Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
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6	
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8	
9	
10	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2014

Human Health and Physiology 44151H

Unit 1 Topics in Human Health and Physiology

H

Monday 23 June 2014 1.30 pm to 3.30 pm

For this paper you must have:
- a ruler
- a calculator.

Time allowed
- 2 hours

Instructions

A
- 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 maximum mark for this paper is 120.
- The marks for questions are shown in brackets.
- 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 correct scientific words.

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

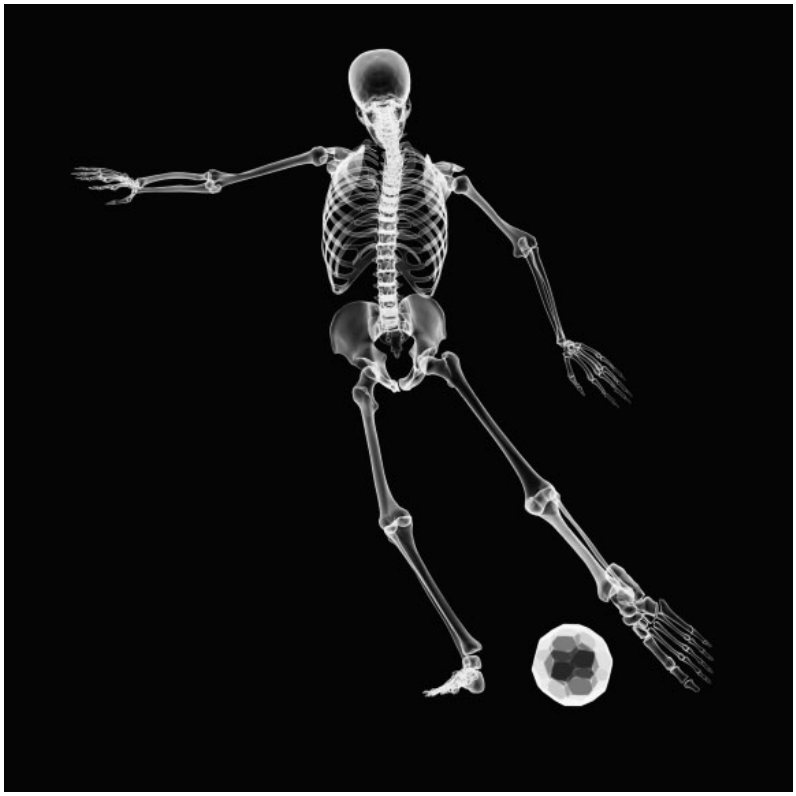
There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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

1 **Figure 1** shows the skeleton of a boy playing football.

Figure 1



1 (a) Give **two** important functions of the skeleton which help the boy to play football.

[2 marks]

1 .....

2 .....

1 (b) A number of physical injuries can occur to the bones, muscles and tendons when a person plays sport.

Give **two** examples of these injuries.

[2 marks]

1 .....

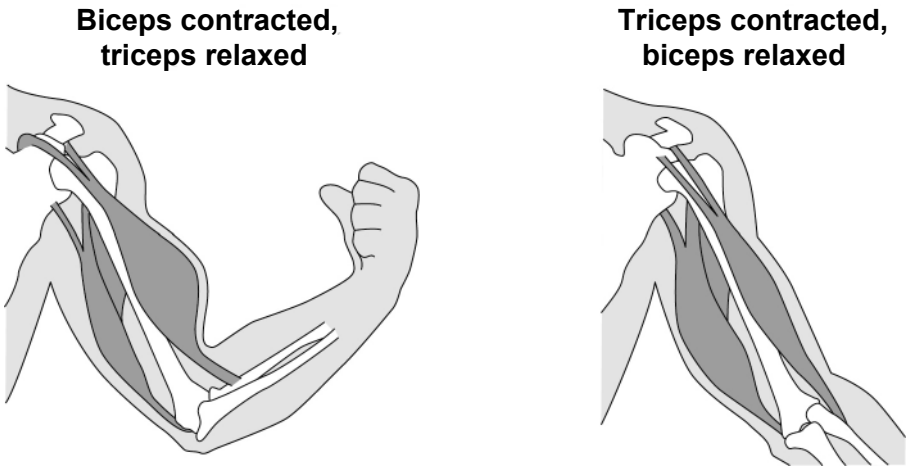
2 .....

Question 1 continues on the next page

1 (c) Muscles are attached to bones of the skeleton. The muscles are arranged in antagonistic pairs.

Figure 2 shows the muscles that cause movement at the elbow.

Figure 2



Tick (✓) **one** box to answer each question.

1 (c) (i) Which of the following contracts to **bend** your arm?

[1 mark]

Extensor ☐

Flexor ☐

Tendon ☐

1 (c) (ii) Which of the following contracts to **straighten** your arm?

[1 mark]

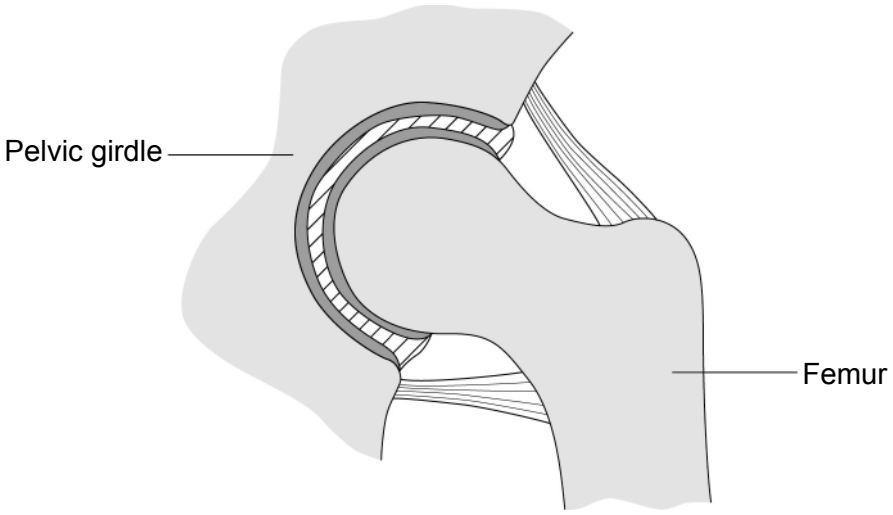
Extensor ☐

Flexor ☐

Tendon ☐

1 (d) **Figure 3** shows the hip joint.

Figure 3



When a person gets older, the hip joint can get damaged and be very painful. Surgery may be needed.

Apart from pain, suggest **one** problem that a damaged hip joint could cause.

[1 mark]

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Question 1 continues on the next page

1 (e) **Table 1** gives information about two different types of surgery for treating hip problems.

Table 1

Hip replacement	Hip resurfacing
This operation is usually for older people, between 60 and 80 years old.	This can only be done if a person has strong bones, so it is usually only suitable for younger adults.
The surgeon cuts into the hip, takes out the damaged hip joint and puts in an artificial joint.	The whole joint is not removed. The surgeon just scrapes off the surface of the femur and the surface of the pelvic cavity.
The artificial joint can be made of metal or ceramics.	The pelvis surface and the top of the thigh bone are both covered with metal.
After 2–3 months, most people can do their normal activities. It may be a year before all the benefits are felt.	People recover within a few weeks.
After the operation, most people can move better.	People have a large range of movement.
A modern joint should last about 15 years, so a person might need another operation later.	This is a new type of surgery so we do not know how long the metal surface will last.

Use information from **Table 1** to answer the questions.

1 (e) (i) Give **two** advantages of hip resurfacing rather than hip replacement.

[2 marks]

1 .....

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2 .....

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1 (e) (ii) Give **two** advantages of hip replacement rather than hip resurfacing.

[2 marks]

1 .....

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2 .....

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1 (e) (iii) A person with hip damage may prefer to take painkillers instead of having surgery.

Give **one** reason why.

[1 mark]

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12

Turn over for the next question

2 **Figure 4** shows a pregnant woman.

Figure 4

2 (a) Apart from the GP (family doctor), name **one** type of health professional who would help care for this woman during her pregnancy.

[1 mark]

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2 (b) The woman wants to make sure she has a healthy pregnancy.
Suggest **two** lifestyle changes this woman may need to make.

[2 marks]

1 .....

2 .....

2 (c) When the baby is born, the health professional may advise the woman to breastfeed her baby.
Give **two** benefits to the **baby** of breastfeeding rather than bottle feeding.

[2 marks]

1 .....

2 .....

2 (d) **Table 2** shows how birth rates in England and Wales have changed between the years 2000 and 2010.

Table 2

	2000	**2001**	**2009**	**2010**
Number of live births in England and Wales	604 441	594 634	706 248	723 165

2 (d) (i) Use the data in **Table 2** to describe the changes in birth rates between 2000 and 2010.
[2 marks]

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2 (d) (ii) Suggest **two** ways in which a change in population affects the rest of society.
[2 marks]

1.....

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2.....

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9

Turn over for the next question

3 **Figure 5** shows a doctor measuring a man's blood pressure.

Figure 5

3 (a) The doctor reads the blood pressure as '128 over 87'. These numbers give the highest and lowest blood pressure measurements in an artery in the upper arm.

Which number, 128 or 87, gives the pressure when the ventricles of the heart contract? Give the reason for your answer.

[1 mark]

Number .....

Reason .....

.....

3 (b) The man then walked at a steady speed on a treadmill.
His blood pressure increased to 140 over 90.

3 (b) (i) Give **one** change in the man's heart that caused the increase in blood pressure during the exercise.

[1 mark]

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3 (b) (ii) Give the names of **two** substances the muscles will need in larger amounts during exercise than at rest.

[2 marks]

1 .....

2 .....

3 (b) (iii) Why are the substances you named in part **(b) (ii)** needed by the muscles in larger amounts during exercise?

[2 marks]

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6

Turn over for the next question

4 **Table 3** and **Table 4** show nutritional information from a packet of breakfast cereal.

Table 3

Typical nutritional information			
	per 100 g	**per 27 g**	**per 27 g + 180 ml semi-skimmed milk**
Energy in kJ	1557	420	760
Protein in g	11.0	3.0	8.9
Carbohydrate in g of which sugars	58.9 1.0	15.9 0.3	24.1 8.4
Fat in g of which saturates	7.7 1.3	2.1 0.3	5.0 2.3
Fibre in g of which beta glucan	10.5 3.7	2.8 1.0	2.8 1.0
Sodium (salt) in g	trace	trace	0.2

Table 4

Guideline daily amounts for adults	
Energy in kJ	8400
Protein in g	45
Carbohydrates in g	230
Total sugars in g	90
Fat in g	70
Saturates in g	20
Fibre in g	24
Salt in g	6
Average values. Individual requirements may vary.	

4 (a) The information from the cereal packet shows that the cereal contains protein, carbohydrate, fat (lipid), fibre and mineral ions. Milk is mainly water.

One other major type of nutrient is **not** mentioned on the cereal packet.
Name this type of nutrient.

[1 mark]

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4 (b) (i) Which type of nutrient, listed on the cereal packet, is the body's main supply of energy?

[1 mark]

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4 (b) (ii) What percentage of the daily amount of energy for adults is provided by a 27 g serving of the cereal and 180 ml of semi-skimmed milk?

Use information from both **Table 3** and **Table 4**.

[2 marks]

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Percentage provided = ...%

4 (b) (iii) Some adults require **more** energy each day than the value given in **Table 4**.
Give **two** reasons why.

[2 marks]

1 .....

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2 .....

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Question 4 continues on the next page

4 (c) **Table 3** shows that the cereal contains protein.

4 (c) (i) Describe how you would test some of the cereal for protein.
Include a description of the result you would expect to see.

[3 marks]

Method .....

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Expected result .....

4 (c) (ii) Give **one** function of protein in the body.

[1 mark]

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4 (d) The manufacturer claims that eating this breakfast cereal helps to lower cholesterol and so maintain a healthy heart.

How does reducing cholesterol help to maintain a healthy heart?

[2 marks]

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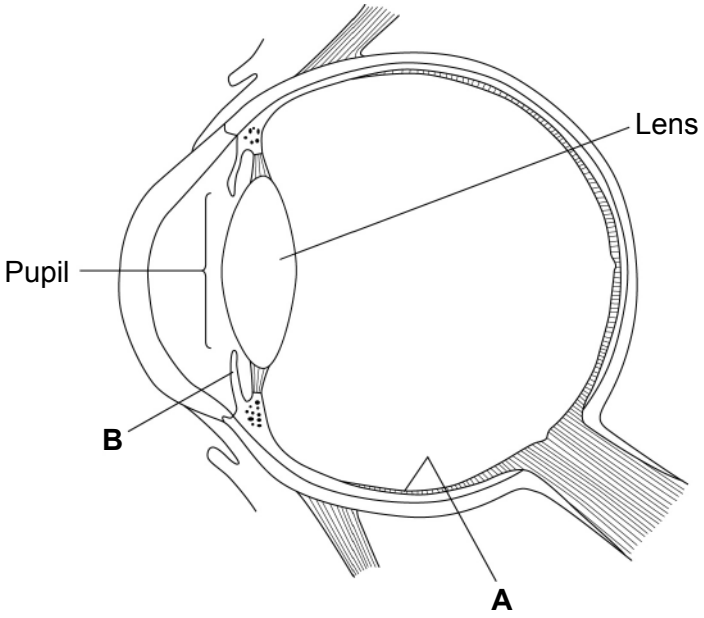
12

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

5 **Figure 6** shows a section through the eye.

Figure 6



5 (a) Name parts **A** and **B**.

[2 marks]

A .....

B .....

5 (b) When a bright light shines into the eye, part **B** helps to reduce the amount of light that reaches part **A**.

This is an example of a reflex action.

5 (b) (i) What is a reflex action?

[2 marks]

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5 (b) (ii) Describe how part **B** reduces the amount of light that reaches part **A**.

[2 marks]

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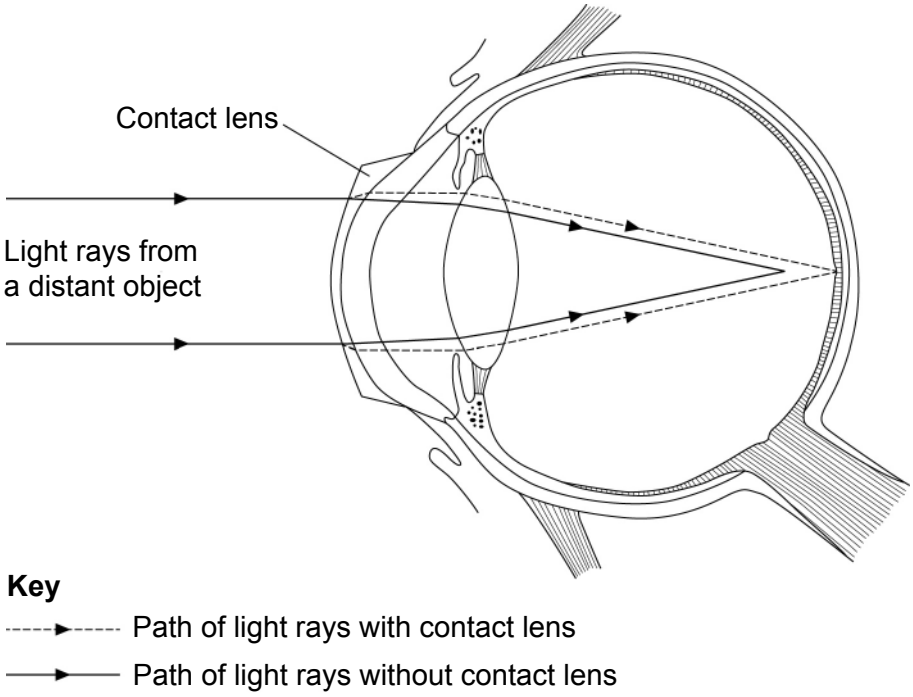
Question 5 continues on the next page

5 (c) A short-sighted person has difficulty focusing on distant objects.

An optometrist can prescribe lenses to correct short sight.

Figure 7 shows how a contact lens can correct short sight.

Figure 7



Use information from **Figure 7** to explain how short sight is corrected by the contact lens.

[2 marks]

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5 (d) As a person gets older, the lens of the eye becomes less flexible.
This may make it difficult to focus on a close object, for example, when reading.

Explain why a less flexible lens may cause difficulty with focusing on a close object.
[3 marks]

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11

Turn over for the next question

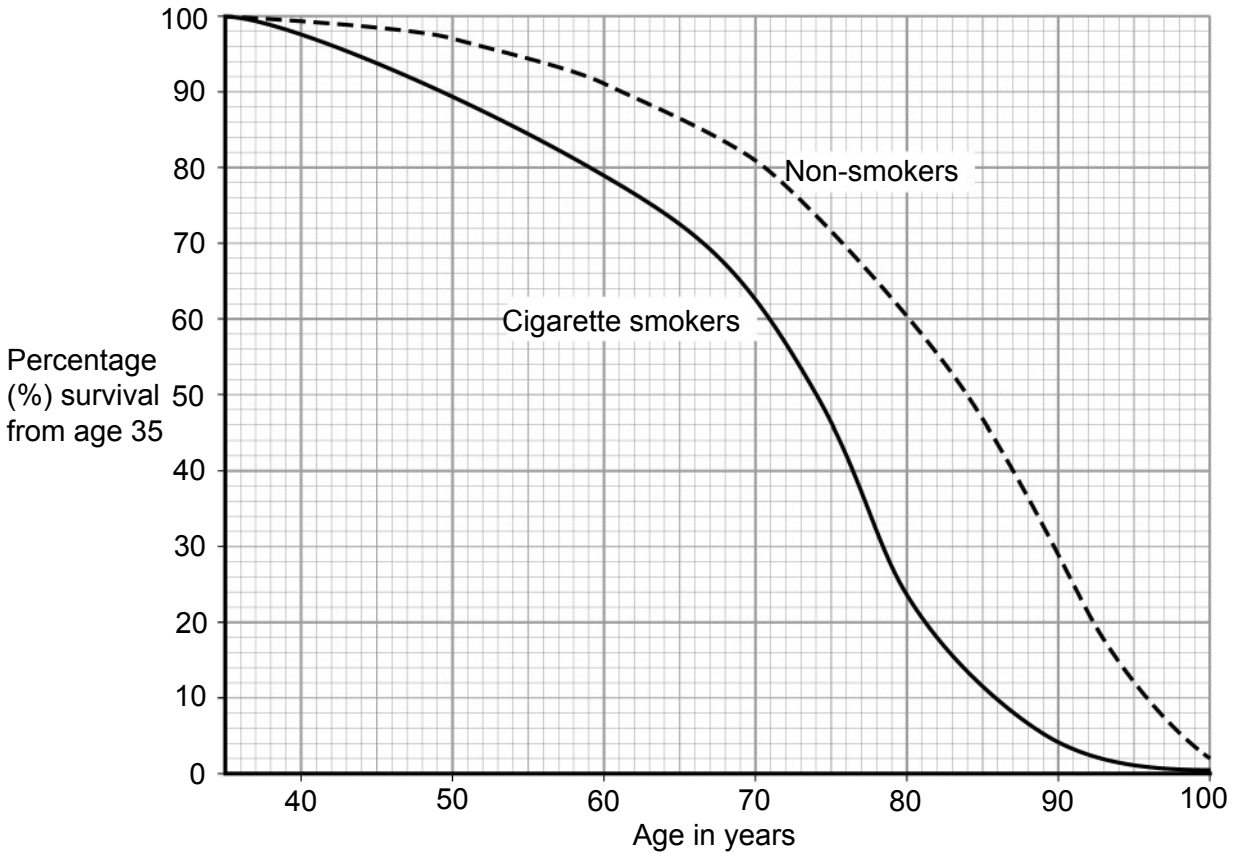
6 (a) Richard Doll did an investigation to find out if cigarette smoking affected how long people live.

He studied two groups of male doctors. One group consisted of cigarette smokers and the other group consisted of non-smokers.

Each doctor was 35 years old at the start of the investigation.
Doll recorded when each man died.
He then calculated the percentage of men surviving at various ages.

Figure 8 shows the results.

Figure 8



Reproduced from British Medical Journal, Mortality in relation to smoking, Richard Doll et al, volume number 328, June 2004, with permission from BMJ Publishing Group Ltd.

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

[2 marks]

1 .....

2 .....

6 (a) (ii) Richard Doll concluded that, on average, smokers live 10 years less than non-smokers.

Explain how **Figure 8** shows this.
Use the numbers for 50% survival.

[2 marks]

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6 (a) (iii) Do the data in **Figure 8** show that **all** cigarette smokers live 10 years less than they would have done if they had been non-smokers?
Give a reason for your answer.

[1 mark]

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6 (b) Cancer is one of the main causes of death in cigarette smokers.

6 (b) (i) What is cancer?

[2 marks]

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Question 6 continues on the next page

6 (b) (ii) Cancer is caused by a mutation.

What is a **mutation**?

[1 mark]

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6 (c) In one investigation, scientists found that 38% of deaths in cigarette smokers were caused by cancer. Most of these cancer deaths were due to lung cancer.

6 (c) (i) Why does cigarette smoking cause cancer mainly in the lungs?

[2 marks]

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6 (c) (ii) Smoking can cause cancer in organs of the body that are **not** part of the breathing system.

Explain how.

[2 marks]

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12

7 The skin stops pathogens from entering the body. If the skin is damaged, pathogens can enter the body. Blood clotting and scab formation at the site of a wound also stop the entry of pathogens.

7 (a) (i) What is a pathogen?

[2 marks]

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7 (a) (ii) Apart from blood clotting and the skin, give **three** other methods by which the body stops the entry of pathogens.

Explain how each method works.

[6 marks]

Method 1 .....

Explanation .....

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Method 2 .....

Explanation .....

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Method 3 .....

Explanation .....

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Question 7 continues on the next page

7 (b) Describe how a blood clot is formed in a healthy person.

[4 marks]

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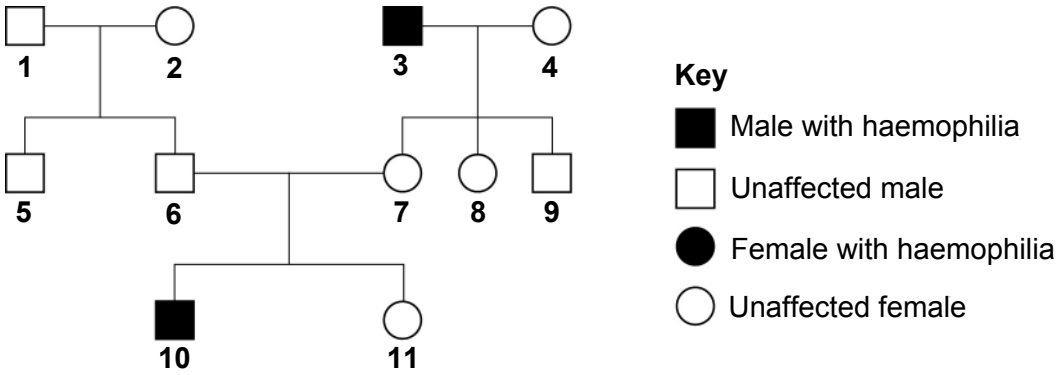
7 (c) Haemophilia is an inherited disorder in which the blood does not clot properly.

Figure 9 shows the inheritance of haemophilia in one family.

Figure 9



Haemophilia is caused by a recessive allele, **h**. This allele is found on the **X** chromosome.

7 (c) (i) **Figure 9** shows that persons **6** and **7** have a son with haemophilia.

How does this show that haemophilia is caused by a recessive allele?

[2 marks]

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7 (c) (ii) Persons **6** and **7** want to have another child.
A genetic counsellor tells them that there is a 1 in 4 chance that this child will be a boy with haemophilia.

Use a genetic diagram to explain why there is a 1 in 4 chance that **6** and **7**'s next child will be a boy with haemophilia.
Use the following symbols:

$\mathbf{X^H}$ = X chromosome with an allele for normal blood clotting (non-haemophiliac)
$\mathbf{X^h}$ = X chromosome with the allele for haemophilia
Y = Y chromosome.

[4 marks]

18

Turn over for the next question

8 Coeliac disease is caused by an allergic reaction to a protein called gluten.
Gluten is found in cereals such as wheat and barley.
If a person with coeliac disease eats food containing gluten, it can damage the villi in the small intestine.

The diagrams show villi in the small intestine. **Figure 10** is the small intestine of a healthy person. **Figure 11** is the small intestine of a person with coeliac disease.

Figure 10

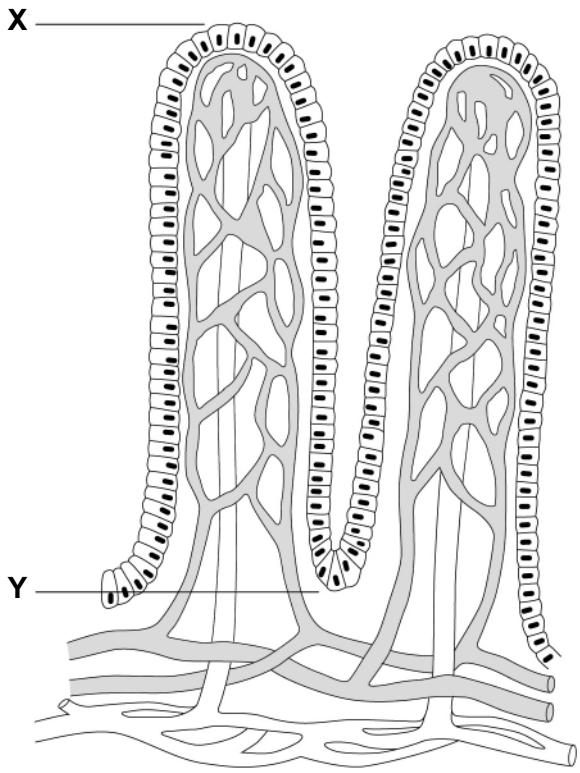
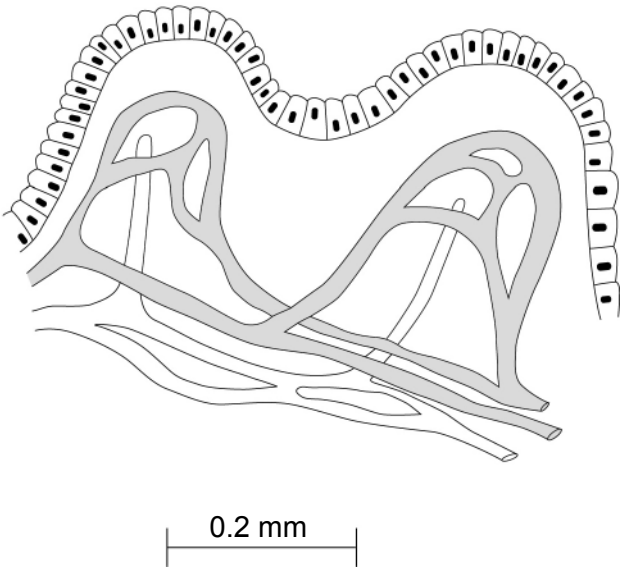


Figure 11



The scale bar represents 0.2 millimetres.

8 (a) (i) Describe **two** ways in which the villi in **Figure 11** are different from those in **Figure 10**.
[2 marks]

1 .....

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2 .....

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8 (a) (ii) Calculate the real length of the villus, **X – Y**, in **Figure 10**.
You should use a ruler and information from the scale bar.

[2 marks]

Real length of the villus, **X – Y**, = ... mm

8 (b) (i) A person with coeliac disease absorbs smaller amounts of digested food.

Explain why.

[2 marks]

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8 (b) (ii) One symptom of coeliac disease is diarrhoea (watery faeces). The absorption of smaller amounts of digested food causes diarrhoea.

Explain how.

[4 marks]

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Question 8 continues on the next page

8 (c) A woman has had abdominal pains and diarrhoea for several weeks.
Her dietician says she should have a blood test for coeliac disease.

People with coeliac disease have an antibody that reacts with a small part of the gluten protein molecule. The blood test will show if these antibodies are in the woman's blood.

Explain why the antibodies will only attach to cells that carry the small part of the gluten protein molecule on their surface.

[2 marks]

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9 The urine of a healthy person contains water, mineral ions and urea.

9 (a) (i) Which organ in the body makes urea?

[1 mark]

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9 (a) (ii) The concentration of substances in urine is variable.

Suggest **two** normal circumstances that would cause an **increase** in the concentration of mineral ions in a person's urine.

[2 marks]

1 .....

2 .....

9 (a) (iii) The pituitary gland makes a hormone which helps the kidneys to control the balance of water and mineral ion concentration of the blood.

Name this hormone.

[1 mark]

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9 (a) (iv) The pituitary gland releases this hormone when the mineral ion concentration of the blood is too high.

Explain why.

[2 marks]

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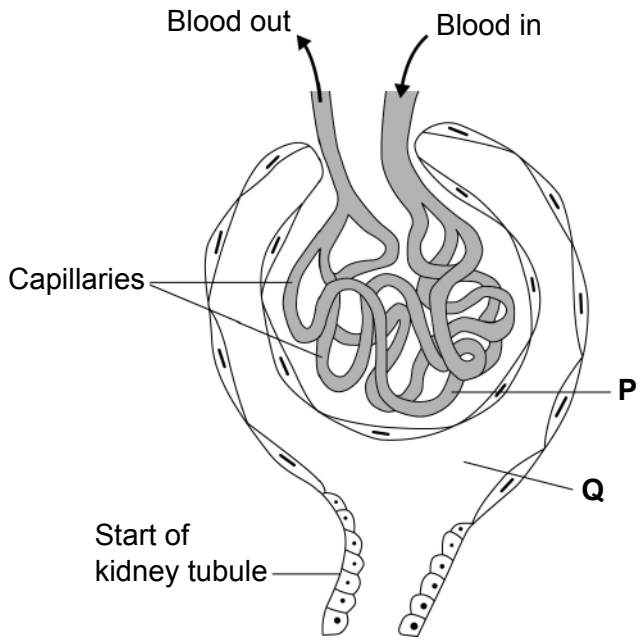
Question 9 continues on the next page

9 (b) **Figure 12** shows the site of filtration in the kidney.

Figure 12



In a healthy person:

- protein and glucose are found in the blood plasma at point **P**
- glucose is also found at point **Q**
- protein is not found at point **Q**
- neither protein nor glucose is found in the urine.

Explain these observations.
Use your knowledge of how the kidney works.

[6 marks]

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Question 9 continues on the next page

9 (c) A man was suffering from loss of appetite, swelling in his hands and feet and an increase in body mass.

His doctor tested a sample of the man's urine and found traces of protein in it. The man had kidney disease and he had to be treated by dialysis.

Figure 13 shows the man connected to a dialysis machine.

Figure 13

9 (c) (i) Explain how dialysis works.

[5 marks]

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9 (c) (ii) Give **one** reason why treating kidney disease with a kidney transplant is better than treatment by dialysis.

[1 mark]

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9 (c) (iii) Give **one** reason why doctors continue to treat kidney disease by dialysis rather than with a kidney transplant.

[1 mark]

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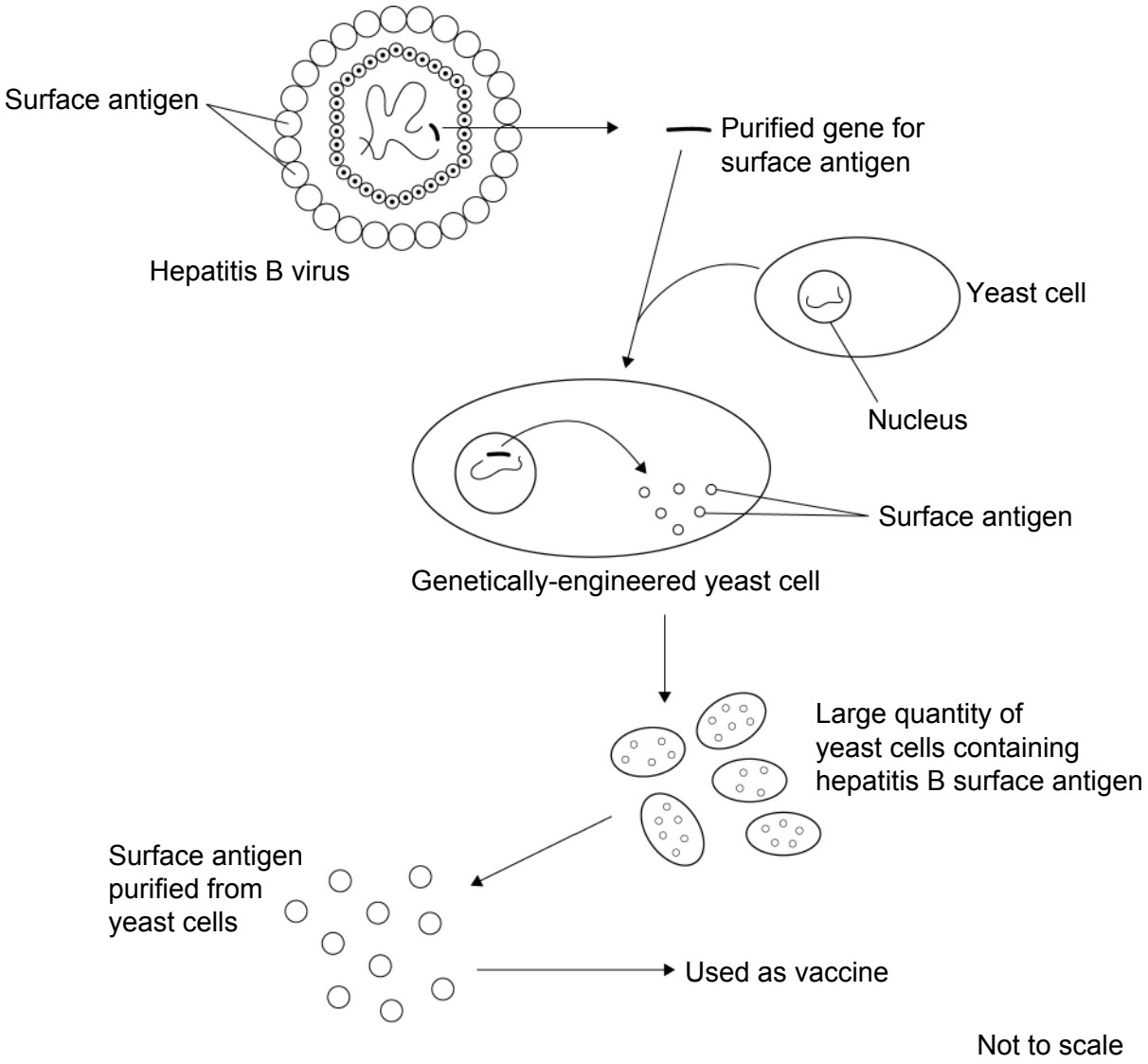
19

Turn over for the next question

10 Hepatitis B is a dangerous disease. It is caused by a virus.

Figure 14 shows how genetic engineers can make a vaccine against hepatitis B.

Figure 14



10 (a) **In this question you will be assessed on your ability to use good English, organise information clearly and use the correct scientific words**.

Describe how genetic engineers produce large amounts of the hepatitis B surface antigen.

Explain how this genetically-engineered surface antigen can be used as a vaccine to make people immune to hepatitis B.

Use information from **Figure 14** and your own knowledge.

[5 marks]

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Extra space .....

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Question 10 continues on the next page

10 (b) Another method of making a vaccine is to heat the hepatitis B virus in order to stop it reproducing. The vaccine would then contain whole virus particles.

It is safer to use the genetically-engineered vaccine than to use a vaccine made by heating the hepatitis B virus.

Explain why.

[4 marks]

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END OF QUESTIONS

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Question 2(d)	Table 2: © Data taken from Office for National Statistics
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