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Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2006

**HUMAN PHYSIOLOGY AND HEALTH**  
**Higher Tier**

3417/H

**H**



Friday 23 June 2006 9.00 am to 11.00 am

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a ruler</li> </ul> <p>You may use a calculator.</p>
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Time allowed: 2 hours

**Instructions**

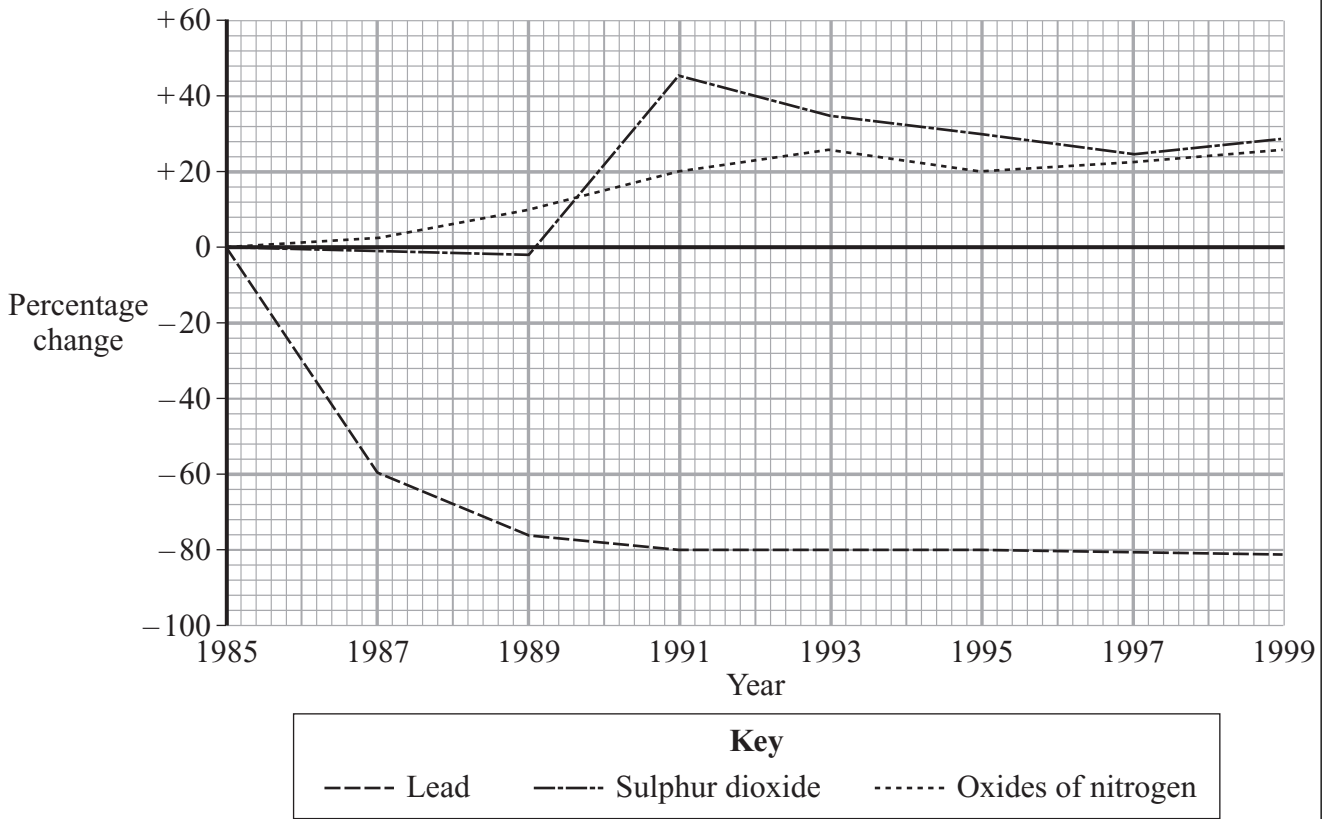
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

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

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

- 1 (a) The graph shows the changes in the amounts of some pollutants released into the atmosphere between 1985 and 1999.



(i) By how much did the amount of lead released change between 1985 and 1989?  
 .....  
 (1 mark)

(ii) Over which **two** year period did the amount of sulphur dioxide released decrease by 10%?  
 between ..... and .....  
 (1 mark)

(iii) The graph does **not** give a completely accurate picture of air pollution.  
 Suggest **two** reasons for this.  
 1.....  
 .....  
 2.....  
 .....  
 (2 marks)

(iv) Between 1985 and 1993 there was a continuous increase in energy use.

Suggest **two** reasons for this increase.

1.....

.....

2.....

.....

(2 marks)

(b) Name **two** gases that may contribute to global warming.

1.....

2.....

(2 marks)

(c) Explain how chlorofluorocarbons (CFCs) can increase the chance of getting skin cancer.

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.....

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(2 marks)

<b>10</b>

**Turn over for the next question**

**Turn over ►**

- 2 (a) The table shows how bacteria are affected by temperature.

Temperature in °C	Effect on bacteria
-30 to -5 Temperature of freezer	Bacteria alive but unable to reproduce
0 to 5 Temperature of refrigerator	Bacteria reproduce very slowly
10 to 18	Bacteria reproduce slowly
20 to 45	Bacteria grow and reproduce rapidly
60 to 110	Most bacteria killed
111 to 140	Bacterial spores killed

- (i) Pasteurised milk is made by heating the milk to 72 °C for 15 seconds and then immediately cooling it to 10 °C.  
Sterilised milk is made by heating the milk to 133 °C.

Explain why pasteurised milk does not stay fresh as long as sterilised milk.

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.....

(3 marks)

- (ii) A piece of frozen meat is defrosted at room temperature for 12 hours.

Explain why it is important to cook this meat thoroughly.

*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 words.*

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*(5 marks)*

- (b) A careless chef prepared cooked chicken on a work surface where raw chicken had also been prepared.

Explain why contamination of the cooked chicken is more dangerous than contamination of the raw chicken.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

*(4 marks)*

3 (a) What is cancer?

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

(b) Give **two** possible causes, other than cigarette smoking, of cancer.

1 .....

2 .....

(2 marks)

(c) Read the following account of a study of the relationship between smoking and lung cancer.

The study took place between 1951 and 2001 and involved 34 439 male British doctors. Information about their smoking habits was obtained in 1951 and at intervals after that.

The study revealed the following:

Men born between 1900 and 1930 who smoked only cigarettes and continued smoking died on average about 10 years earlier than lifelong non-smokers.

Stopping smoking increased life expectancy.

Stopping at age 30 increased life expectancy by 10 years.

Stopping at age 40 increased life expectancy by 9 years.

Stopping at age 50 increased life expectancy by 6 years.

Stopping at age 60 increased life expectancy by 3 years.

For men born between 1900 and 1909, the probability of dying in middle age (35 – 69) was 42 %. For men born in the 1920s, the probability of dying in middle age was 43 %.

(i) How many people took part in the study?

.....  
 (1 mark)

(ii) Of the men born between 1900 and 1930, how did the life expectancy of those who smoked only cigarettes and continued smoking compare with lifelong non-smokers?

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

(iii) By how much did life expectancy increase if a man gave up smoking:

aged 30; .....

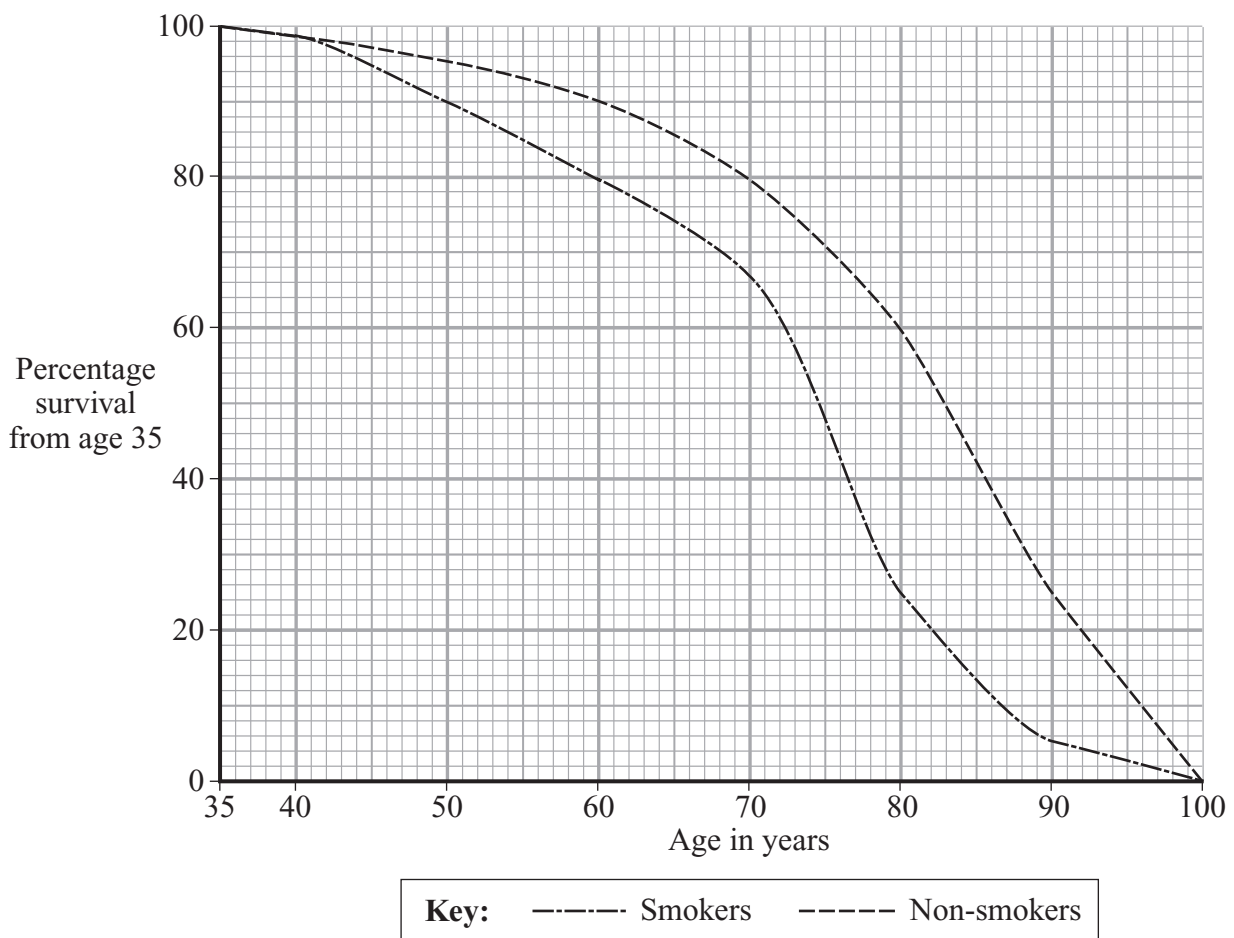
aged 50? .....

(2 marks)

(iv) What was the probability of a cigarette smoker, born in 1906, dying in middle age (35 – 69)?

.....  
(1 mark)

(d) The graph shows some of the data from the study.



(i) What was the difference in the percentage of smokers and non-smokers aged 35 who survived to reach 80 years of age?

.....  
(1 mark)

(ii) To what age did 90% of smokers aged 35 survive?

.....  
(1 mark)

4 (a) Name **two** parts of the digestive system where protease enzymes act.

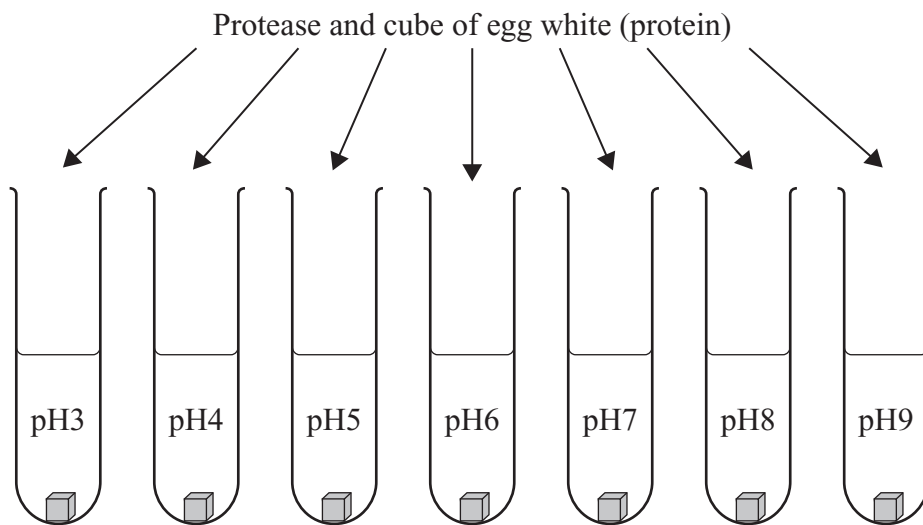
1 .....

2 .....

(2 marks)

(b) A student carried out an investigation to find the effect of pH on the activity of a protease enzyme.

The following apparatus was set up.



The table shows the results.

pH	3	4	5	6	7	8	9
Time for cube to dissolve in minutes	78	65	84	95	115	did not dissolve	did not dissolve

(i) What would be the most suitable temperature for this investigation?

.....  
(1 mark)

(ii) At what pH was the enzyme most active?

.....  
(1 mark)



(iii) Explain why the cube of egg white dissolved.

.....

.....

.....

.....

(2 marks)

<b>6</b>

**Turn over for the next question**

**Turn over ►**

5 (a) Give **two** ways in which the body makes use of energy.

1 .....

.....

2 .....

.....

(2 marks)

(b) (i) Energy is released by the process of respiration.

Complete this equation for respiration.



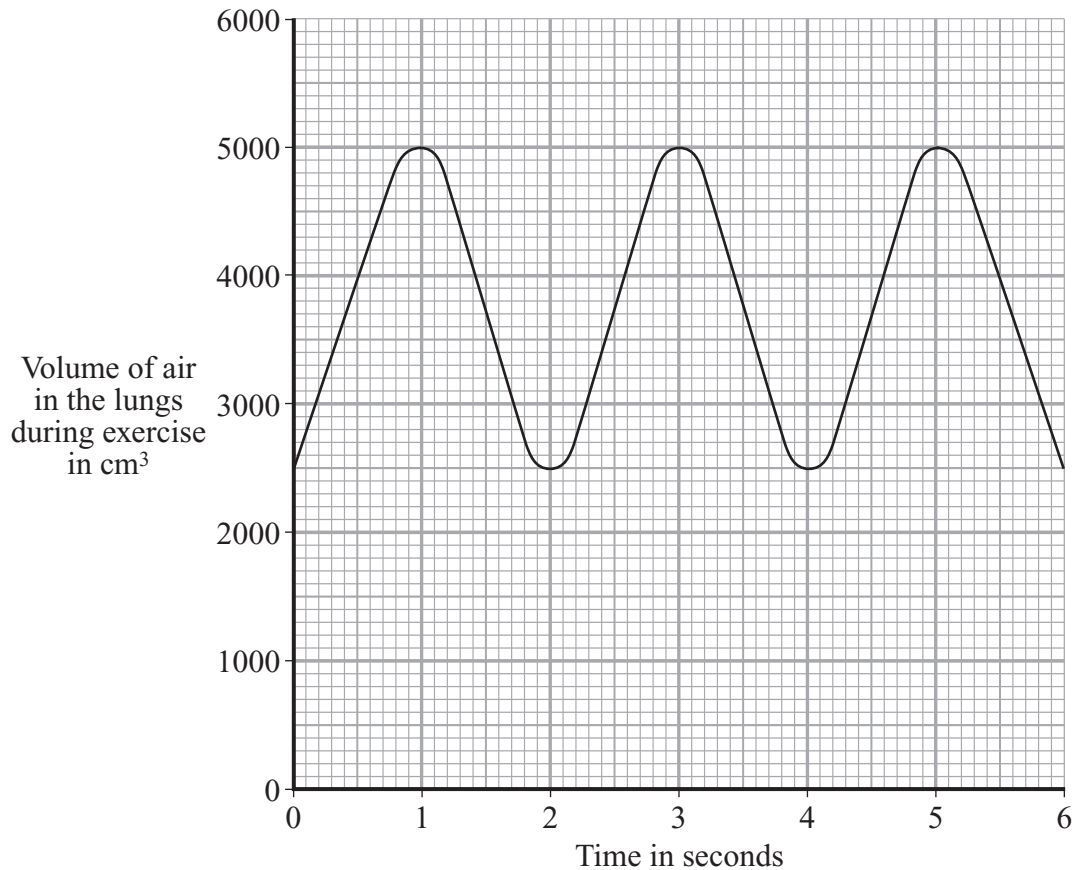
(2 marks)

(ii) In which part of the blood is carbon dioxide carried?

.....

(1 mark)

(c) The graph shows how the volume of air in the lungs changes during exercise.



- (i) What is the maximum change in the volume of air in the lungs during exercise?

.....  
(1 mark)

- (ii) Between which **two** times during the first **two** seconds is the person breathing in?

.....  
(1 mark)

- (iii) How many breaths per minute is the person taking?

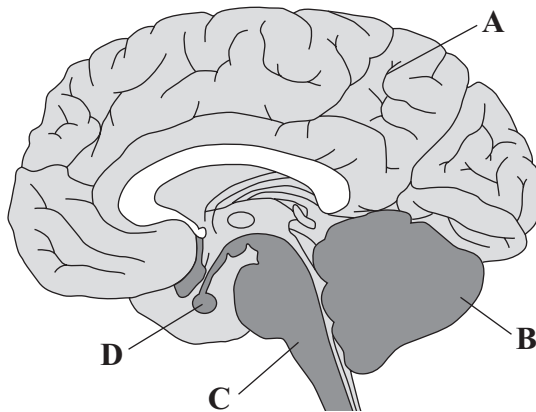
.....  
(1 mark)

8
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**Turn over for the next question**

**Turn over ►**

6 (a) The diagram shows a section of the brain.



(i) Name the parts labelled **A**, **B** and **D**.

**A** .....

**B** .....

**D** .....

*(3 marks)*

(ii) State the function of the part labelled **C**.

.....

.....

*(1 mark)*

(b) What is a reflex action?

.....

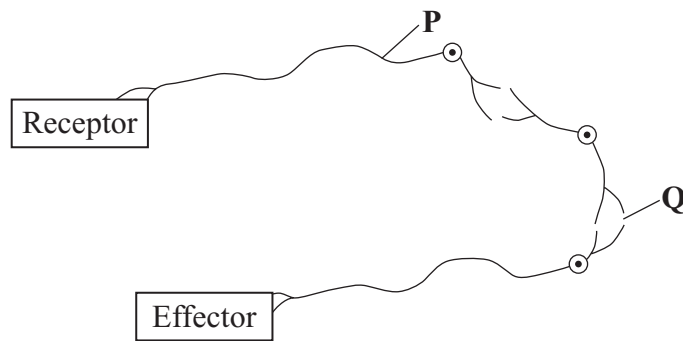
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*(2 marks)*

(c) The diagram shows the neurones involved in a reflex action.



(i) What type of neurone is labelled **P**?

.....  
(1 mark)

(ii) What is the name of the gap labelled **Q**?

.....  
(1 mark)

(iii) Name **one** type of effector.

.....  
(1 mark)

9
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**Turn over for the next question**

**Turn over ►**

7 (a) In which parts of the body are eggs and sperm produced?

Eggs .....

Sperm.....

(2 marks)

(b) The table shows some of the stages in the production of *in vitro* (test tube) babies.

	<b>In vitro</b>
<b>Stage 1</b>	Parents produce eggs and sperm
<b>Stage 2</b>	Eggs and sperm collected from parents
<b>Stage 3</b>	Fertilisation takes place in a culture medium
<b>Stage 4</b>	Zygote forms in culture medium
<b>Stage 5</b>	Embryo removed from culture medium
<b>Stage 6</b>	Embryo implanted in uterus

(i) Suggest **two** features that the culture medium must have if the production of test tube babies is to be successful.

1.....  
.....

2.....  
.....

(2 marks)

(ii) An essential part of **Stage 1** is stimulating the mother to produce several eggs.

Suggest a reason for this.

.....  
.....

(1 mark)

8 (a) (i) What type of cell division produces new body cells?

.....  
(1 mark)

(ii) What type of cell division produces egg and sperm cells?

.....  
(1 mark)

(b) Describe the structure of DNA.

.....  
.....  
.....  
.....  
.....  
.....  
(3 marks)

(c) (i) What is a mutation?

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

(ii) State **two** possible causes of mutations.

1.....  
.....  
2.....  
.....  
(2 marks)

(iii) Some mutations may be beneficial.

Suggest **one** example of this.

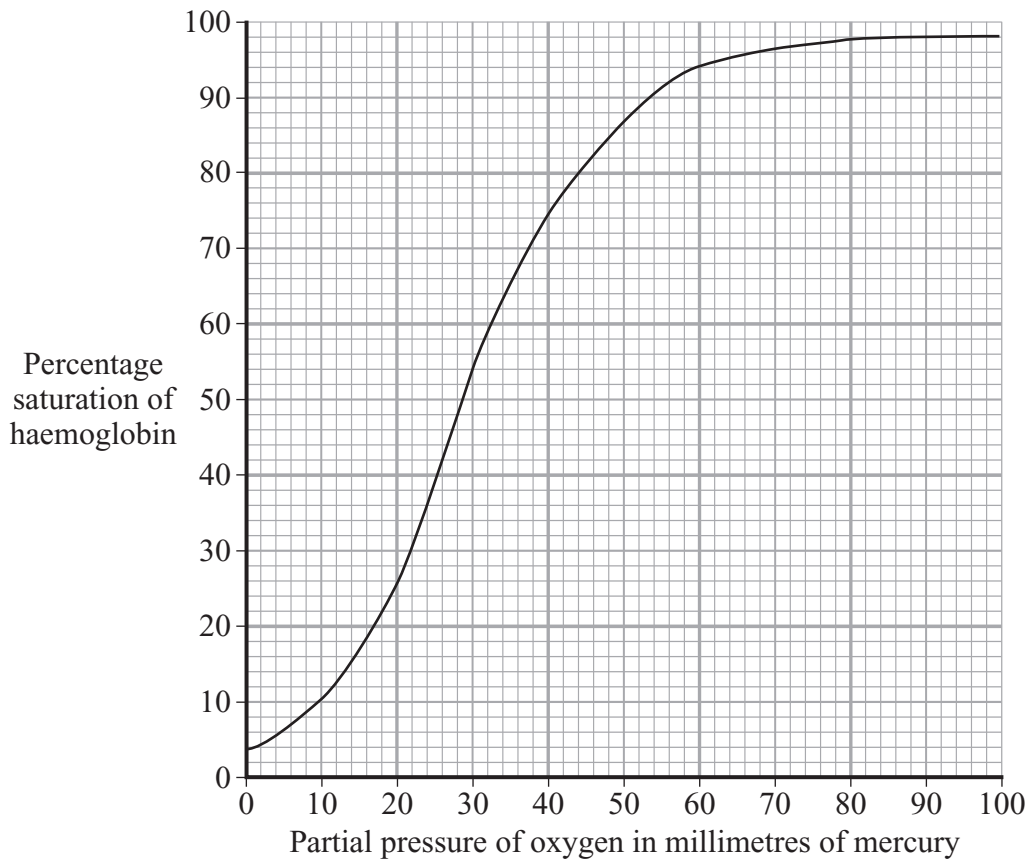
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(1 mark)

9 (a) Where in the blood is haemoglobin found?

.....  
.....

(1 mark)

(b) The graph shows the changes in the percentage saturation of haemoglobin in the blood (the amount of haemoglobin able to combine with oxygen) in varying oxygen concentrations.



(i) The partial pressure of oxygen in the lungs is 95 millimetres of mercury.

What is the percentage saturation of haemoglobin in the blood in the lungs?

.....  
(1 mark)

(ii) The percentage saturation of haemoglobin in the blood leaving the muscle cells is 16%.

What is the partial pressure of oxygen in the blood leaving the muscle cells?

.....  
(1 mark)



(iii) Why is the percentage saturation of haemoglobin in the renal vein only 16%?

.....  
 .....

(1 mark)

(iv) What happens to haemoglobin in the lungs?

.....  
 .....

(2 marks)

(c) (i) What is an antigen?

.....  
 .....

(1 mark)

(ii) Complete the blood group compatibility table.

Blood group	Antigens	Antibodies	Can give blood to group	Can receive blood from group
AB	A and B	None		AB, A, B, O
A		b	A and AB	A and O
B	B	a	B and AB	B and O
O	None	a and b	AB, A, B, O	

(3 marks)

10
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**Turn over for the next question**

**Turn over ►**

**10** (a) Name **three** waste materials released by the liver.

- 1 .....
- 2 .....
- 3 .....

(3 marks)

(b) Explain how the kidneys regulate the water content of the blood.

*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 words.*

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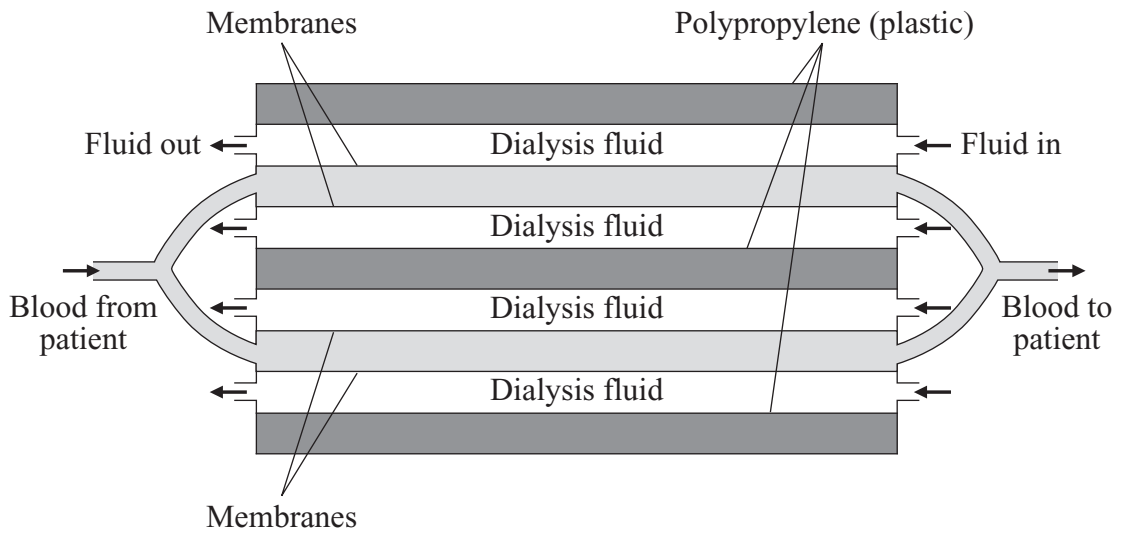
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(6 marks)

(c) The diagram shows a kidney dialysis machine.



(i) State **one** property of the membranes used in the dialysis machine.

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.....  
(1 mark)

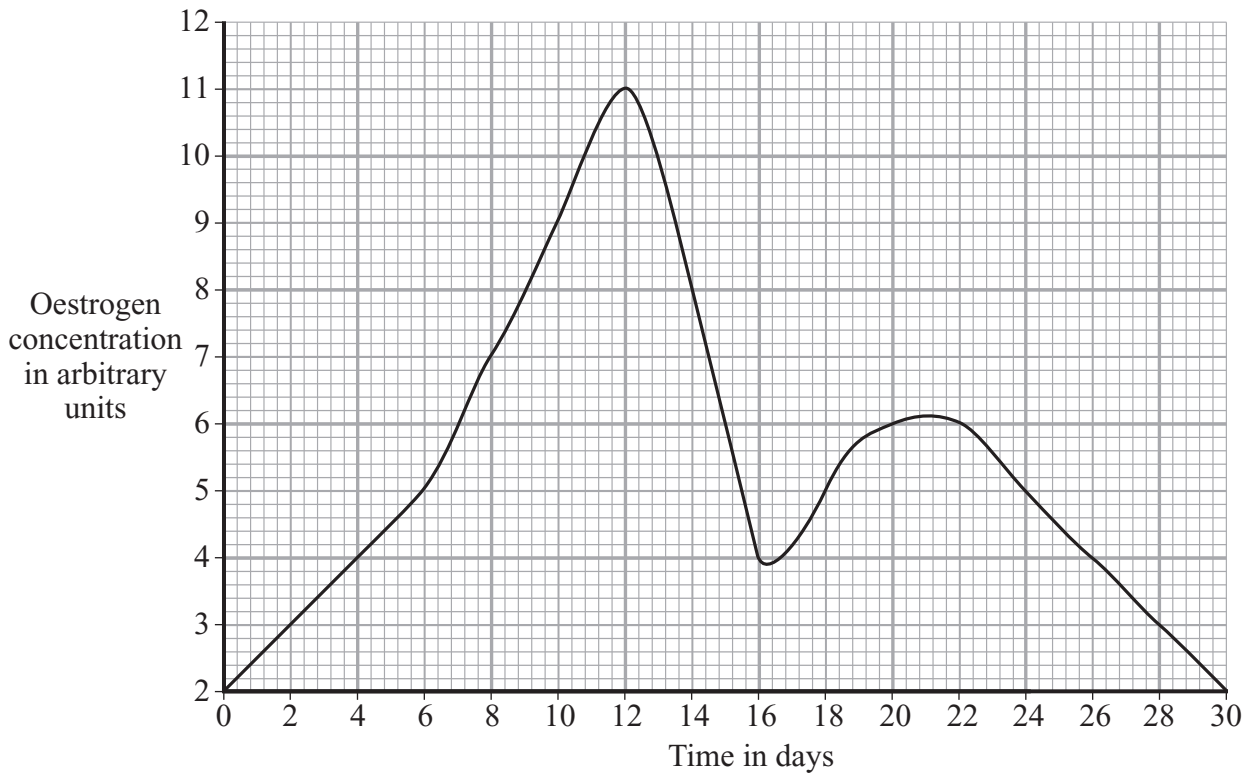
(ii) How is the blood leaving the dialysis machine different from the blood entering the dialysis machine?

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.....  
.....  
.....  
(3 marks)

Turn over for the next question

Turn over ►

11 (a) The graph shows the oestrogen concentration in the blood over a period of 30 days.



(i) What was the rate of decrease in oestrogen concentration between day 22 and day 30?

.....  
(1 mark)

(ii) On the graph, sketch a line to show the approximate concentration of progesterone over the 30 days. (3 marks)

(iii) Describe the changes in the uterus which would be taking place between:

day 0 and day 5;

.....  
.....

day 6 and day 12.

.....  
.....  
(2 marks)

(b) (i) Where and when is gonadotrophin produced?

.....  
.....  
.....  
.....

(2 marks)

(ii) What is the function of gonadotrophin?

.....  
.....  
.....

(1 mark)

(c) Explain how reproductive hormones can be used in controlling fertility.

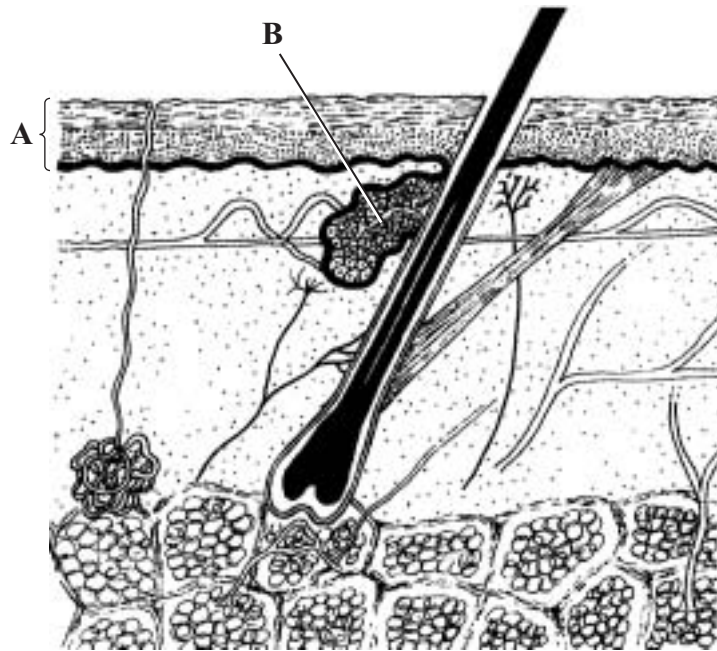
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(4 marks)

**Turn over for the next question**

**Turn over ►**

12 The diagram shows a section through the skin.



(a) (i) Explain how parts **A** and **B** act as protective structures.

**A**.....

.....

.....

.....

**B**.....

.....

.....

.....

(4 marks)

(ii) Explain how the skin acts as a receptor organ.

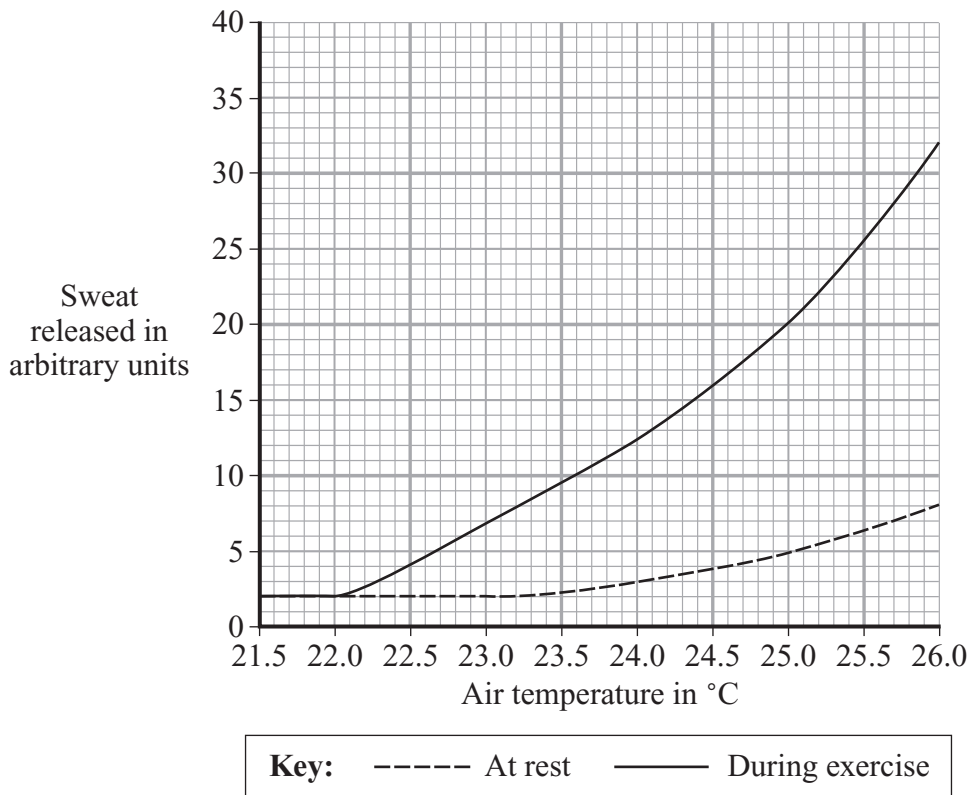
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(2 marks)

- (b) The graph shows the amounts of sweat released from the body when at rest and during exercise at different air temperatures.



- (i) How many units of sweat are released when at rest at an air temperature of 24°C?

.....  
(1 mark)

- (ii) What is the difference between the amounts of sweat released when at rest and during exercise at an air temperature of 25.5°C?

.....  
(1 mark)

- (iii) What is the relationship between air temperature and the amounts of sweat released when at rest and during exercise?

.....  
.....  
.....  
.....  
(2 marks)

**Question 12 continues on the next page**

**Turn over ►**

(iv) When the air temperature rises, the core body temperature stays the same.

Explain how the core body temperature is kept constant.

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(5 marks)

15
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**END OF QUESTIONS**

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS AND PUBLISHERS

Question 3 Source: adapted from R DOLL et al, British Medical Journal, June 2004

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