Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
TOTAL	

General Certificate of Secondary Education
Higher Tier
Specimen Paper

Human Health & Physiology 44151H

Date: XXXX

H

For this paper you must have:
- a ruler

You may use a calculator.

Time allowed
- 2 hours

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.
- You are expected to use a calculator where appropriate.
- In some questions you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

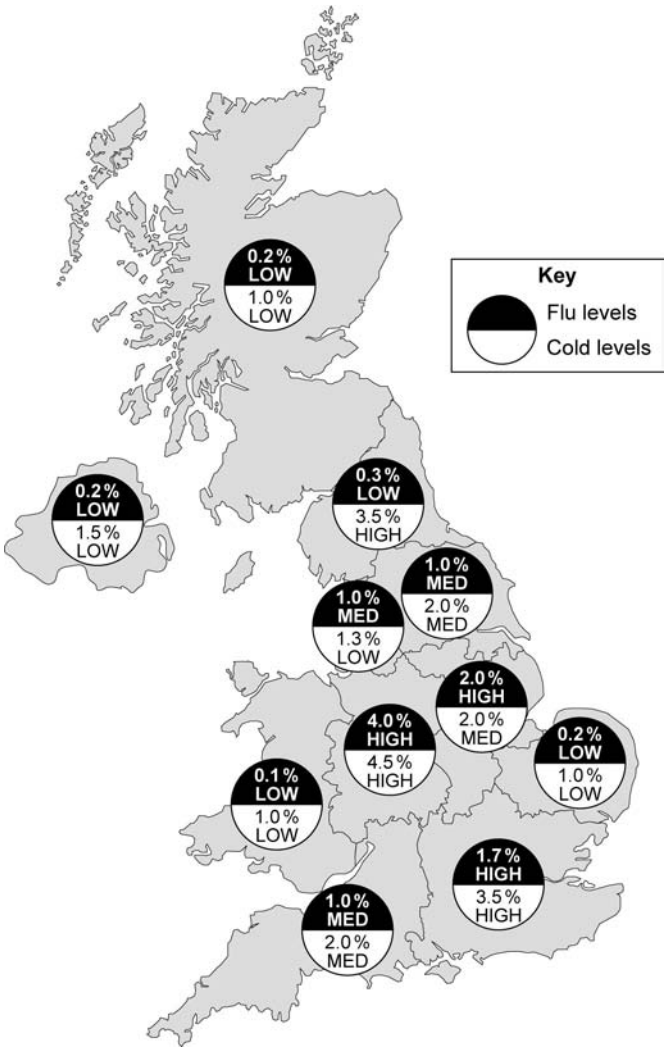
Advice
- In all calculations, show clearly how you work out your answer.

Areas outside the box will not be scanned for marking

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

1 The Health Protection Agency (HPA) collects information to identify outbreaks of infectious diseases.

The drawing shows the percentage of people who were affected by colds and flu in different parts of the UK in November 2007.



Barcode

1 (a) What was the highest percentage of people suffering from colds?

.....%
(1 mark)

1 (b) (i) Suggest how the HPA collected the data shown on the map.

.....

.....

.....
(1 mark)

1 (b) (ii) The highest percentages of people with colds or flu were found in cities.

Suggest and explain a reason for this.

.....

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.....
(2 marks)

Question 1 continues on the next page

1 (c) The diagram shows two methods which are used to give humans protection against infectious disease.
Method A can be used against polio. **Method B** is often used against tetanus.

Method A – Active immunity

Person receives small dose of weakened polio virus (antigen)

↓

Virus multiplies slowly in body

↓

Antibodies made

↓

Person given second dose of weakened virus, after a time more antibodies are made

Method B – Passive immunity

Tetanus bacteria (antigen) injected into another animal

↓

Antibodies made

↓

Blood removed from animal, used to produce a serum with antibodies

↓

Serum injected into person infected with tetanus

↓

Tetanus antibodies are soon broken down by the liver

1 (c) (i) Name the substances produced by the body which destroy harmful viruses and bacteria.

.....

(1 mark)

1 (c) (ii) Explain why **Method A** gives long lasting protection against polio.
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

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(4 marks)

Barcode

1 (c) (iii) Why does **Method B not** give long lasting protection against tetanus?

.....

.....

(1 mark)

1 (c) (iv) In immunisation against polio a second dose of the weakened virus is given, this is known as a booster.

Suggest why this booster is necessary.

.....

.....

(1 mark)

1 (c) (v) **Method A** would **not** be helpful for a person who had just been infected with tetanus bacteria.

Explain the reason for this.

.....

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.....

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(2 marks)

1 (c) (vi) Why is **Method B** very good for dealing quickly with an infection of tetanus?

.....

.....

(1 mark)

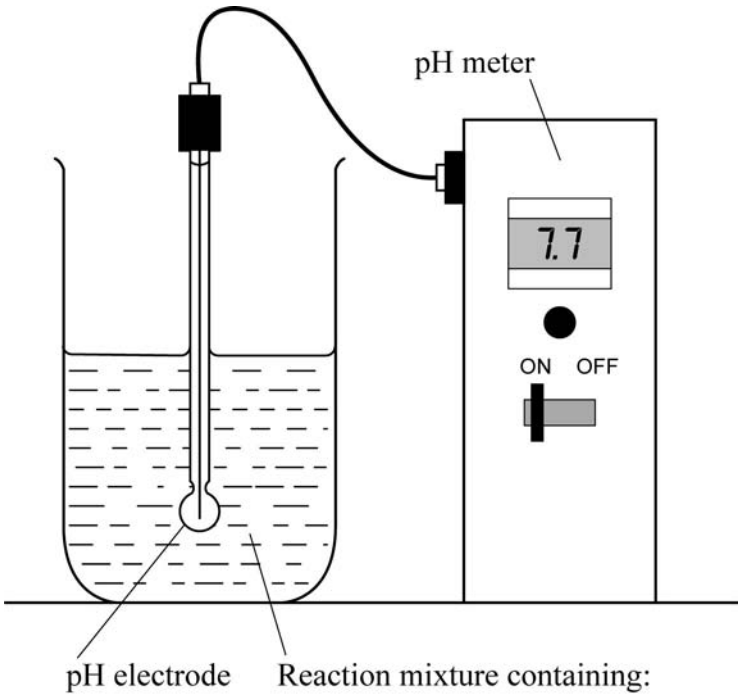
14

2 The diagram shows the apparatus used to investigate the digestion of milk fat by an enzyme. The reaction mixture contained milk, sodium carbonate solution (an alkali) and the enzyme. The pH meter was attached to a data recorder.

In Experiment **1**, bile was also added.

In Experiment **2**, an equal volume of water replaced the bile.

In each experiment, the pH was recorded at 2-minute intervals.



Experiment 1	**Experiment 2**
10 cm^3 milk (contains fat)	10 cm^3 milk (contains fat)
2 cm^3 sodium carbonate solution	2 cm^3 sodium carbonate solution
1cm^3 bile	1 cm^3 water
1 cm^3 enzyme	1 cm^3 enzyme

2 (a) (i) Name the dependent variable in this investigation.

.....

(1 mark)

2 (a) (ii) Name **two** control variables in this investigation.

1 .....

2 .....

(2 marks)

2 The results of the two experiments are given in the table.

Time in minutes	pH	
	Experiment 1: with bile	**Experiment 2: no bile**
0	9.0	9.0
2	8.8	9.0
4	8.7	9.0
6	8.1	8.8
8	7.7	8.6
10	7.6	8.2

2 (b) Milk fat is a type of lipid.

Name the enzyme which catalyses the breakdown of lipids.

.....

(1 mark)

2 (c) What was produced in each experiment to cause the fall in pH?

.....

(1 mark)

2 (d) (i) For Experiment **1**, calculate the average rate of fall in pH per minute, between 4 minutes and 8 minutes.

Show clearly how you work out your answer.

.....

.....

.....pH units per minute

(2 marks)

Question 2 continues on the next page

2 (d) (ii) Why was the fall in pH faster when bile was present?

.....

.....

(1 mark)

2 (e) Suggest **two** reasons why it is better to use a pH meter attached to a data recorder rather than pH paper in this investigation.

1 .....

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2 .....

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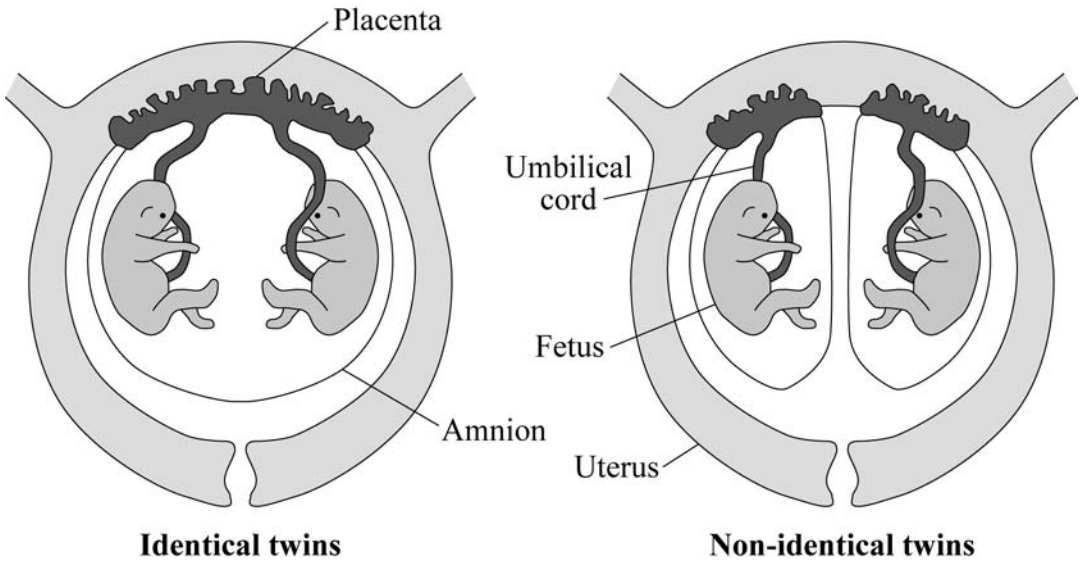
(2 marks)

10

Barcode

3 A fetus develops in its mother's uterus.

3 (a) The diagrams show identical and non identical twins developing in the uterus.



Using the information in the diagrams, give **two** ways in which the development of non-identical twins is different from that of identical twins.

1 .....

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2 .....

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(2 marks)

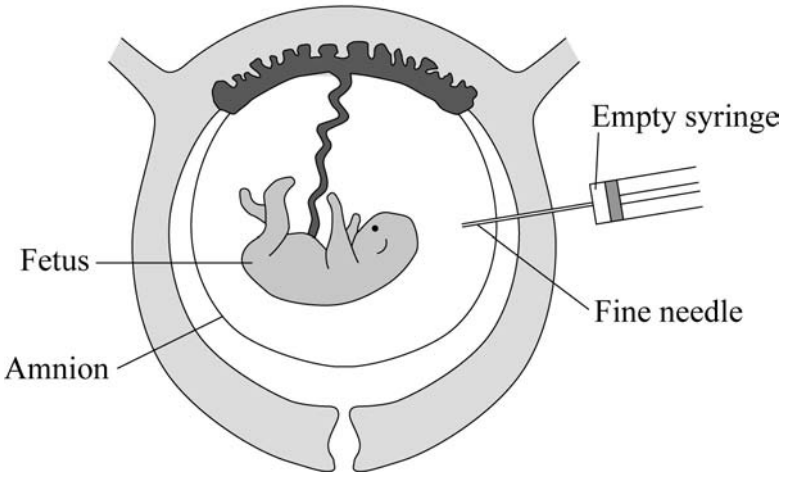
Question 3 continues on the next page

3 (b) To identify certain medical conditions, cells of the fetus may be examined before birth.

The photograph shows an obstetrician obtaining fetal cells.

The diagram shows how the fetal cells are obtained.

It is important that the obstetrician does not allow the syringe needle to touch the fetus.



3 (b) (i) Suggest how this method allows the obstetrician to obtain cells of the fetus.

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(1 mark)

Barcode

3 (b) (ii) Suggest arguments for and against the screening of a fetus for a medical condition.

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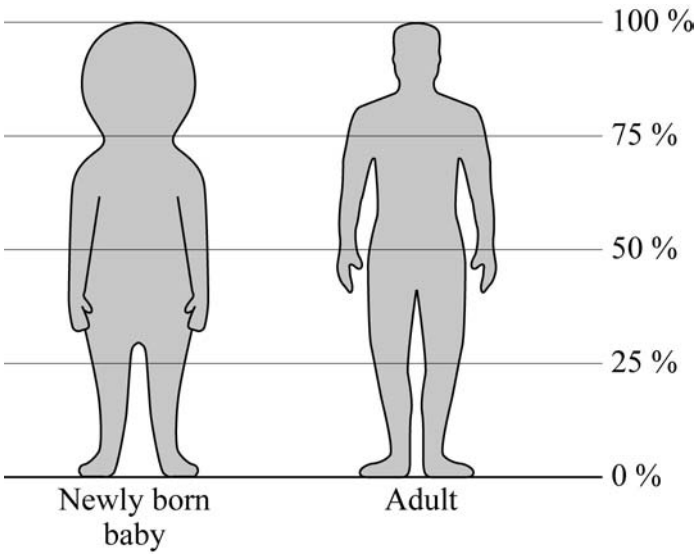
(4 marks)

7

4 The diagram shows the relative sizes of different parts of the body of a newly born baby and of an adult.



4 (a) In the newly born baby, about what proportion of the body consists of the head?

.....

(1 mark)

4 (b) In the adult, about what proportion of the body consists of the head?

.....

(1 mark)

4 (c) What happens to the relative rate of growth of the head and of the legs as a person grows up?

.....

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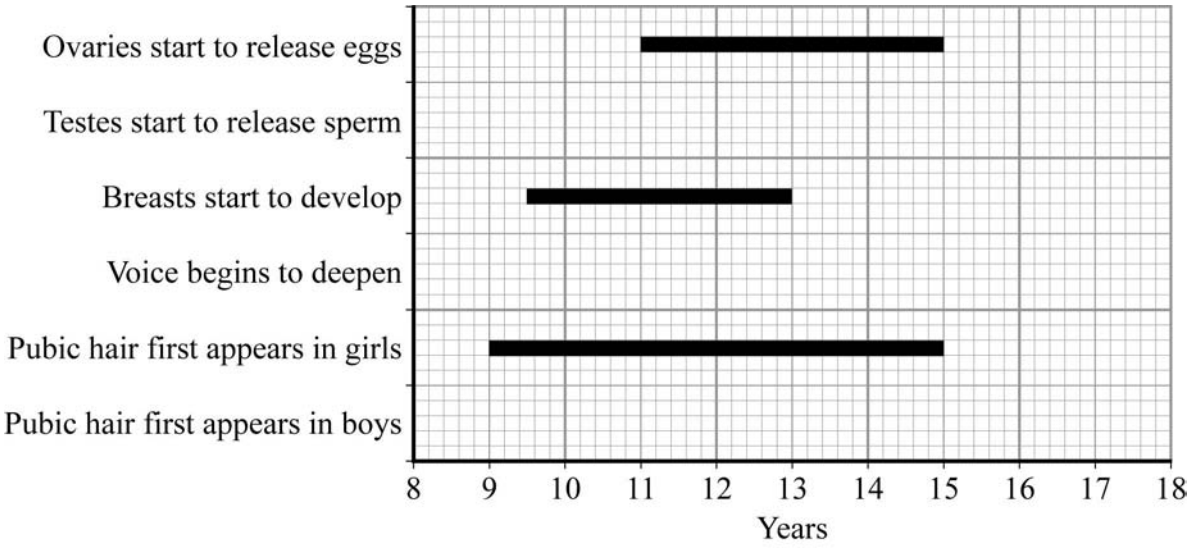
(2 marks)

Barcode

4 (d) The changes that occur in adolescence were studied in a group of girls and in a group of boys.

The chart shows the age when some of these changes take place in girls.



The table gives information on the age when some changes take place in boys.

	Earliest age (years)	**Latest age (years)**
Testes start to produce sperm	12	16.5
Voice begins to deepen	14	17.6
Pubic hair first appears	11	15

4 (d) (i) Add the information given in the table to the chart.

(3 marks)

4 (d) (ii) Use the data to give **one** general conclusion about the different timing of puberty in boys and girls.

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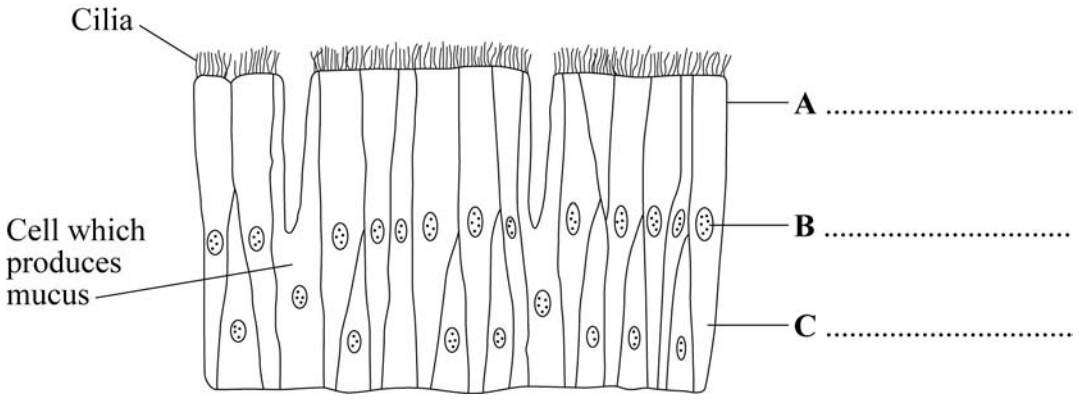
(1 mark)

8

Areas outside the box will not be scanned for marking

5 The diagram shows a group of cells from the airways of the lungs.



5 (a) On the diagram, name the parts labelled **A**, **B** and **C**.

(3 marks)

5 (b) What is the function in the airways of

5 (b) (i) mucus

.....

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(1 mark)

5 (b) (ii) cilia?

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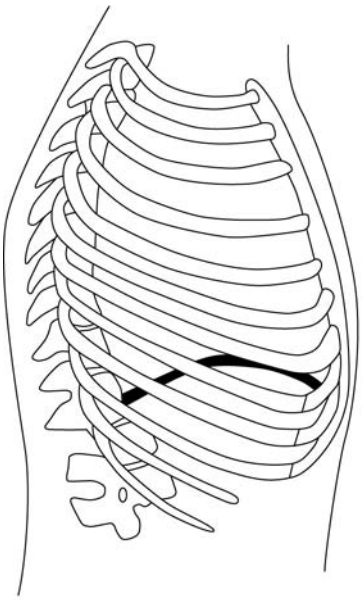
(2 marks)

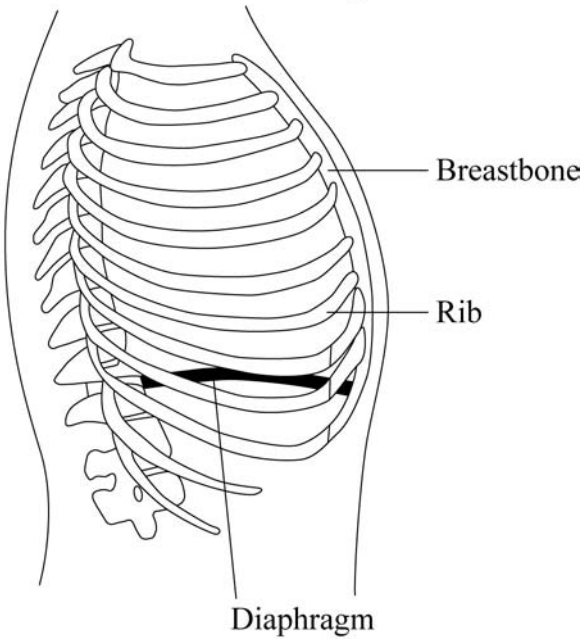
Barcode

5 (c) The drawings show the position of the ribs and diaphragm before and after inhaling.

A Postion before inhaling



B Postion after inhaling



Explain how the change in the position of the ribs and diaphragm during inhaling causes air to enter the lungs.

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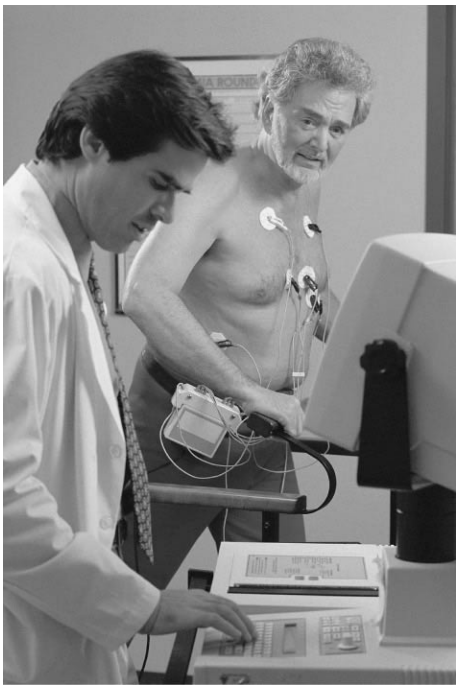
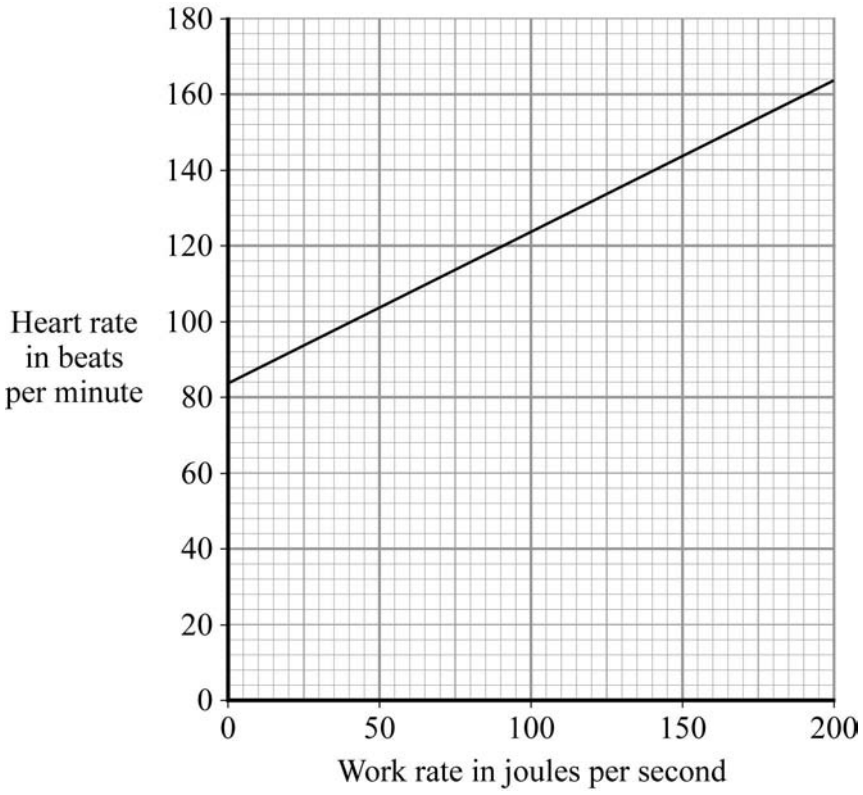
(3 marks)

9

6 The photograph shows a technician monitoring the effect of exercise on a patient's heart. The data obtained enables a cardiologist to diagnose heart disease.



6 (a) The graph shows how work rate affected the patient's heart rate.



Barcode

6 (a) (i) Use information from the graph to describe the relationship between the work rate and heart rate.

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(2 marks)

6 (a) (ii) Explain, as fully as you can, how changes in the patient's heart rate are an advantage to his body.

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(4 marks)

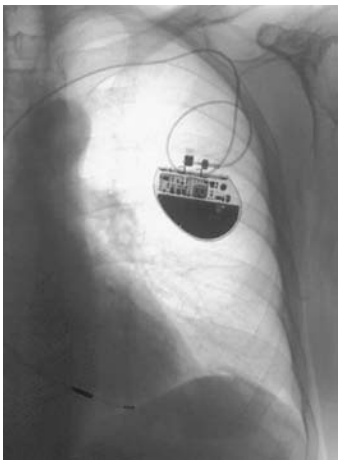
Question 6 continues on the next page

6 (b) Patients with an irregular heartbeat may be fitted with a pacemaker.
Photograph **1** shows an early type of pacemaker strapped to the patients arm.

Photograph **2** shows an X-ray photograph of a modern pacemaker. This pacemaker is inserted under the skin of the thorax and has leads that are embedded in to the heart.

Photograph 1

Photograph 2



6 (b) Suggest advantages and disadvantages of the modern pacemaker compared with the early type of pacemaker.

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(4 marks)

10

Barcode

7 A person may feel pains in the chest when they do something strenuous.

7 (a) Complete the sentences.

These chest pains are called .....

The pains are caused because the..... muscle in the

heart is short of ..... .

(3 marks)

Cardiologists study the function and disorders of the heart.

7 (b) (i) They have found that, if there is too much cholesterol in the blood, it can be deposited on the walls of blood vessels. This makes the blood vessels narrower.

What is the name of this condition?

.....

(1 mark)

7 (b) (ii) Complete the sentence.

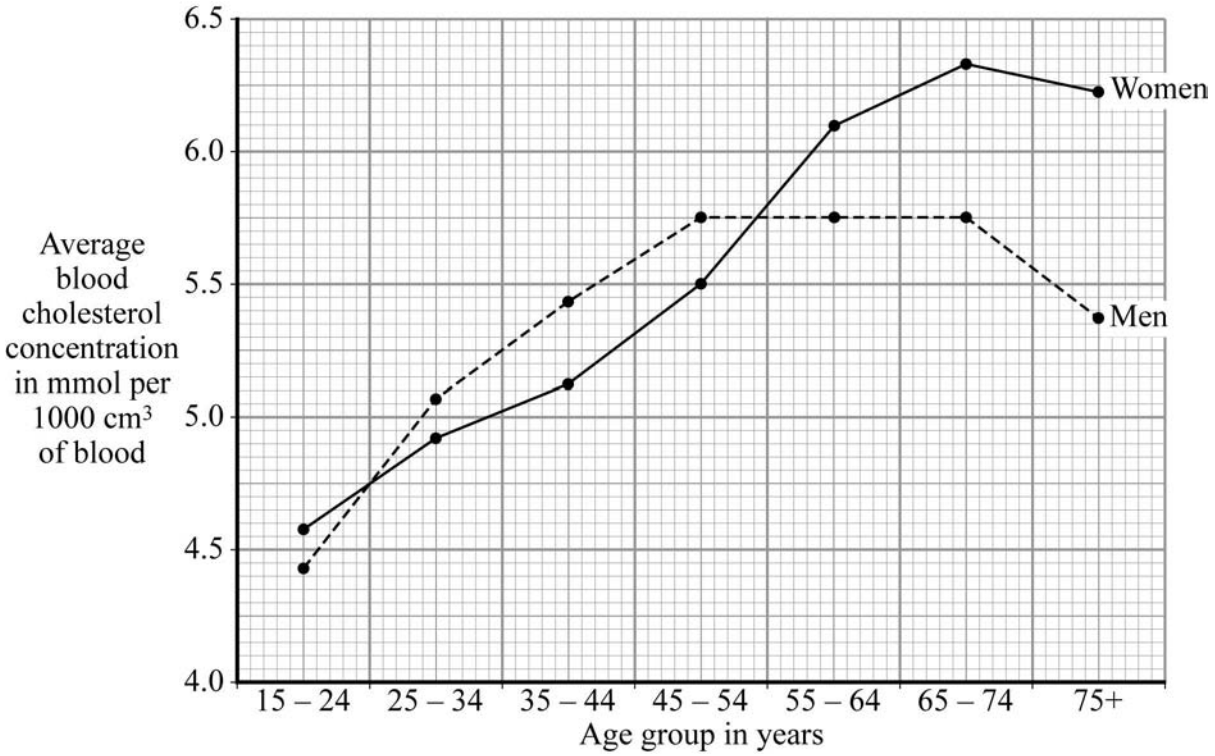
The layer of cholesterol may have been caused by a diet containing a lot of

foods rich in ..... .

(1 mark)

Question 7 continues on the next page

7 (c) The graph shows the average blood cholesterol in various age groups of men and women.



7 (c) (i) The data for the graph was obtained by measuring the blood of a large number of people to find the average blood cholesterol for the different age groups.

Why were a large number of people used?

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(1 mark)

7 (c) (ii) A man aged 62 has a son aged 33. The son looks at the graph and says to his father, 'My blood cholesterol concentration must be less than yours'.

Why is the son wrong?

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(1 mark)

Barcode

7 (c) (iii) From information in the graph, state which group shows the greatest risk of heart attack.

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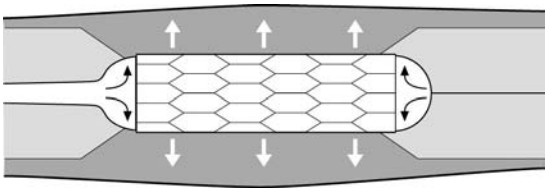
(1 mark)

7 (d) Cardiologists use a technique called angioplasty to widen a narrowed or totally-obstructed blood vessel. A balloon catheter is moved into or near the blockage. The balloon is inflated to place a device called a stent at the site of the blockage. The balloon is deflated and the catheter removed.



Suggest how angioplasty benefits a patient.

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(2 marks)

10

8 Read the following passage which is from an advice book for diabetics.

Insulin Reactions

Hypoglycaemia or 'hypo' for short, occurs when there is too little sugar in the blood.

It is important always to carry some form of sugar with you and to take it immediately you feel a 'hypo' start. A hypo may start because:

- you have taken too much insulin, or
- you are late for a meal, have missed a meal altogether, have eaten too little at a meal, or
- you have taken a lot more exercise than usual.

The remedy is to take some sugar.

Do not wait to see if it will pass off, as an untreated 'hypo' could lead to unconsciousness.

8 (a) (i) Many diabetics need to take insulin.

Explain why.

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(2 marks)

8 (a) (ii) Explain why there is too little sugar in the blood if too much insulin is taken.

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(2 marks)

8 (a) (iii) Explain why there is too little sugar in the blood if the person exercises more than usual.

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(2 marks)

8 (b) Suggest why sugar rather than a starchy food, is recommended for a 'hypo'.

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(2 marks)

Question 8 continues on the next page

8 (c) Explain, using insulin as an example, what is meant by negative feedback.

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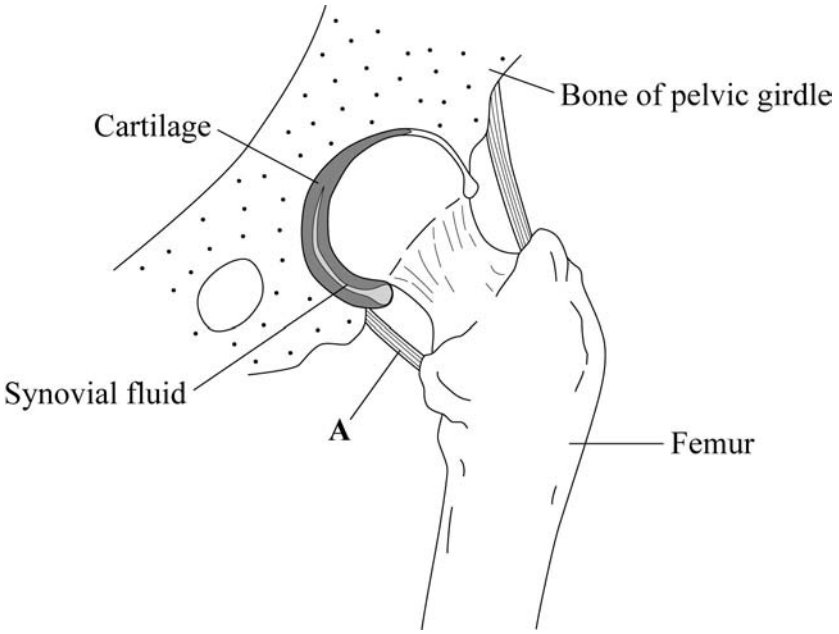
(3 marks)

11

Barcode

9 A patient has a damaged hip joint.

The diagram shows a section through the damaged hip joint. Hip joints are synovial joints.



9 (a) (i) Name the structure labelled **A**.

.....

(1 mark)

9 (a) (ii) The patient has difficulty moving.

Using evidence from the diagram, suggest **two** reasons why they find movement difficult.

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(2 marks)

Question 9 continues on the next page

9 (b) An orthopaedic surgeon replaces the damaged joint with an artificial joint. The person is then able to walk easily again.

9 (b) (i) The orthopaedic surgeon advises the patient to have a painkilling injection rather than a general anaesthetic for the operation.

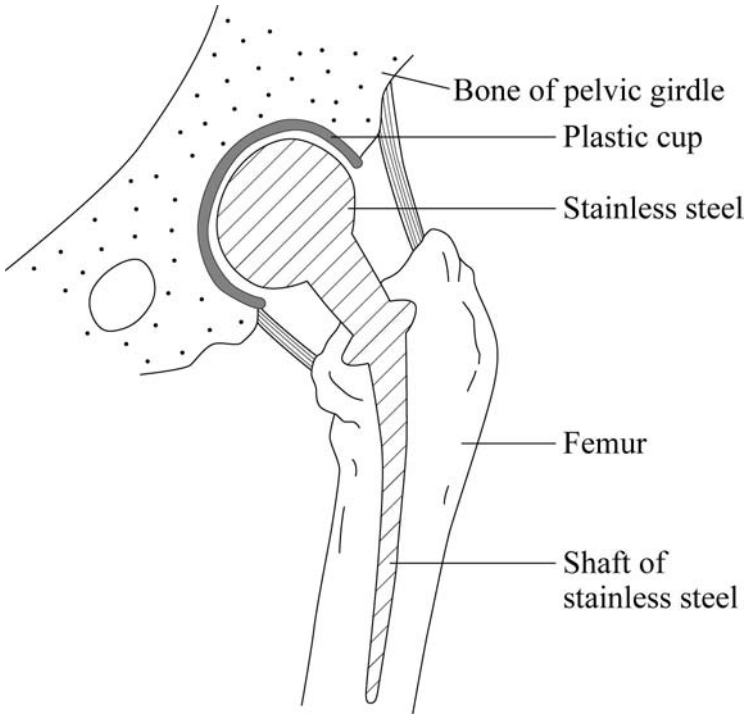
Suggest **two** reasons for this.

.....

.....

(2 marks)

The diagram shows an artificial joint in place.



Barcode

9 (b) (ii) Like cartilage, the surfaces of the new joint are very smooth.

Suggest and explain the advantage of this smoothness to the person with the artificial joint.

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(2 marks)

9 (c) A lack of protein in the diet can result in our bones becoming brittle.

Explain why.

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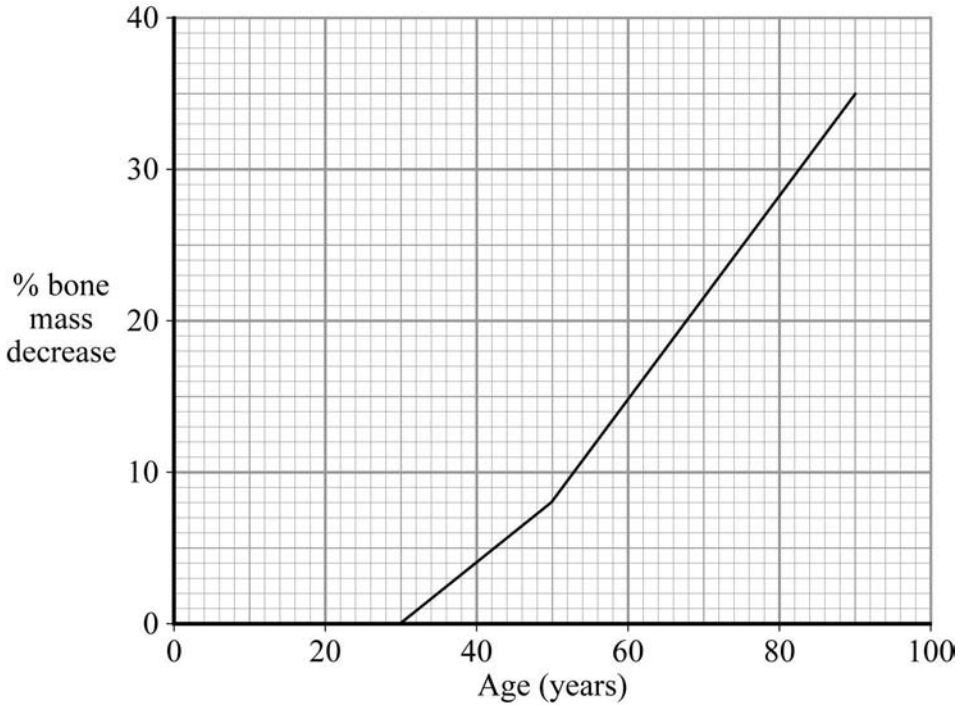
(2 marks)

Question 9 continues on the next page

9 (d) Doctors have found that peak bone mass occurs around the age of 30.

The graph shows the average percentage decrease in bone mass in women from the age of thirty to the age of ninety.



Describe and explain the shape of the graph.

In this question you will be assessed on using good English, organizing information clearly and using specialist terms where appropriate.

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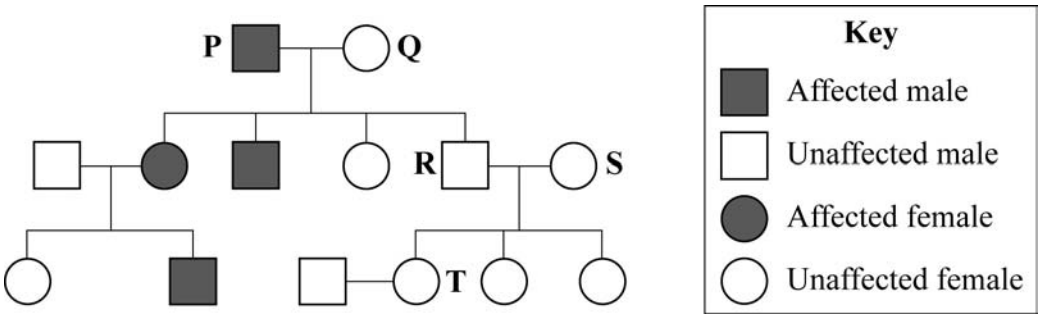
(4 marks)

Barcode

10 Huntington's disease is a rare inherited disorder of the nervous system.
It is caused by a dominant allele **H**.
The recessive allele of this gene is represented by **h**.

The diagram shows the inheritance of Huntington's disease in a family.



10 (a) Use a genetic diagram to show the inheritance of the Huntington's disease allele by the children of parents **P** and **Q**.

(3 marks)

10 (b) **T** and her partner are thinking about starting a family. What advice would a genetic counsellor give to them about the chance of their child having Huntington's disease?

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(2 marks)

5

11 In Vitro Fertilisation (IVF) can help some women become pregnant.

11 (a) A woman went to an IVF clinic for treatment. How would a doctor in the IVF clinic explain the reasons for the inclusion of each of the following stages in IVF treatment to her?

11 (a) (i) The woman is given an injection of follicle-stimulating hormone (FSH) shortly after menstruation.

.....

.....

(1 mark)

11 (a) (ii) She is also given an injection of luteinizing hormone (LH).

.....

.....

(1 mark)

11 (a) (iii) Several eggs are then removed from her body.

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(1 mark)

11 (a) (iv) The eggs are placed in a solution very similar in composition to the fluid inside the female reproductive tract before the sperm are added to them.

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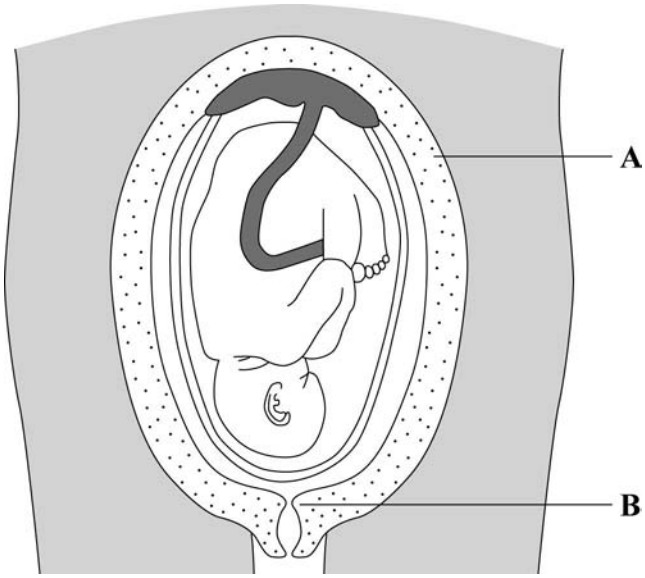
(1 mark)

11 (b) The woman became pregnant after the first round of IVF treatment. The diagram shows a fetus in the uterus shortly before birth.



Describe the roles of structures **A**, and **B** during the birth process.

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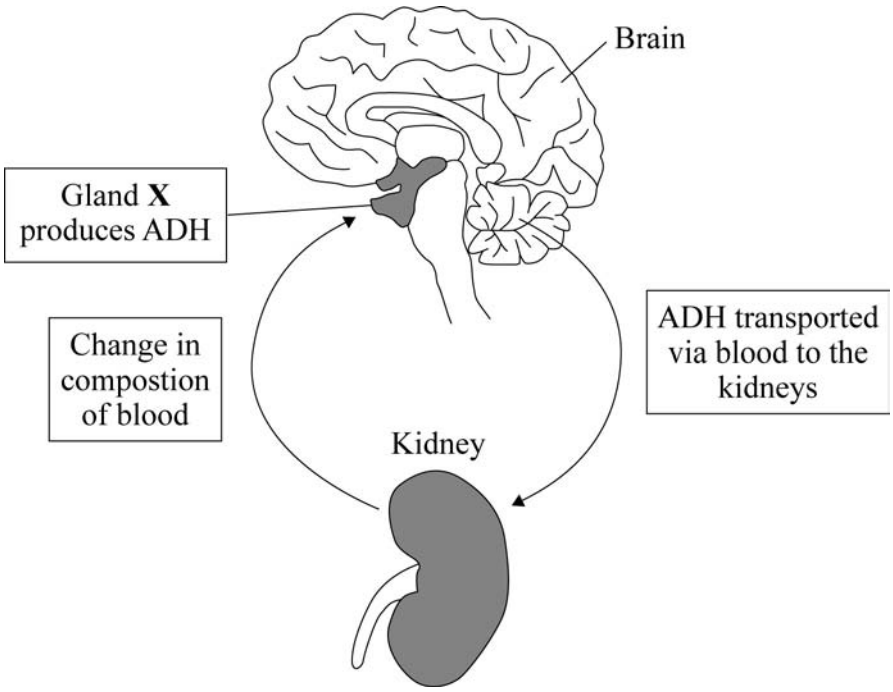
(3 marks)

7

12 The diagram shows some of the processes which control the composition of blood.



12 (a) (i) Name gland **X**.....

(1 mark)

12 (a) (ii) What is the stimulus which causes gland **X** to produce ADH?

.....

.....

(1 mark)

Barcode

12 (a) (iii) What type of substance is ADH?

.....

(1 mark)

12 (b) Explain the effect of an increase in ADH production on the kidney and on the composition of the urine.

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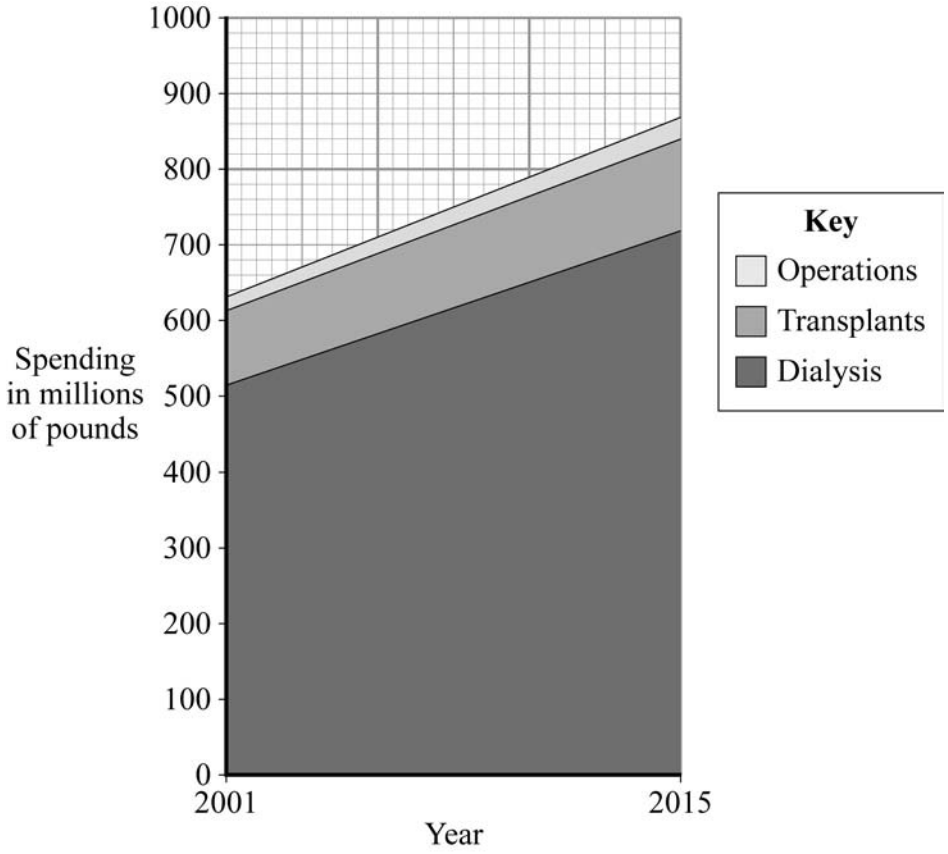
(3 marks)

Question 12 continues on the next page

12 (c) Scientists in the NHS are studying the future cost of kidney failure to the country. The graph shows the projected spending on treatment of kidney failure until 2015.

It does not include changes due to inflation.



12 (c) (i) Suggest **one** explanation for the increase in spending on treatment of kidney failure between 2001 and 2015.

.....

.....

(1 mark)

Barcode

12 (c) (ii) Between 2001 and 2015, the cost of treating one patient by dialysis is much greater than treating the same patient by transplant.

Explain why.

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(2 marks)

12 (c) (iii) The spending on transplants is not expected to change very much between 2001 and 2015.

Suggest **one** explanation for this.

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(1 mark)

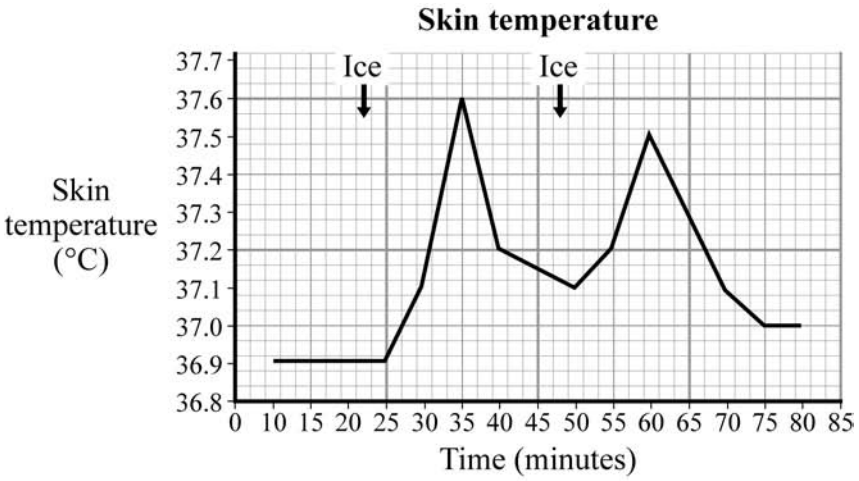
10

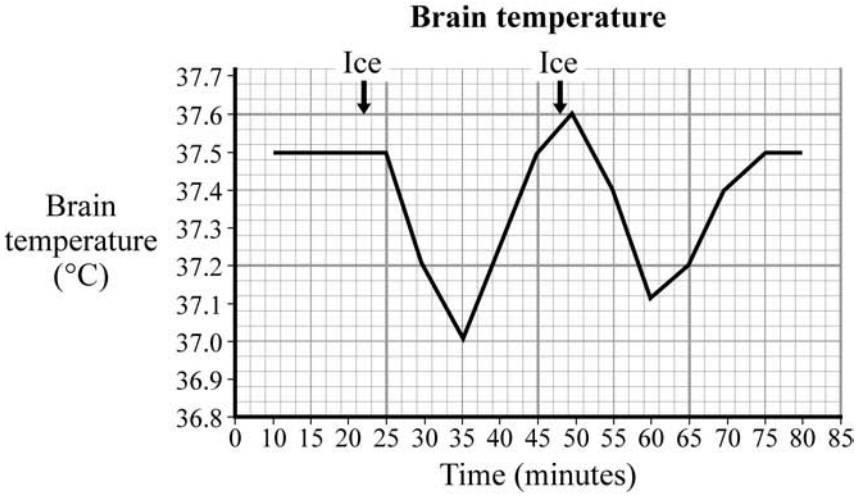
Turn over for the next question

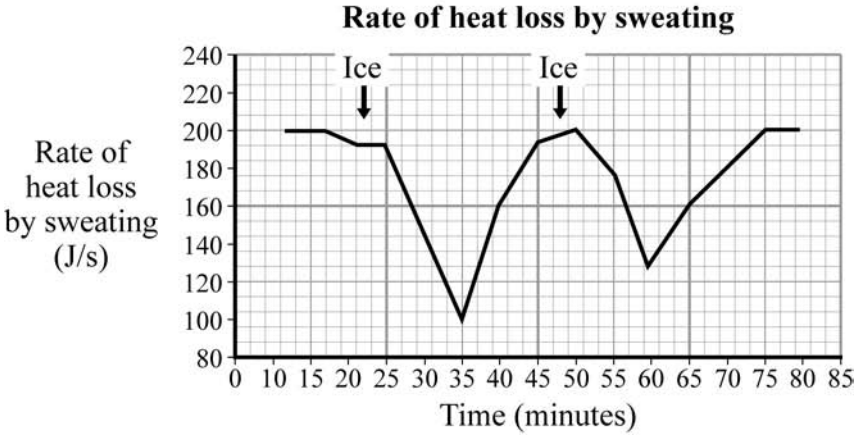
13 Scientists carried out an investigation into the control of sweating in humans.

The subject was placed in a chamber where the temperature was maintained at 45ºC.

The subject swallowed ice at the times indicated on the graphs.







Barcode

13 Explain, as fully as you can, why the subject's skin temperature, brain temperature and rate of heat loss by sweating were affected in the way shown by the graphs.

Skin temperature

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Brain temperature

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Rate of heat loss by sweating

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6

END OF QUESTIONS

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Question 3 Amniocentesis sampling with needle and ultrasound, Saturn Stills / Science Photo Library

Question 6 Doctor giving mature man a stress test, Jupiter Images

Question 6b Patient with Pacemaker © ER Productions/CORBIS

X-Ray Showing Pacemaker by Charles O'Rear, Jupiter Images

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