the lungs each minute when the person was running at 20 kilometres per hour. Show your working.

..... cubic centimetres
(2 marks)

- (iv) Describe the benefits of increasing the breathing rate and the volume of each breath when the level of activity increases.

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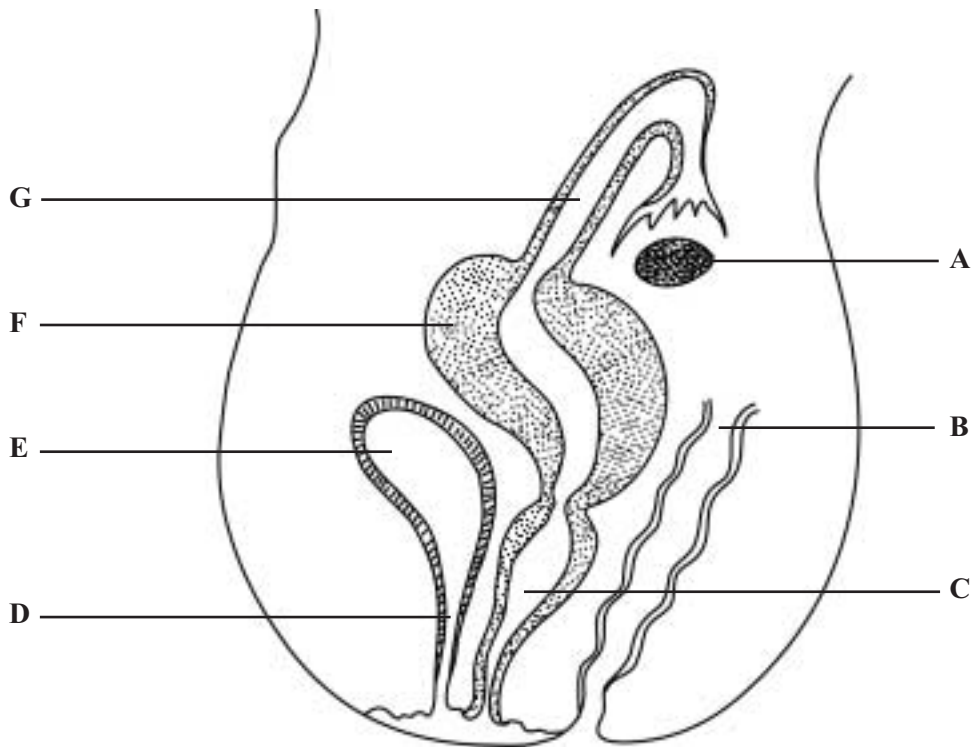
(2 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 3 (a) The diagram shows the female reproductive system.



Match **one** of the letters, **A, B, C, D, E, F** or **G**, from the diagram with each of the following:

receives sperm during intercourse;

.....

contracts during childbirth;

.....

produces eggs.

.....

(3 marks)

- (b) (i) Name the organ that makes sperm.

.....

(1 mark)

(ii) After being released into the female body, a sperm fertilises the egg. Describe how sperm reach the egg and how fertilisation takes place.

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(4 marks)

(c) Describe how non-identical twins are formed.

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(2 marks)

QUESTION 3 CONTINUES ON THE NEXT PAGE

Turn over ▶

(d) Read the passage.

Ovranette is a combined oral contraceptive, commonly called the ‘pill’. It is taken for 21 days of the menstrual cycle. The ‘pill’ contains two naturally occurring female hormones, oestrogen and progesterone. These hormones stop the release of eggs. They also thicken the mucus in the cervix and alter the lining of the uterus.

Experience has shown that, taken correctly, the ‘pill’ is an extremely effective method of contraception.

Women who take the ‘pill’ have a slightly increased risk of developing a blood clot inside an artery or vein (thrombosis). Breast cancer has been found more often in women taking the ‘pill’.

(i) The ‘pill’ is a female form of contraception. Name a male form of contraception.

.....

 (1 mark)

(ii) Name the female organ that produces oestrogen and progesterone.

.....
 (1 mark)

(iii) How do the following prevent pregnancy?

Stopping the release of eggs

.....

Thickening the mucus in the cervix

.....

Altering the lining of the uterus

.....

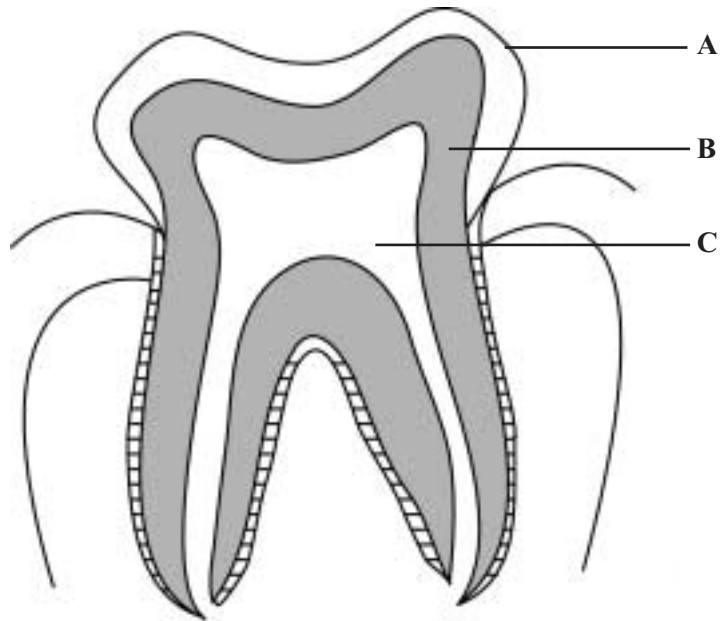
 (3 marks)

(iv) Suggest why some women get pregnant even when taking the ‘pill’.

.....

 (1 mark)

4 The diagram shows a vertical section of a tooth.



(a) Match **one** of the letters, **A**, **B** or **C**, from the diagram with each description.

It contains nerves and blood vessels.

It contains enamel.
(2 marks)

(b) State the function of this tooth. Explain how this tooth is adapted for this function.

Function:
.....

How it is adapted:
.....
(2 marks)

(c) Describe how tooth decay occurs.

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(3 marks)

- 5 (a) Read the following passage.

In England, in the early 18th century, smallpox was a very common viral disease that was often fatal. In 1717, attempts were made to protect people by injecting them with small amounts of matter from the sores of smallpox victims. Some of these attempts were successful but the majority resulted in death.

In 1796, Edward Jenner noticed that many dairy maids suffered from cowpox, a viral disease of cows. These dairy maids did not catch smallpox. Jenner became convinced that infection with cowpox could protect people from developing smallpox.

Jenner tested his idea in the following way: he removed some infected matter from a sore of a dairy maid suffering from cowpox. This matter was injected into the blood of a healthy, young boy whose family were infected with smallpox. Seven weeks later, the boy had not developed smallpox despite close contact with his family.

Jenner decided to confirm his idea by injecting the boy with smallpox. The boy did not develop the disease.

Jenner carried out several further experiments and published his work, but his ideas were not accepted by other scientists for several years.

- (i) What observation did Jenner make?

.....

 (1 mark)

- (ii) What theory did Jenner develop?

.....

 (2 marks)

- (iii) What was the result of Jenner's test on the boy?

.....

 (1 mark)

(iv) Suggest **one** other possible explanation for Jenner's results.

.....
.....
(1 mark)

(v) What reasons could other scientists have for not accepting Jenner's ideas?

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(1 mark)

(b) Suggest **one** reason why modern vaccines are usually tested on animals before being used on humans.

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(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

6 (a) What is meant by excretion?

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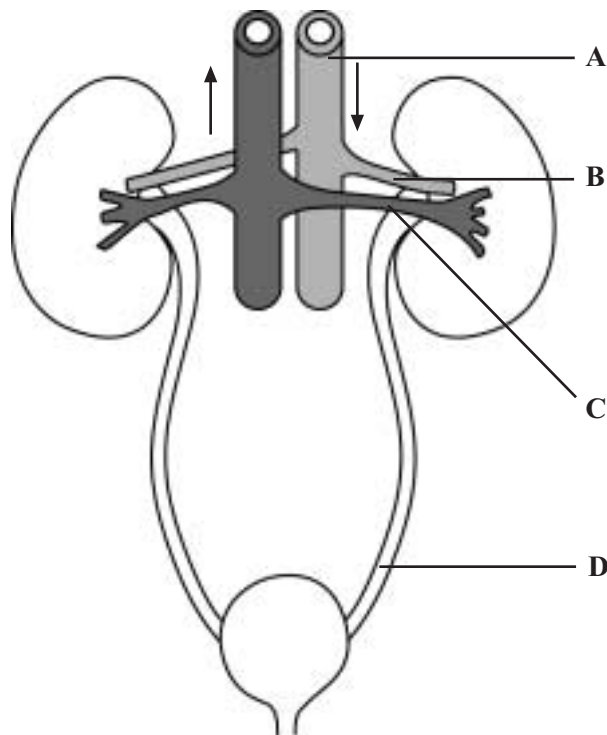
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(2 marks)

(b) The diagram shows the kidneys and associated blood vessels.



(i) Which blood vessel, **A**, **B** or **C**, takes blood into the kidneys?

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(1 mark)

(ii) What is the function of structure **D**?

.....

.....

(1 mark)

- 7 (a) Read the following passage.

Cholera is a highly infectious bacterial disease.

The bacterium affects the digestive system, in particular the large intestine, causing severe and persistent diarrhoea. Death can occur in as little as 12 hours.

Fortunately, deaths from cholera can be prevented by the use of two relatively simple and straightforward treatments.

- (i) How is cholera transmitted from person to person?

.....

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(1 mark)

- (ii) Suggest how the effect of cholera on the digestive system may cause death.

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(1 mark)

- (iii) Suggest **one** of the two treatments for cholera and explain how it would work.

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(1 mark)

- (b) (i) What is an antigen?

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(1 mark)

- (ii) Immunity to cholera can develop as a result of exposure to and recovery from the disease. Explain how the body develops this immunity.

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(3 marks)

$\frac{\quad}{7}$

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

8 (a) The table shows the frequency of blood groups in several populations.

Population	Frequency as percentage of population			
	Group O	Group A	Group B	Group AB
Chinese	45	33	17	5
North American Indian	90	10	0	0
South American Indian	83	17	0	0
English	46	42	9	3
Australian	45	40	3	12

(i) Suggest a reason for the close similarity in the frequency of the blood groups in the English and Australian populations.

.....

 (1 mark)

(ii) Explain why there are no people with group AB blood in the North and South American Indian populations.

.....

 (2 marks)

(b) State the possible genotypes of people with the following blood groups:

(i) group O
 (1 mark)

(ii) group A **and**
 (2 marks)

(c) Which blood group is a result of co-dominance?
 (1 mark)

(d) Haemophilia is a disease in which the ability of the blood to clot is impaired. The condition is caused by a sex-linked recessive allele.

(i) What is a sex-linked allele?

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(1 mark)

(ii) A man and a woman, neither of whom has haemophilia, can have a child who has haemophilia.

Use a genetic diagram to explain how this may happen.

(4 marks)

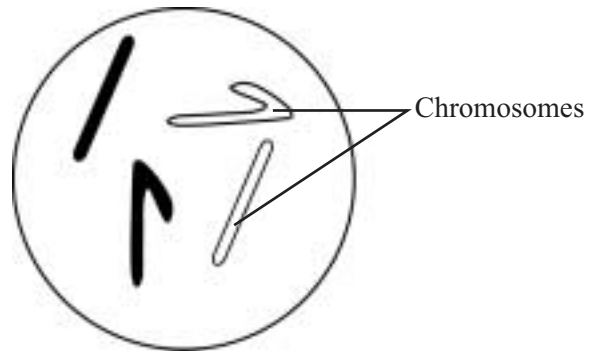
12

Turn over ▶

- 9 (a) When do cells divide by meiosis?

.....
(1 mark)

- (b) The diagram shows a nucleus from a cell.



Draw diagrams to show the nuclei formed from this cell after it has divided by meiosis.

(3 marks)

(c) The chromosomes contain DNA. Describe how DNA controls the formation of protein in the cell.

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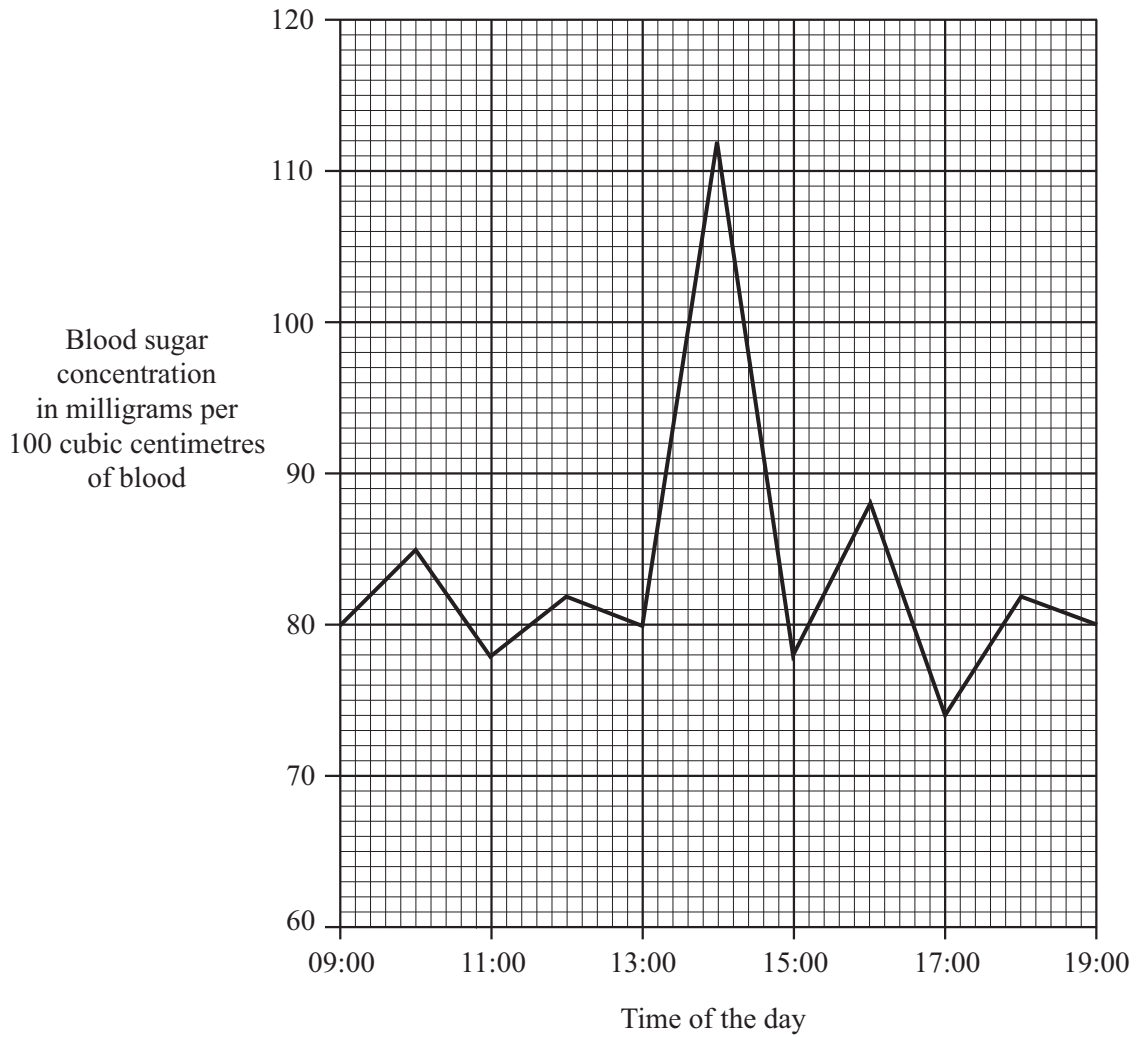
(3 marks)

$\frac{\quad}{7}$

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 10 (a) The graph shows the variation in blood glucose levels of a healthy person over a 10-hour period.



- (i) What was the maximum variation in one hour in blood glucose concentration?

.....
(1 mark)

- (ii) Suggest how the rise in blood glucose concentration between 13:00 and 14:00 was caused.

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(1 mark)

(b) Explain the role of hormones in keeping the blood glucose concentration within narrow limits.

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(5 marks)

(c) The normal treatment for diabetes consists of control of the diet and regular injections of insulin. Some diabetic patients have been treated by a pancreas transplant. What are the advantages and disadvantages to the patient of pancreas transplants?

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(4 marks)

- 11 (a) In America the levels of air pollution are measured using an Air-Quality Index. This is shown in the table.

Air-Quality Index	Air quality description	Concentration of substance in micrograms per cubic metre Mean level measured over given time period				
		Solid particles (24 hours)	Sulphur dioxide (24 hours)	Carbon monoxide (8 hours)	Ozone (1 hour)	Nitrogen oxides (8 hours)
500	Very Hazardous	1000	2620	55 000	1200	3750
400	Hazardous	875	2100	46 000	1000	3000
300	Very Unhealthy	625	1600	34 000	800	2260
200	Unhealthy	325	800	17 000	400	1130
100	Moderate	260	365	10 000	235	No figures
50	Good	75	80	5000	118	No figures

- (i) Suggest why mean levels of the substances are used to measure the air quality.

.....
(1 mark)

- (ii) By what factor does the mean level of sulphur dioxide increase when the Air-Quality Index increases from 50 to 300?

.....
(1 mark)

- (iii) The Air-Quality Index is applied when mean levels of 4 of the 5 substances reach the level given in the table. What Air-Quality Index would be applied to the following air sample?

Substance	Mean concentration of substance in micrograms per cubic metre
Solid particles	685
Sulphur dioxide	1550
Carbon monoxide	34 100
Ozone	850
Nitrogen oxides	2290

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(1 mark)

- (b) During the Second World War, an Italian train took shelter from bombing in a five-mile long tunnel for several hours. 300 people on the train died from carbon monoxide poisoning. Suggest how these deaths may have been caused.

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(4 marks)

QUESTION 11 CONTINUES ON THE NEXT PAGE

Turn over ►

- (c) Sewage may contaminate rivers. Explain, in detail, how sewage entering the river could lead to the death of aquatic animals such as fish.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific terms.

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(5 marks)

12

- 12 (a) A student investigated the effect of temperature and bile on the action of lipase.

Six test tubes were set up as shown in the table.

Tube	Contents	Temperature (°C)
1	10 cm ³ milk, lipase, pH indicator, bile	35
2	10 cm ³ milk, lipase, pH indicator, bile	25
3	10 cm ³ milk, lipase, pH indicator, bile	15
4	10 cm ³ milk, lipase, pH indicator, bile	5
5	10 cm ³ milk, lipase, pH indicator	35
6	10 cm ³ milk, boiled lipase, pH indicator, bile	35

Bile is an alkaline substance.

The pH indicator is colourless when the pH is 7 or less and red when the pH is over 7.

The time taken for the indicator to change colour was recorded and is shown in the table.

Tube	Time in minutes for indicator to change colour
1	7
2	13
3	26
4	32
5	16
6	No change

(i) What colour was the indicator in tube 1 at the start after the addition of the bile?

.....
(1 mark)

(ii) Explain why there was no change in colour in tube 6.

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(1 mark)

(iii) What do the results from tubes 1 and 5 tell you about the effect of bile on the reaction?

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(1 mark)

(iv) Explain the reason for this effect.

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(2 marks)

(v) Explain how the action of lipase causes the indicator to change colour.

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(3 marks)

(vi) What is the effect of temperature on the reaction?

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(1 mark)

QUESTION 12 CONTINUES ON THE NEXT PAGE

Turn over ►

(b) In cystic fibrosis, the pancreatic duct (the tube from the pancreas) becomes blocked. Explain how this leads to the presence of fat in the faeces.

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(2 marks)

END OF QUESTIONS

