Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Secondary Education
Higher Tier
June 2012

Human Health and Physiology 44151H

Unit 1 Topics in Human Health and Physiology

Monday 25 June 2012 9.00 am to 11.00 am

For this paper you must have:
- a ruler
- 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. Do not write outside the box around each page or on blank pages.
- 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 your ability to use good English, organise information clearly and use the correct scientific words.

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

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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

1 Pathogens cause diseases.

1 (a) Give **one** example of a disease:

1 (a) (i) caused by a virus

.....

(1 mark)

1 (a) (ii) caused by a bacterium

.....

(1 mark)

1 (a) (iii) caused by a fungus

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(1 mark)

1 (a) (iv) caused by a protoctistan.

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(1 mark)

1 (b) Describe **two** ways in which the body prevents the entry of pathogens.

1 .....

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2 .....

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(2 marks)

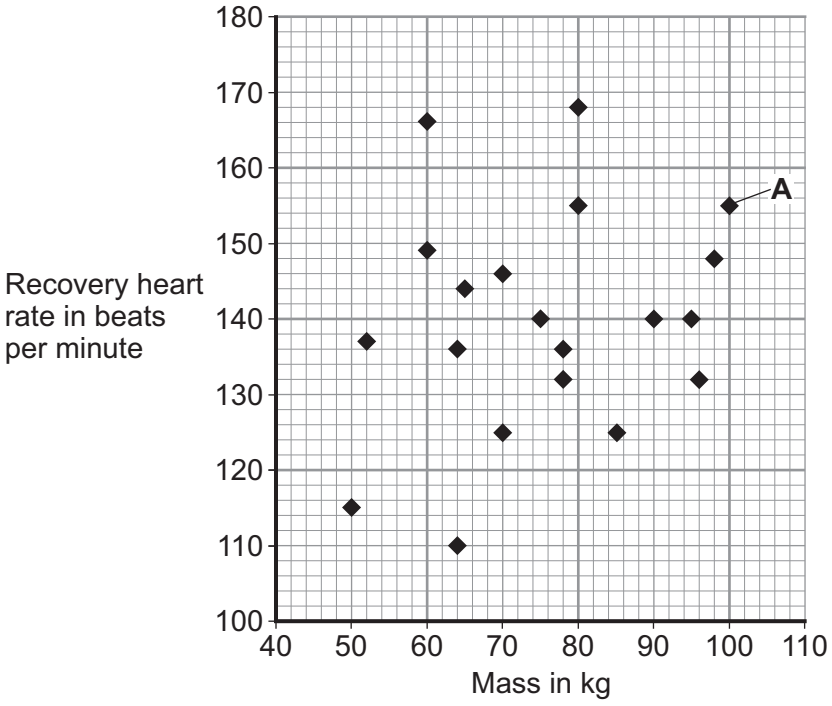
6

Turn over for the next question

2 Most colleges have a student health adviser. An adviser was concerned about the fitness of students in one class. She persuaded the students to take part in a fitness investigation.

- The students weighed themselves.
- Each student did 20 step-ups per minute for 5 minutes.
- The students then waited 1 minute before measuring their heart rates. The heart rate 1 minute after exercise is called the recovery heart rate.

The graph shows the students' results.



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

1 .....

2 .....

(2 marks)

2 (b) Name the type of graph that was used to present the students' data.

.....

(1 mark)

2 (c) **On the graph,** draw a ring around the plot for the fittest student. *(1 mark)*

2 (d) Give a conclusion to this investigation that can be drawn from the data in the graph.

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(1 mark)

2 (e) Give **two** factors, other than mass, that might have affected recovery heart rate.

1 .....

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2 .....

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(2 marks)

2 (f) Heart rate increases during exercise.
Explain the advantage of this increase in heart rate to a person.

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(3 marks)

2 (g) Give **two** recommendations that the health adviser might give to the student labelled **A** on the graph.

1 .....

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2 .....

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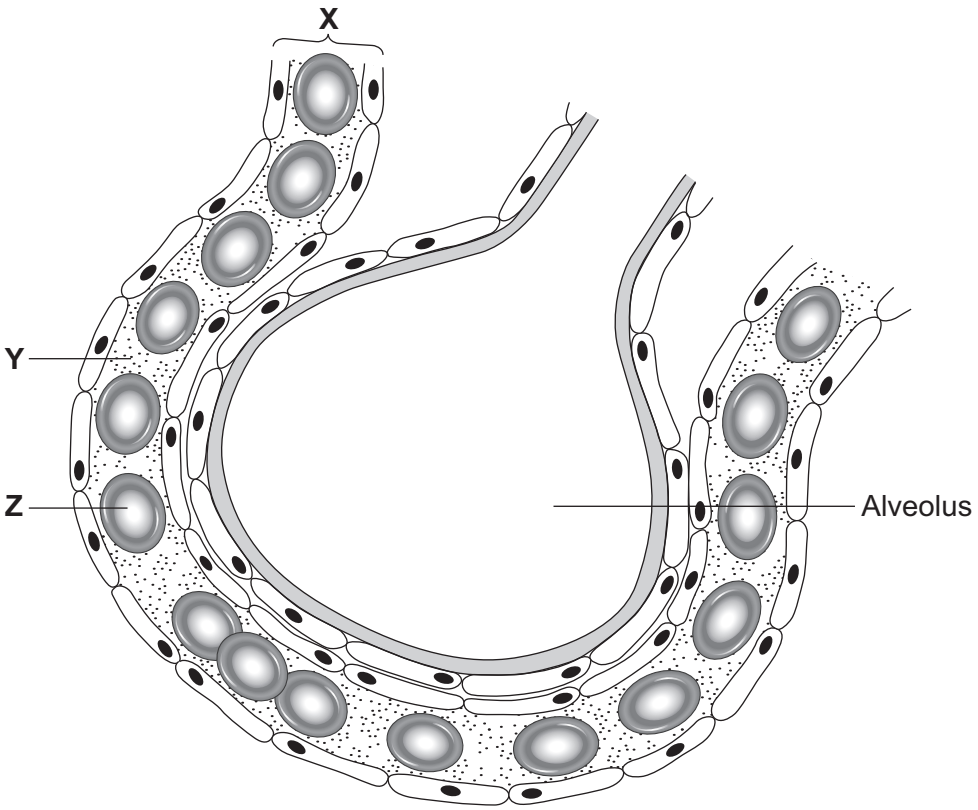
(2 marks)

12

3 Gaseous exchange takes place in the alveoli.

The diagram shows a section through an alveolus.



3 (a) Name the parts labelled **X**, **Y** and **Z** on the diagram.

X .....

Y .....

Z .....

(3 marks)

The table shows the percentage of some gases in the air breathed in and out by a boy.

Gases	Air breathed in	Air breathed out
carbon dioxide	0.04%	4.0%
oxygen	20.0%	16.0%

3 (b) Describe what happens in the lungs to change the levels of oxygen and carbon dioxide in this way.

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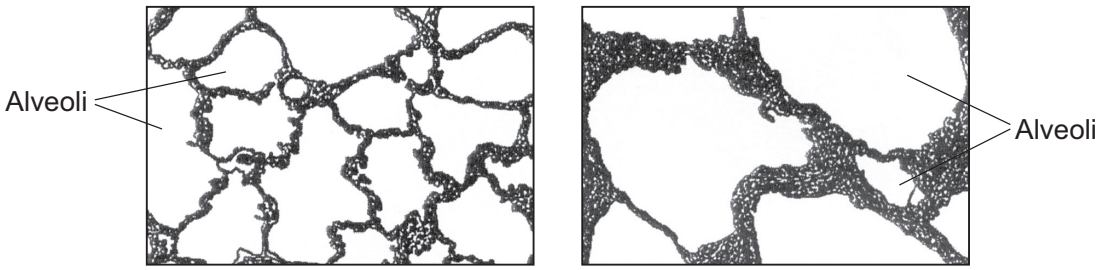
(3 marks)

The diagrams below show lung tissue from a healthy person and lung tissue from a person with emphysema (a lung disease). The diagrams are drawn to the same scale.



Lung tissue from a healthy person

Lung tissue from a person with emphysema

3 (c) Give **two** differences in structure between the lung tissue from the healthy person and the lung tissue from the person with emphysema.

1.....

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2.....

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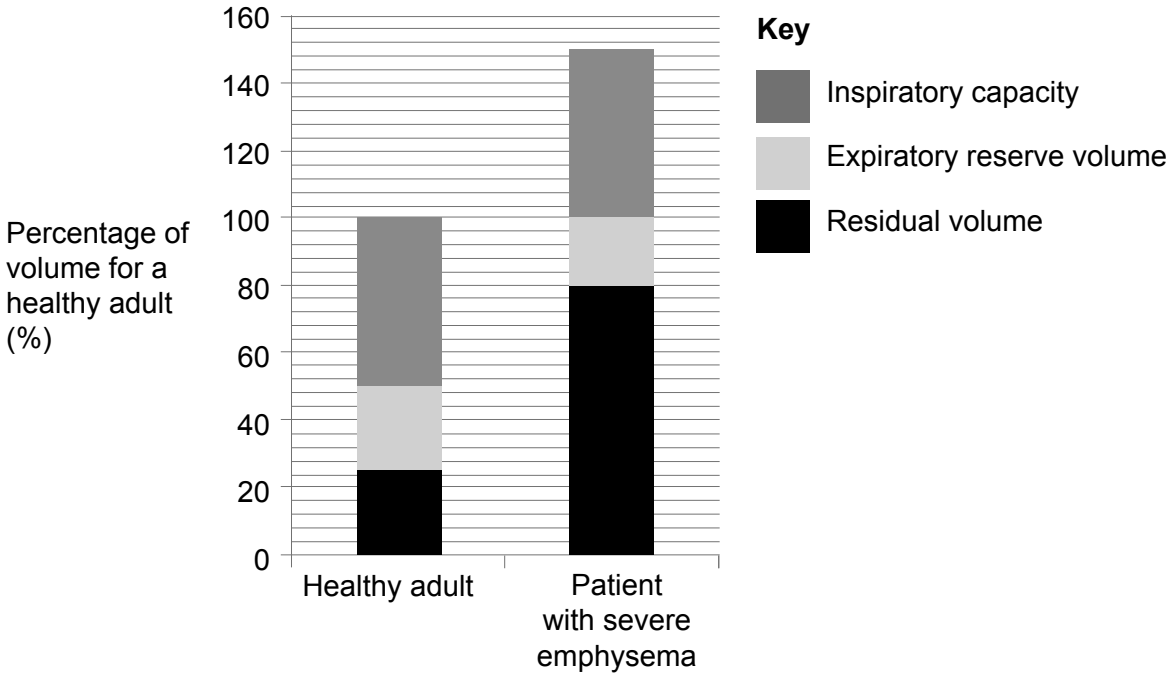
(2 marks)

Question 3 continues on the next page

3 (d) The photograph shows a technician using a spirometer to investigate lung function in a person with emphysema. The chart shows the effect of emphysema on breathing.



- Inspiratory capacity is the volume of air taken in during normal breathing.
- Expiratory reserve volume is the volume of additional air that can be pushed out after the end of normal breathing.
- Residual volume is the volume of air that is left in the lungs after forcing out as much air as possible.

3 (d) (i) Use information from the chart to give **two** effects of emphysema on breathing.

1 .....

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2 .....

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(2 marks)

3 (d) (ii) Patients with severe emphysema can only walk for a short distance before getting 'out of breath'.

Use information from the diagrams on page 7 and data from the chart to suggest an explanation for this shortage of breath.

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(2 marks)

12

Turn over for the next question

4 Back pain is estimated to cost the economy about £4.5 billion per year in the UK.

4 (a) Apart from the cost of treating back pain, suggest **one** other reason why the cost to the economy is so high.

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.....

(1 mark)

4 (b) Chiropractors and physiotherapists treat back pain in different ways.

4 (b) (i) How does a chiropractor treat back pain?

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(1 mark)

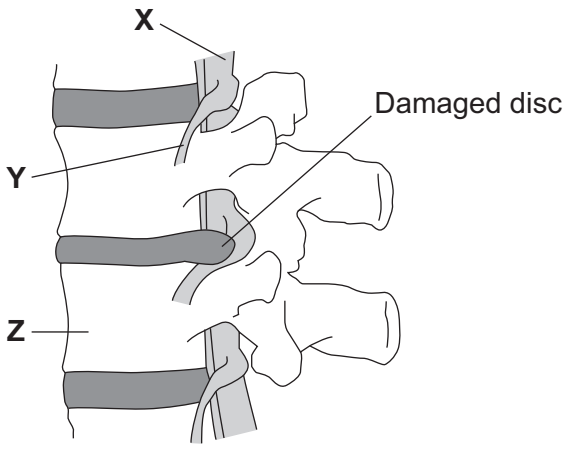
4 (b) (ii) How does a physiotherapist treat back pain?

.....

.....

(1 mark)

4 (c) The diagram shows a damaged disc in the spine.



4 (c) (i) Name the structures labelled **X, Y** and **Z** on the diagram.

X .....

Y .....

Z ..... *(3 marks)*

4 (c) (ii) The damaged disc causes severe pain.

Suggest **one** explanation for the severe pain.

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(1 mark)

7

Turn over for the next question

5 Jamie Oliver campaigns for healthy school meals.

The photograph shows Jamie with one of his healthy school meals.

5 (a) The meal in the photograph is meat curry, rice, salad and an orange.

Complete each sentence with **one** correct example of a nutrient.

5 (a) (i) Meat is a good source of ..... *(1 mark)*

5 (a) (ii) Rice is a good source of ..... *(1 mark)*

5 (a) (iii) The orange is a good source of ..... *(1 mark)*

5 (b) Give **one** function in the body of each of the following nutrients.

You should **not** give examples of preventing deficiency diseases.

5 (b) (i) Vitamin A

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.....

(1 mark)

5 (b) (ii) Vitamin C

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(1 mark)

5 (b) (iii) Iron

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(1 mark)

5 (b) (iv) Sodium ions

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(1 mark)

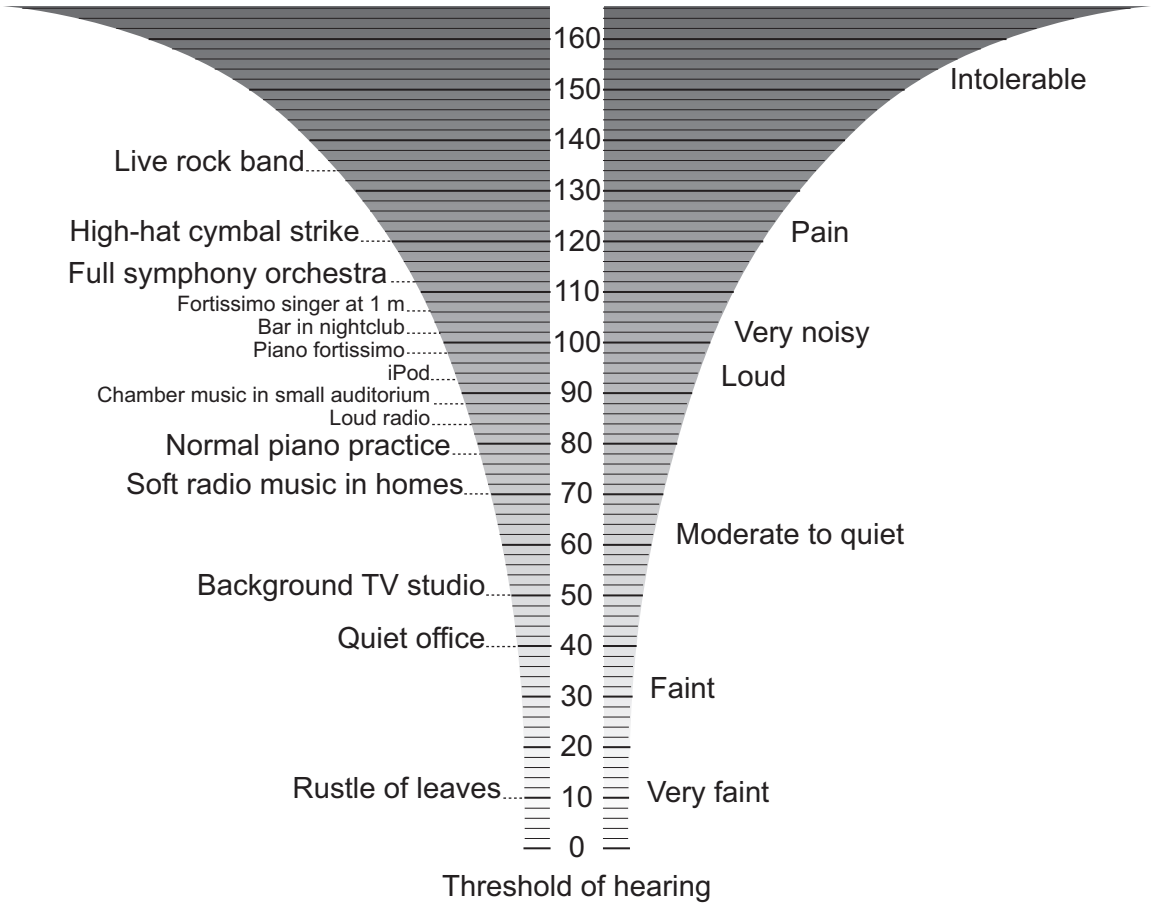
7

Turn over for the next question

6 People who work in the entertainment professions are at risk of damage to their hearing.

People who go to places of entertainment are also at risk.

The diagram shows approximate noise levels in the music industry measured in decibels (dB).



Use data from the diagram to:

6 (a) (i) give **one** example of a very noisy place of entertainment

.....

(1 mark)

6 (a) (ii) give the approximate number of decibels for a live rock band.

Answer .....dB

(1 mark)

6 (b) The amount of damage to hearing depends on the loudness of the sound and the length of time you are exposed to the sound.

The table below shows the relationship between noise level and safe exposure time per session.

Noise level in dB	Safe exposure time per session in hours
80	8.0
83	4.0
86	2.0
89	1.0
92	0.5

Describe fully the relationship between noise level and safe exposure time per session.

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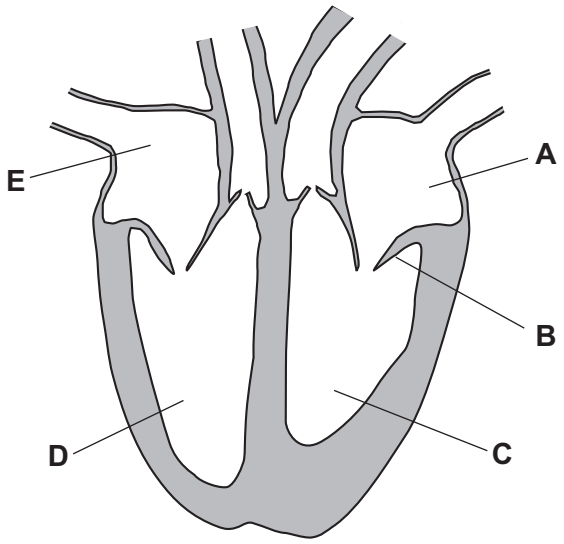
(2 marks)

4

Turn over for the next question

7 The diagram shows a section through the human heart.



7 (a) (i) Name the chambers labelled **A** and **D** on the diagram.

A .....

D .....

(2 marks)

7 (a) (ii) Which **two** of the chambers, **A, C, D** and **E**, contain deoxygenated blood?

☐ and ☐

(1 mark)

7 (a) (iii) Describe the function of the structure labelled **B** on the diagram.

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(2 marks)

7 (b) The photograph shows a technician using a monitor to check the activity of a patient's heart.

The monitor shows that the patient has had a heart attack.

7 (b) (i) Explain the link between a person's blood cholesterol level and the chances of a heart attack.

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(3 marks)

7 (b) (ii) A physiotherapist suggests to the patient that exercise will help to prevent a further heart attack.

Suggest **one** reason why exercise might be effective in helping to prevent a further heart attack.

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(1 mark)

9

There are no questions on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

8 Smallpox was a very common disease in the UK in the eighteenth century.

A country doctor called Edward Jenner discovered a way of protecting people from smallpox.

- He noticed that milkmaids often caught cowpox from cows.
- He also noticed that the milkmaids did not catch smallpox.
- Jenner had the idea that cowpox gave people protection against catching smallpox.
- To test his idea, he collected the pus from cowpox sores and injected it into a healthy boy.
- He then injected the boy with smallpox.
- The boy did not develop smallpox.

8 (a) Evaluate the issues involved in Jenner's method.
You should give arguments for, arguments against and a conclusion.

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(4 marks)

Question 8 continues on the next page

8 (b) Describe what is meant by:

8 (b) (i) natural immunity

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(1 mark)

8 (b) (ii) artificial immunity

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(1 mark)

8 (b) (iii) passive immunity.

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(1 mark)

8 (c) In drug trials, half of the volunteers are given a placebo (e.g. a tablet which does not contain the drug). Vaccines also have to be trialled.
HIV is a dangerous disease spread by sexual contact.
A new vaccine against HIV was trialled on 3000 volunteers.

The investigators found:

- 24 cases of HIV infection among the 741 volunteers who received one dose of the vaccine.
- This compared with 21 cases of HIV infection among the 762 volunteers who were vaccinated with a placebo.

- 19 cases of HIV infection among the 672 volunteers who received two doses of the vaccine.
- This compared with 11 cases of HIV infection among the 691 volunteers who received two doses of the placebo.

8 (c) (i) Suggest what was used as a placebo in this investigation.

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(1 mark)

8 (c) (ii) Did the design of the investigation give reliable results?

Draw a ring around your answer. Yes / No.

Give the reason for your answer.

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(1 mark)

8 (c) (iii) Based on the results, the investigators have stopped the trial.
Suggest **two** reasons for the investigators' decision.

1 .....

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2 .....

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(2 marks)

11

Turn over for the next question

9 The kidneys remove toxic compounds such as urea from the blood.

9 (a) Describe how urea is formed in the body.

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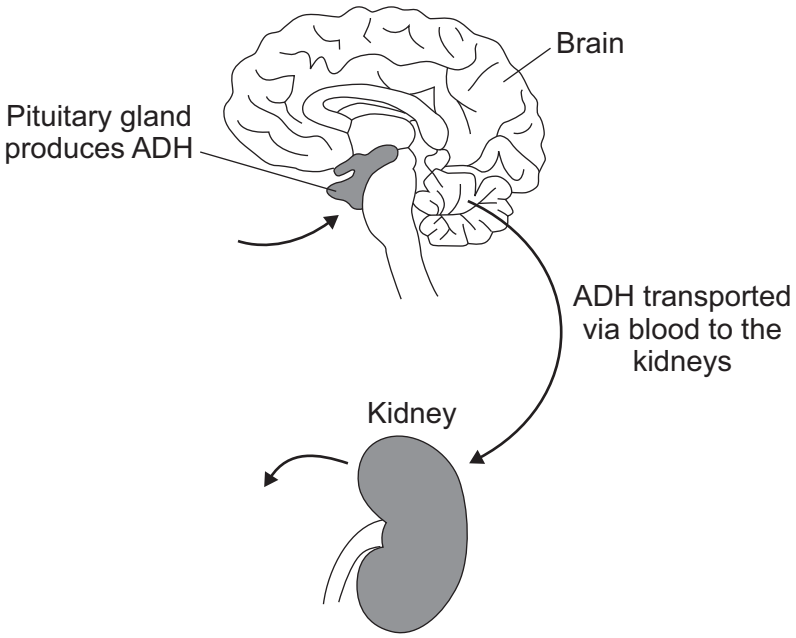
(3 marks)

9 (b) The diagram shows the role of the hormone ADH in the control of the volume and composition of urine.



9 (b) (i) What is the stimulus which causes the pituitary gland to produce ADH?

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(1 mark)

9 (b) (ii) 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)

9 (c) Kidney failure may be treated by dialysis.

The table shows the amounts of two substances in the blood of one patient before dialysis and after dialysis.

Substance	**Concentration in blood plasma in grams per dm^3**	
	Before dialysis	**After dialysis**
Urea	4.50	0.30
Sodium ions	2.88	3.00

Explain the reasons for the change in concentration of urea and sodium ions before and after dialysis.

Urea .....

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Sodium ions .....

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(4 marks)

Question 9 continues on the next page

9 (d) Kidney failure may be treated by peritoneal dialysis. There are two types of peritoneal dialysis, CPD (continuous peritoneal dialysis) and IPD (intermittent peritoneal dialysis).

CPD

- In CPD, about 2 litres of dialysis fluid is in the peritoneal cavity at any one time, so the blood is treated constantly.
- The fluid is changed four times a day at home and the peritoneal cavity is refilled with fresh dialysis fluid. This process takes about 45 minutes. Most people space the sessions throughout the day to suit themselves.

IPD

- IPD usually requires several trips to hospital and most patients need between 36 and 44 hours of IPD each week.
- In IPD, the dialysis fluid is left in the peritoneal cavity for a short time and then drained out. One complete treatment cycle takes about one hour. Each session requires several complete treatment cycles.
- The dialysis fluid in IPD is not changed as frequently as in CPD.

Which type of peritoneal dialysis do you think a doctor would advise for a young, active patient?

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Explain fully the reasons for your choice.

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(3 marks)

14

Turn over for the next question

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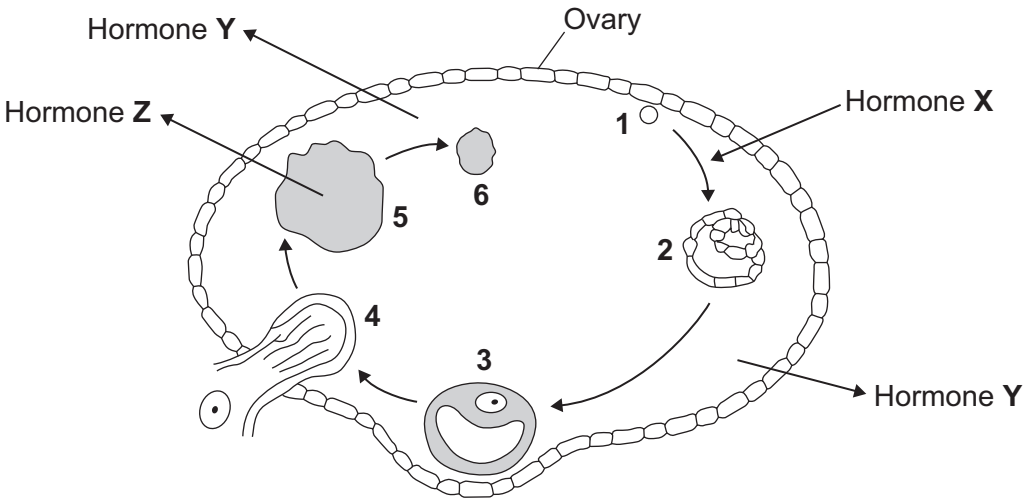
10 The diagram shows some of the events that occur in the ovary during the menstrual cycle.



10 (a) (i) Name hormones **X, Y** and **Z**.

X .....

Y .....

Z .....

(3 marks)

10 (a) (ii) Name structure **2**.

.....

(1 mark)

10 (a) (iii) Give **two** effects of hormone **X** on the ovary.

1 .....

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2 .....

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(2 marks)

10 (a) (iv) Name the hormone which causes event **4**.

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(1 mark)

10 (a) (v) Name structure **5**.

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(1 mark)

10 (b) Describe how the events shown in this cycle would change if a fertilised egg became implanted in the uterus lining.

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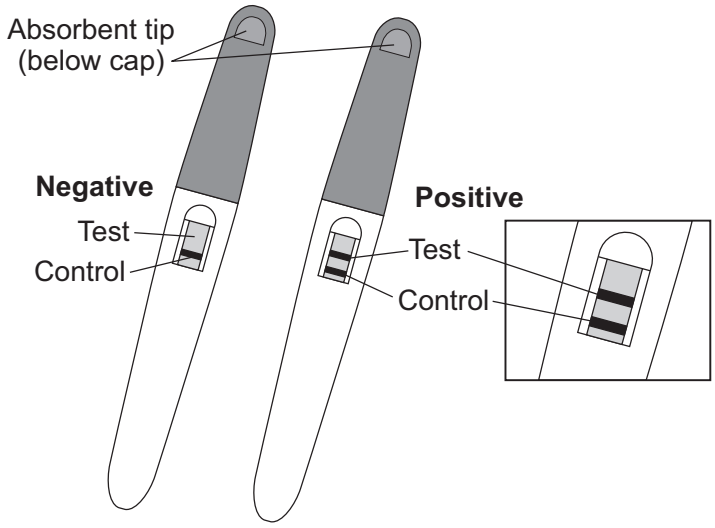
(4 marks)

10 (c) When an embryo implants in the uterus lining, some of its cells secrete a hormone called hCG. An hCG pregnancy test is a test used to determine whether or not a woman is pregnant. The hCG pregnancy test detects the hormone hCG in blood or urine. The hCG blood test is the more reliable, but hCG urine tests are more common.

The diagram shows typical hCG urine tests.



10 (c) (i) Suggest **one** reason why hCG urine tests are far more common than hCG blood tests.

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(1 mark)

Question 10 continues on the next page

10 (c) (ii) The hCG test is accurate to within + or – 25 units of hCG.

The table shows the range of concentrations of hCG for the first 6 weeks of pregnancy.

Weeks after last menstrual period	Days after fertilisation	Units of hCG
3	7	0 to 5
4	14 (next period due)	5 to 426
5	21	18 to 7340
6	28	1080 to 56 500

A woman misses her menstrual period. She decides to use the hCG test to see if she is pregnant.

When is the earliest time she can take the test to be sure that it is accurate?

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Explain the reason for your answer.

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(3 marks)

16

Turn over for the next question

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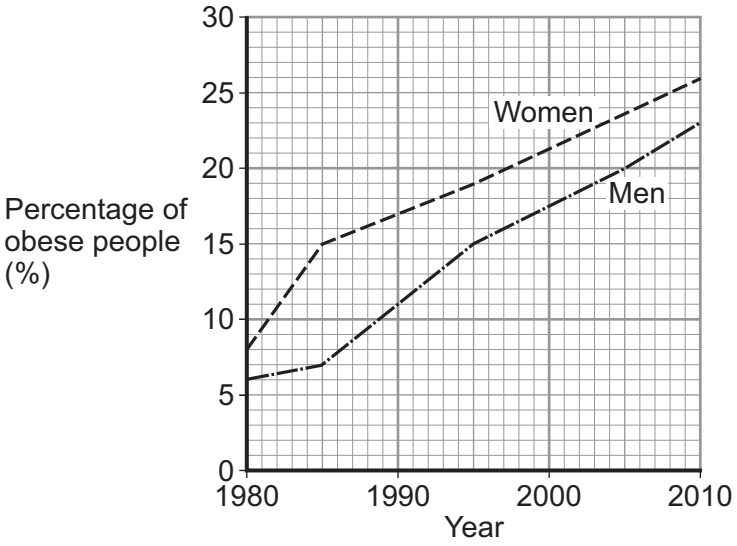
11 Obesity is an increasing problem in the UK.
The graph shows trends in obesity between 1980 and 2010.



11 (a) Suggest **one** reason for:

11 (a) (i) the increase in obesity in both men and women between 1980 and 2010

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(1 mark)

11 (a) (ii) the difference in the data for men and for women.

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(1 mark)

11 (b) (i) Give **two** possible effects of obesity on the health of a person.

1 .....

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2 .....

.....

(2 marks)

11 (b) (ii) Suggest **two** problems that the rise in obesity might cause to the National Health Service.

1 .....

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2 .....

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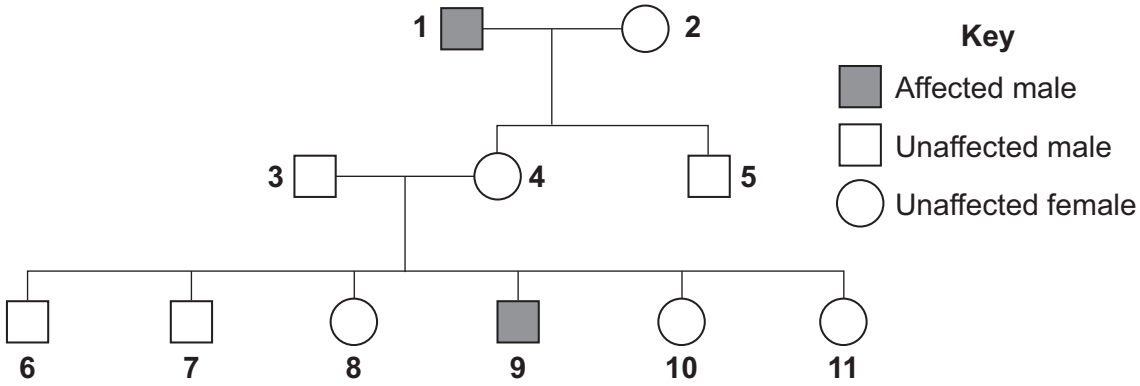
(2 marks)

6

Turn over for the next question

12 Duchenne muscular dystrophy is a sex-linked condition. The condition is caused by a recessive allele **d**. Healthy people have the allele **D.**

The diagram shows the inheritance of Duchenne muscular dystrophy in a family.



12 (a) Explain why person **9** was affected by Duchenne muscular dystrophy even though neither of his parents was affected.

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(5 marks)

12 (b) Person **7** has a brother affected by Duchenne muscular dystrophy. Person **7** is worried that if he starts a family, one of his children might be affected.

A genetic counsellor advises person **7** that it is very unlikely his children would be affected by Duchenne muscular dystrophy.

Explain why the genetic counsellor gave this advice.

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(3 marks)

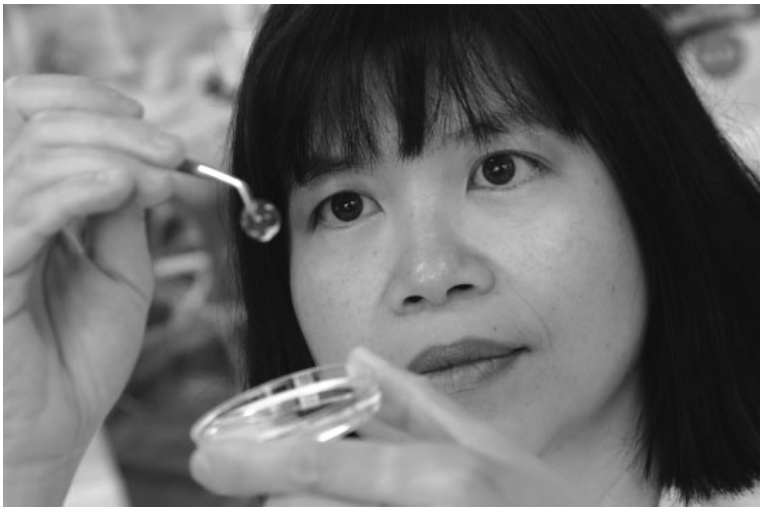
8

Turn over for the next question

13 Damage to the cornea may result in blindness. Until recently, the only treatments for this damage were to transplant a cornea from a dead person or to use a plastic cornea. Very few plastic corneas have given good results.

Genetic engineers have modified yeast cells to produce the protein collagen, which is the main constituent of the cornea. The collagen is then moulded into the shape of a cornea. The new cornea is used to replace the damaged one. After a while, cells and nerves grow into the new cornea. The genetically engineered cornea has been tested on ten patients. Vision improved significantly in all ten patients.

The photograph shows a cornea produced by this method.



13 (a) Describe how genetic engineers could have modified yeast cells to produce human collagen.

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(3 marks)

13 (b) Evaluate the use of corneas produced by yeast compared with transplanted corneas and plastic corneas. Use information from the opposite page and your own knowledge and understanding.

In this question you will be assessed on your ability to use good English, organise information clearly and use correct scientific words where appropriate.

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(5 marks)

8

END OF QUESTIONS

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