

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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10	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
June 2011

## Human Health and Physiology 44151H

Monday 27 June 2011 1.30 pm to 3.30 pm

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.



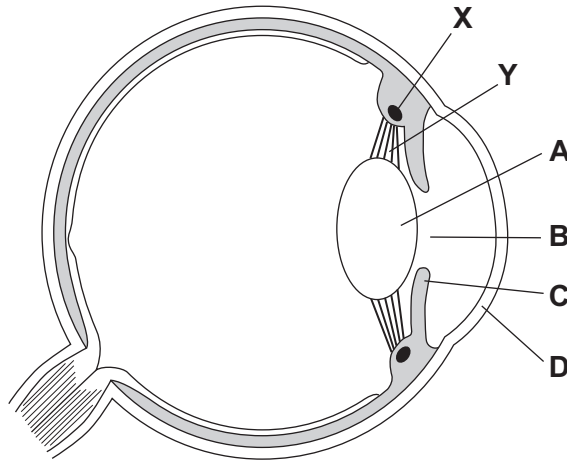
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M/Jun11/44151H

**44151H**

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

**1** The diagram shows a section through the eye.



**1 (a)** Name the structures labelled

- A** .....
- B** .....
- C** .....
- D** .....

(4 marks)

**1 (b)** Explain how the structures labelled **X** and **Y** help the eye to focus on a near object.

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(3 marks)



1 (c) The photograph shows an optometrist measuring the pressure inside a patient's eye.



1 (c) (i) How does the optometrist use the instrument shown in the photograph to measure the pressure inside the patient's eye?

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(1 mark)

1 (c) (ii) Name **one** disease which may cause high pressure inside the eye.

.....

(1 mark)

1 (c) (iii) Explain how high pressure in the eye may affect eyesight.

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(2 marks)

11

Turn over ▶



- 2 A doctor advises Laura to see a dietician.



The dietician first calculates Laura's Body Mass Index (BMI).

BMI is calculated by  $\text{mass} \div \text{height}^2$ .

The dietician finds that Laura has a mass of 85 kg and a height of 1.5 m.

- 2 (a) (i) Calculate Laura's Body Mass Index.

Show clearly how you work out your answer.

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BMI = .....  
(2 marks)

- 2 (a) (ii) The table shows Body Mass Index Categories.

Body Mass Index	Category
Below 16.5	Severely underweight
16.5 – 18.4	Underweight
18.5 – 24.9	Healthy weight
25 – 29.9	Overweight
30 or above	Obese

Which category is Laura?

.....  
(1 mark)



**2 (b)** The dietician gives Laura two pieces of advice about diet.

What should these **two** pieces of advice be?

1 .....

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2 .....

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(2 marks)

**2 (c)** Jane lives in Britain and has a Body Mass Index of 15. She is not eating enough food.

Name **one** dietary disease Jane may have.

.....

(1 mark)

**2 (d)** Some diets lead to an increased risk of heart attacks.

**2 (d) (i)** Explain the link between diet and heart attacks.

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

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(4 marks)

**Question 2 continues on the next page**

**Turn over ▶**



2 (d) (ii) Give **one** way in which a physiotherapist can help a patient to recover from a heart attack.  
Do **not** include advice about diet in your answer.

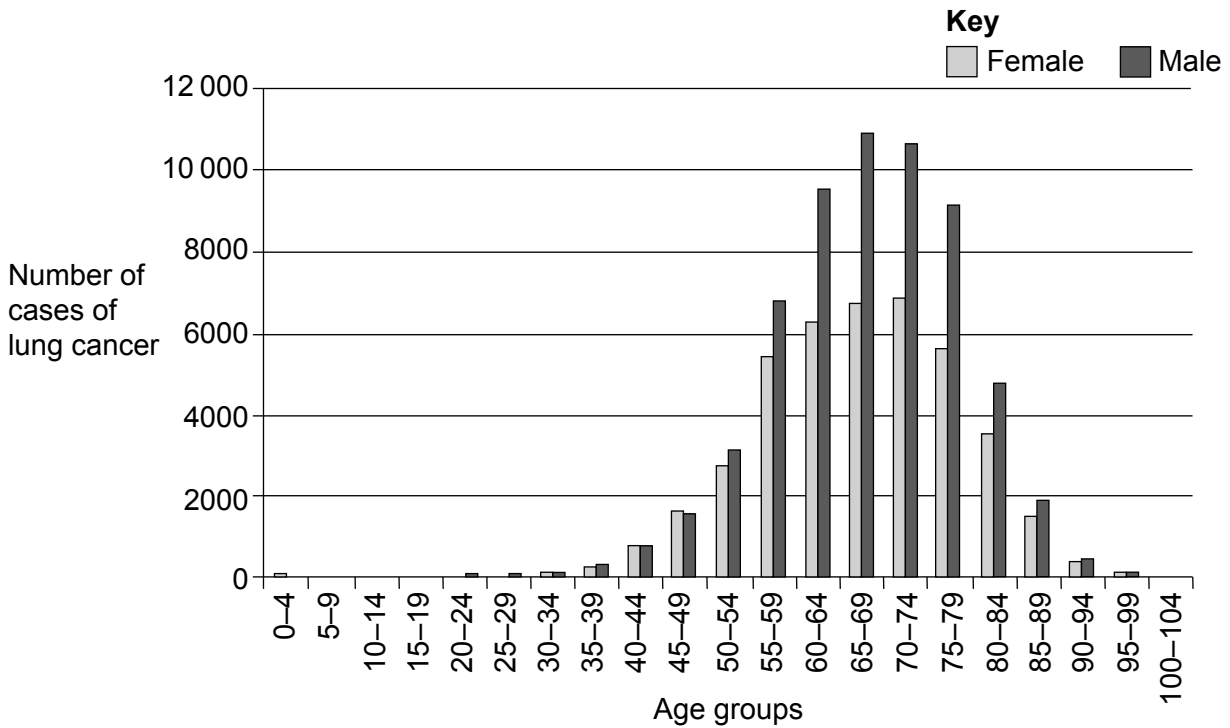
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(1 mark)

11
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3 The NHS collects statistics on the number of people treated in hospitals for different diseases.

The graph shows the number of cases of lung cancer in males and females treated in hospitals in the UK in 2007.



3 (a) Give **two** conclusions from the data in the graph.

1 .....

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2 .....

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(2 marks)



**3 (b)** Suggest **one** reason why the NHS needs to know the number of cases of lung cancer treated in hospitals.

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(1 mark)

**3 (c) (i)** Suggest **one** method of diagnosing lung cancer.

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(1 mark)

**3 (c) (ii)** Which health service professional would use the equipment for the method you have given in part (c) (i)?

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(1 mark)

**3 (d)** Suggest **two** methods of treating lung cancer.

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

7

**Turn over for the next question**

**Turn over ▶**



4 Acupuncture is an alternative therapy for many conditions.

4 (a) Describe how acupuncture is carried out.

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(2 marks)

Urticaria is a condition which produces an itchy rash on the skin. The rash appears for a few hours and then disappears. In some people, urticaria does not respond to conventional treatment. Doctors investigated the effectiveness of acupuncture in relieving the symptoms of urticaria in these patients.

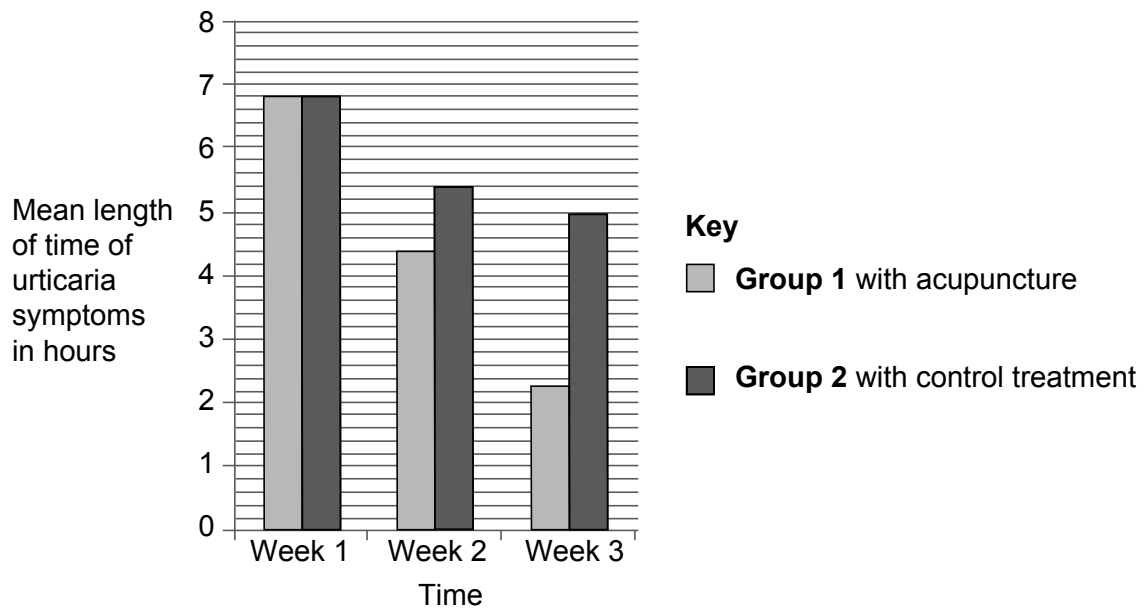
- 40 patients whose urticaria did not respond to conventional treatment took part in the investigation.
- **Group 1** was given acupuncture treatment daily for three weeks.
- **Group 2** was given a control treatment daily for three weeks.
- The table shows the composition of each group.

Characteristic	Group 1 given acupuncture treatment	Group 2 given control treatment
Male	8	8
Female	12	12
Mean age in years	30	30
Mean length of time patients had suffered from urticaria in years	12	11





The bar chart shows the results of the investigation.



4 (b) (i) Give **two** control variables that were used in this investigation.

1 .....

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2 .....

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(2 marks)

4 (b) (ii) Give the dependent variable in this investigation.

.....

(1 mark)

4 (c) There was some improvement in the patients in **Group 2**.

Suggest **one** explanation for this.

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(1 mark)

4 (d) Why would it be better to show all the results rather than the mean length of time of the urticaria symptoms?

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(1 mark)

Question 4 continues on the next page

Turn over ▶



**4 (e)** A patient with urticaria that does not respond to conventional treatments visits a consultant dermatologist (skin specialist).

Based on the results of this investigation, what advice would you expect the dermatologist to give to the patient about acupuncture treatment.

Explain the reason for your answer.

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(2 marks)

<b>9</b>



5 The poster encourages girls to be vaccinated against cancer of the cervix (cervical cancer).

Cervical cancer is caused by the human papillomavirus (HPV) which is transmitted by sexual intercourse.



5 (a) Describe **one** way in which the female body prevents the HPV from invading cells in the reproductive system.

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(2 marks)

Question 5 continues on the next page

Turn over ▶



5 (b) If cervical cancer is not detected early it may become malignant.

5 (b) (i) Give **one** way in which cancer cells differ from normal cells.

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(1 mark)

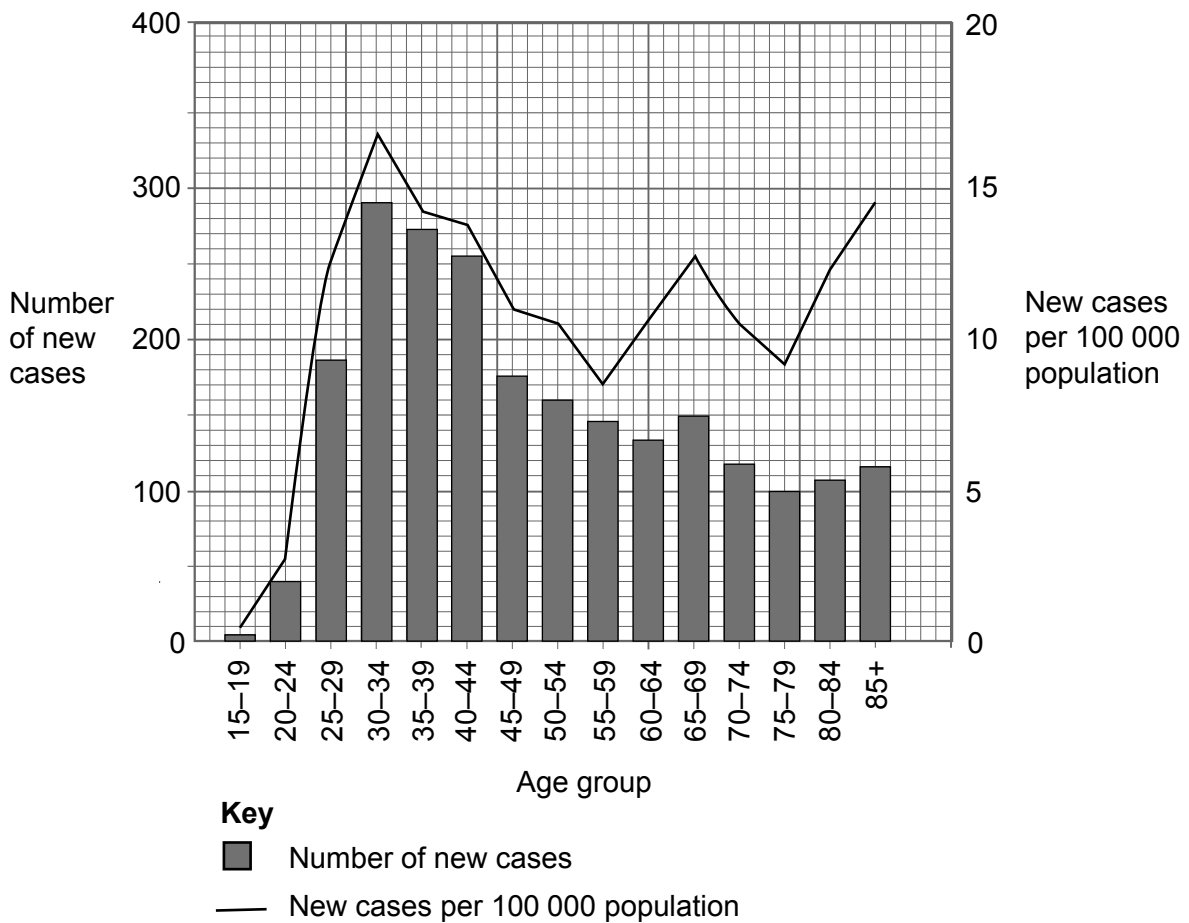
5 (b) (ii) Malignant tumours are very dangerous.

Explain why.

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(2 marks)

The graph shows the number of new cases of cervical cancer in England in 2005.



Source: Office for National Statistics



5 (c) (i) Describe the relationship between the number of new cases of cervical cancer and age.

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(2 marks)

5 (c) (ii) A city has 500 000 inhabitants.  
How many new cases of cervical cancer in women aged 25–29 would you expect in one year in this city?  
Show clearly how you work out your answer.

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Number of cases.....

(2 marks)

5 (c) (iii) The NHS is targeting girls aged 13 for vaccination against the HPV.  
Using data from the graph, suggest an explanation for the NHS choosing this age group.

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(2 marks)

5 (d) Many parents are uneasy about their daughters being vaccinated against the HPV.  
Suggest **two** reasons why.

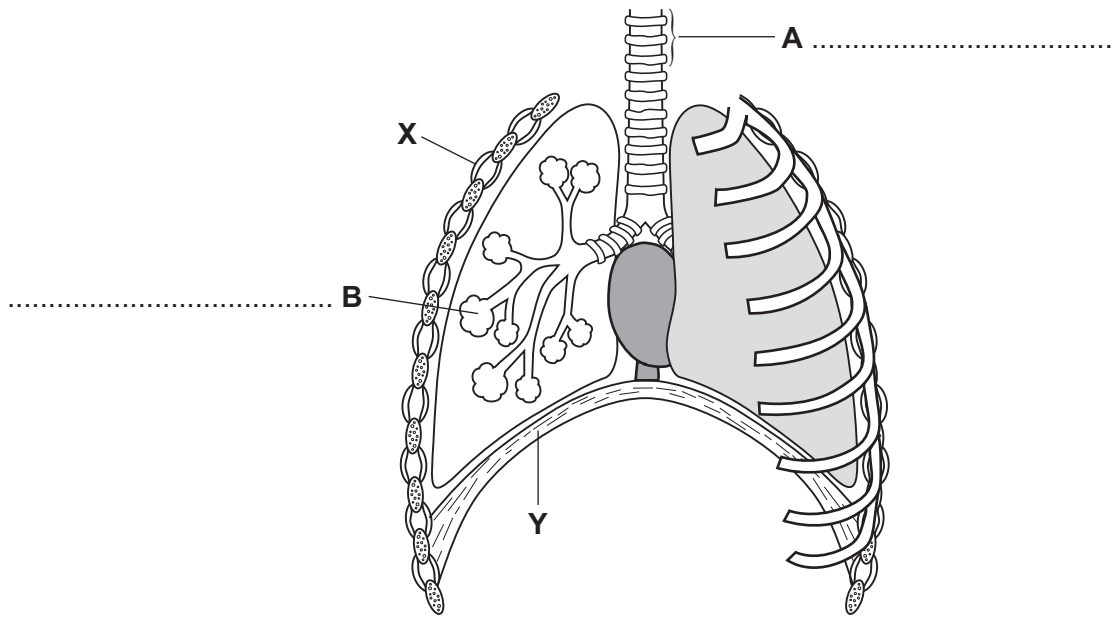
1 .....

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(2 marks)



6 The diagram shows the human breathing system.



6 (a) On the diagram, name the structures labelled **A** and **B**. (2 marks)

6 (b) The structures labelled **X** and **Y** cause air to move into the lungs.  
Explain how.

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(4 marks)



**6 (c)** The photograph shows a paramedic training to give mouth-to-mouth resuscitation.



**6 (c) (i)** What should the paramedic check before starting mouth-to-mouth resuscitation?

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*(1 mark)*

**6 (c) (ii)** It is very important to start mouth-to-mouth resuscitation as soon as possible after a person has stopped breathing.

Explain why.

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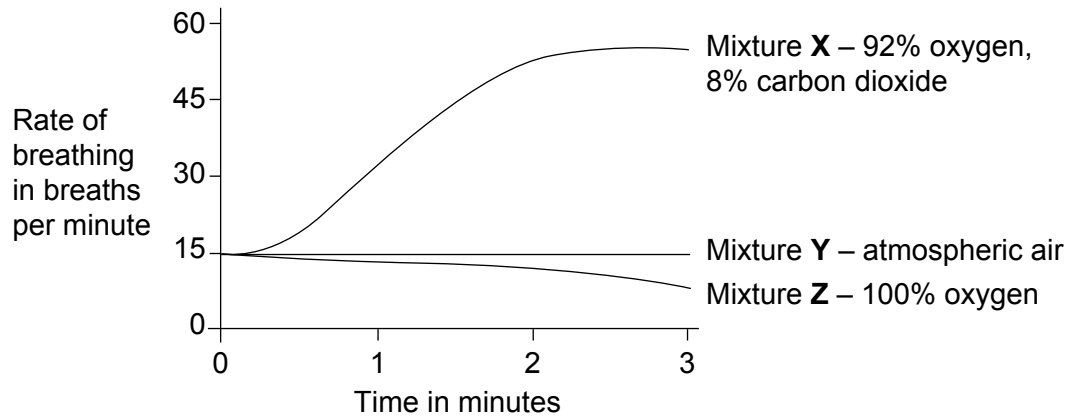
*(2 marks)*

**Question 6 continues on the next page**

**Turn over ▶**



6 (d) Exercise physiologists investigated the effect of breathing in different gas mixtures on the rate of breathing. The results are shown on the graph.



Explain the results:

6 (d) (i) for mixture X

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(2 marks)

6 (d) (ii) for mixture Z.

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(2 marks)





**Turn over for the next question**

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ANSWER IN THE SPACES PROVIDED**

**Turn over ▶**



7 Blood glucose concentration is controlled by hormones.

The table shows the concentrations of glucose and insulin in the blood plasma of a healthy person before and after a meal.

Time after eating meal in minutes	Concentration of glucose in blood plasma in mg per 100 cm <sup>3</sup>	Concentration of insulin in blood plasma in arbitrary units
0	82	19
5	88	19
10	96	28
15	106	35
20	110	44
25	108	49
30	101	52
35	93	46
40	87	41
45	82	33

7 (a) (i) Insulin controls the concentration of glucose in blood plasma. Use information from the table to explain how.

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(3 marks)

7 (a) (ii) The data in the table provides an example of negative feedback. Explain how.

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(2 marks)



7 (b) Diabetics who do not produce insulin need insulin injections.

The insulin can be delivered by an insulin pump.  
One type of insulin pump is shown in the photograph.



Read the information about how one schoolgirl uses this insulin pump.

Each time Alyssa is ready to eat, she pricks her finger to get a sample of blood to test the concentration of circulating glucose. She must also estimate the approximate amount of carbohydrates she can eat, based on the food type and portion size. For many of the foods Alyssa eats regularly, she has a good idea what the amount of carbohydrate is. For newer foods, or meals eaten out, she has a small handbook that can provide the information she needs. Alyssa then inputs both her blood glucose and estimated carbohydrate intake to the pump. The pump then delivers the appropriate dose of fast-acting insulin that will offset her intake.

Alyssa is a very active schoolgirl. Using the insulin pump is much better for her than injecting one large dose of insulin each day.

Using the above information, explain why.

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(3 marks)

8

Turn over ▶



**8** Cystic fibrosis is an inherited condition.

Symptoms of cystic fibrosis include

- reduced absorption of calcium and vitamin D in the intestine
- secretion of thick mucus which lines the lungs
- secretion of thick mucus which blocks the pancreatic duct.

**8 (a)** Describe how each of the following affects the body.

**8 (a) (i)** Reduced absorption of calcium and vitamin D in the intestine.

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*(2 marks)*

**8 (a) (ii)** Secretion of thick mucus which lines the lungs.

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*(2 marks)*

**8 (a) (iii)** Secretion of thick mucus which blocks the pancreatic duct.

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*(2 marks)*



**8 (b)** Cystic fibrosis is caused by a mutant allele.

Explain how a mutant allele affects chemical reactions inside cells.

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(2 marks)

**8 (c)** The table shows the chance of being a carrier for someone with a family history of cystic fibrosis.

Relationship to person who has cystic fibrosis	Risk of being a carrier
Brother or sister	2 in 3
Aunt or uncle	1 in 2
First cousin	1 in 4
Second cousin	1 in 16

The cystic fibrosis allele is recessive.

The risk of being a carrier is highest if a brother or sister has cystic fibrosis.

Use a genetic diagram to explain why.

(4 marks)

**Question 8 continues on the next page**

**Turn over ▶**



**8 (d)** A genetic test shows that both a mother and a father are carriers of cystic fibrosis. A genetic counsellor might suggest the following IVF (in-vitro fertilisation) options.

**Option 1** Screening the embryo for cystic fibrosis before implanting it into the mother's uterus.

**Option 2** Using donor sperm and the mother's egg.

**Option 3** Using a donor egg and the father's sperm.

**8 (d) (i)** Explain why the couple might reject **Option 1**.

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*(2 marks)*

**8 (d) (ii)** Explain why the couple might reject **Options 2 and 3**.

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*(2 marks)*

**8 (e)** Gene therapy is being trialled as a treatment for cystic fibrosis.

Outline how genetic engineers might transfer normal alleles to a patient with cystic fibrosis.

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*(3 marks)*



**9** Medical professionals are developing new treatments for heart disease.

**9 (a) (i)** Name the part of the right atrium that controls heartbeat.

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(1 mark)

**9 (a) (ii)** What is the usual treatment for an irregular heartbeat?

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(1 mark)

**9 (b)** Worldwide, about 20 000 people die each year while waiting for a heart transplant.

There is a shortage of donors and so Magdi Yacoub’s team are researching new ways of treating people with heart disease.

Describe **one** of the team’s research projects.

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(2 marks)

**Question 9 continues on the next page**

**Turn over ▶**



**9 (c)** Read the article about the development of an artificial heart.

Until recently artificial hearts had two major disadvantages:

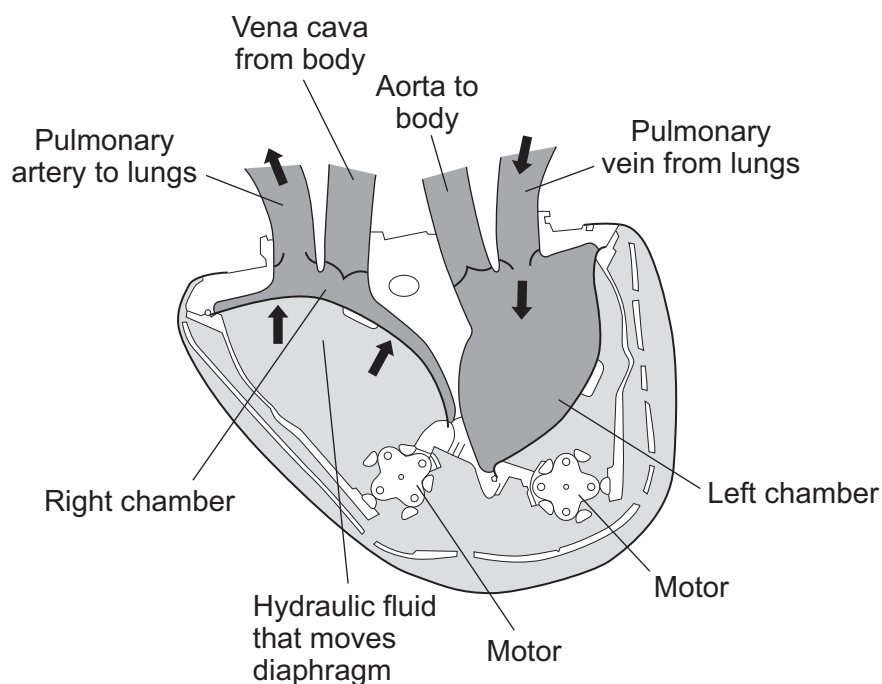
- wires that protrude through the skin for the power supply
- a high risk of producing blood clots.

A French company says that it is close to overcoming these disadvantages. It has reduced the risk of clots by creating a heart with a “pseudo-skin” of biosynthetic materials.

The power supply gets electricity through the skin between two transformers, one inside and one outside the body. The company says the battery could last for between 5 and 16 hours, after which it would have to be recharged, to prevent the artificial heart stopping.

The artificial heart has been tested successfully on calves and sheep. It will be implanted in patients with terminal heart failure for a clinical trial in two or three years' time. If the trial is successful the French artificial heart will be available as an alternative to a transplant in 2013.

The drawing shows a section through this artificial heart.





**9 (c) (i)** Give **two** ways in which the action of this artificial heart differs from that of a living human heart.

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(2 marks)

**9 (c) (ii)** Using the information in this question, evaluate the treatment of heart failure using the French artificial heart as an alternative to transplanting living human hearts.

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

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(5 marks)

11

Turn over ▶



**10** Health visitors advise most mothers of young babies to breastfeed them.



**10 (a) (i)** Give **two** benefits of breastfeeding to a baby.

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*(2 marks)*

**10 (a) (ii)** Give **two** benefits of breastfeeding to the mother.

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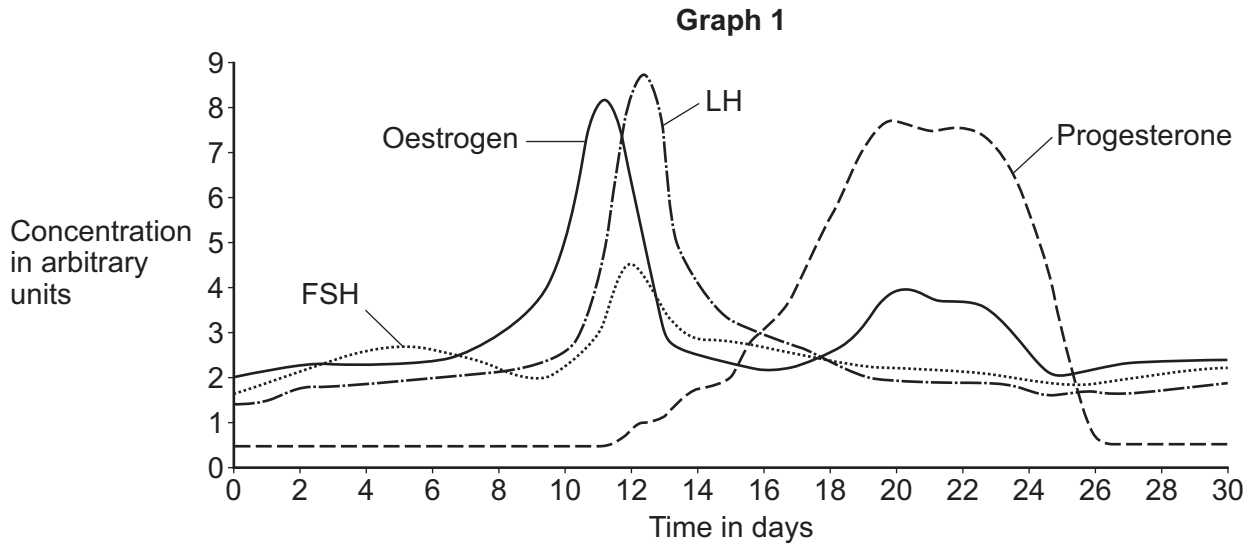
2 .....

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*(2 marks)*



**Graph 1** shows the concentrations of hormones in the blood of a woman during her menstrual cycle.



**10 (b) (i)** Give **one** function of FSH.

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 (1 mark)

**10 (b) (ii)** Give **one** function of oestrogen.

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 .....  
 (1 mark)

**10 (b) (iii)** Give **one** function of LH.

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 (1 mark)

**10 (b) (iv)** Give **one** function of progesterone.

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 (1 mark)

**Question 10 continues on the next page**

**Turn over ▶**



**10 (c)** When a woman is pregnant, intercourse does not result in another pregnancy.  
Explain why.

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*(3 marks)*

Some women have difficulty in becoming pregnant. A new device has been marketed to help such women. The woman attaches a very small temperature sensor in her armpit. The sensor sends 20 000 temperature readings each day to the device. Indicators on the device show the days on which intercourse is most likely to result in pregnancy.

**10 (d)** The new device is much more effective than a previous method which involved using a thermometer under the tongue to measure body temperature before getting out of bed in the morning.

Explain why.

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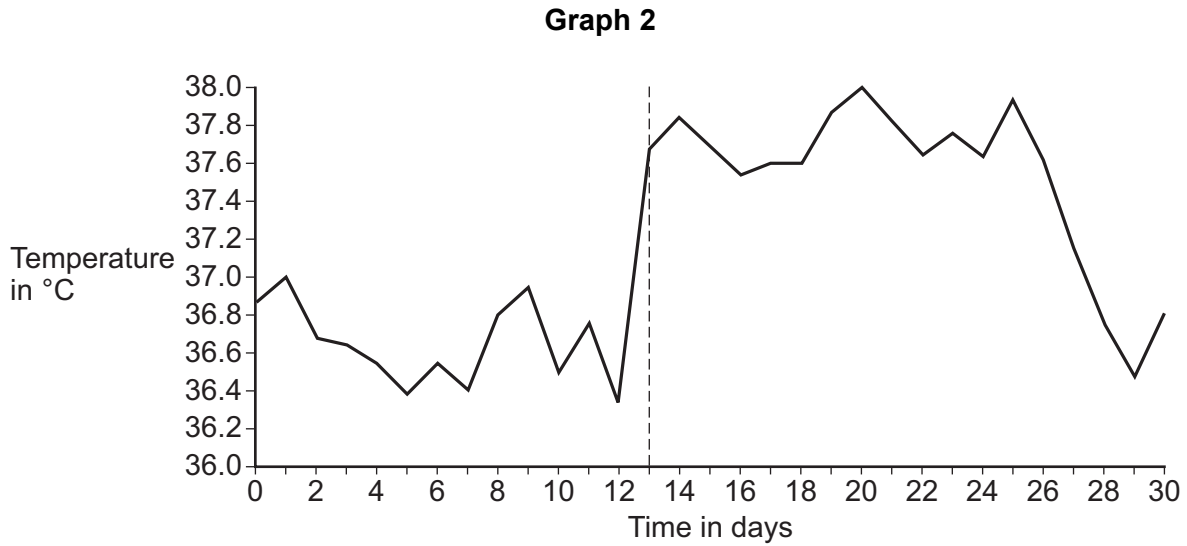
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*(2 marks)*



Data from the new device can be downloaded onto a PC and the data plotted on a graph.

**Graph 2** displays the data.



**10 (e)** The new device helps a woman to become pregnant.  
Use information from **Graph 1** and **Graph 2** to explain how.

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(3 marks)

**Question 10 continues on the next page**

**Turn over ▶**



**10 (f)** A couple who are opposed to other methods of contraception ask a gynaecologist about using the device to reduce the risk of pregnancy.

The gynaecologist tells them that it would be very risky to use the new device in this way.

Use information from **Graph 1** and **Graph 2** to explain why the gynaecologist gave this advice.

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(2 marks)

<b>18</b>

**END OF QUESTIONS**



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