| Centre Number | | | | | | Candidate Number | | | | |
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| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
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| 7 | |
| 8 | |
| TOTAL | |

General Certificate of Education
Advanced Level Examination
June 2011

# Applied Science SC14

## Unit 14 The Healthy Body

**Wednesday 22 June 2011 9.00 am to 10.30 am**

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

**Time allowed**
- 1 hour 30 minutes

**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.
- Show the working of your calculations.

**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You will be marked on your ability to
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.
- You are expected to use a calculator where appropriate.

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

**1** A sports coach wanted to improve the performance of his swimming team. He introduced special training exercises to increase the efficiency of their breathing.

Before starting the training, each member of the team used a spirometer to measure their initial breathing rate and tidal volume.

**1 (a) (i)** Describe how the spirometer should be used to obtain these data.

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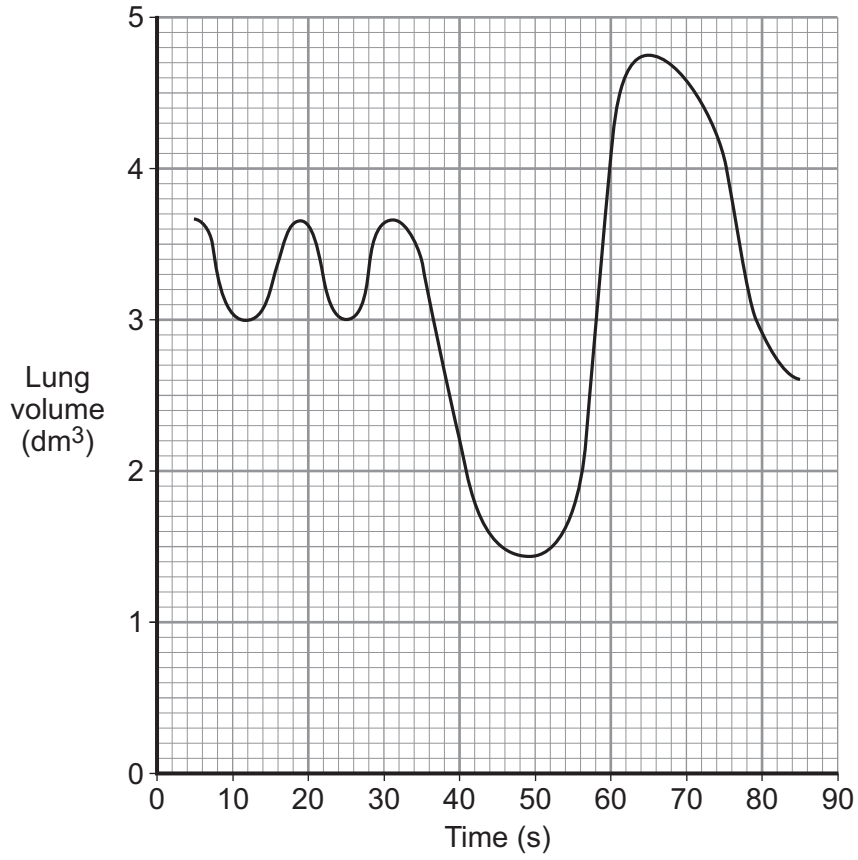
*(2 marks)*

One member of the team obtained the trace shown below.



**1 (a) (ii)** Use the trace to calculate the total volume of air that enters the team member's lungs in one minute.

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..... $dm^3\ min^{-1}$

*(2 marks)*

The coach explained that the training exercises would help to improve the strength of the diaphragm muscle.

**1 (b)** How does the diaphragm cause air to enter the lungs?

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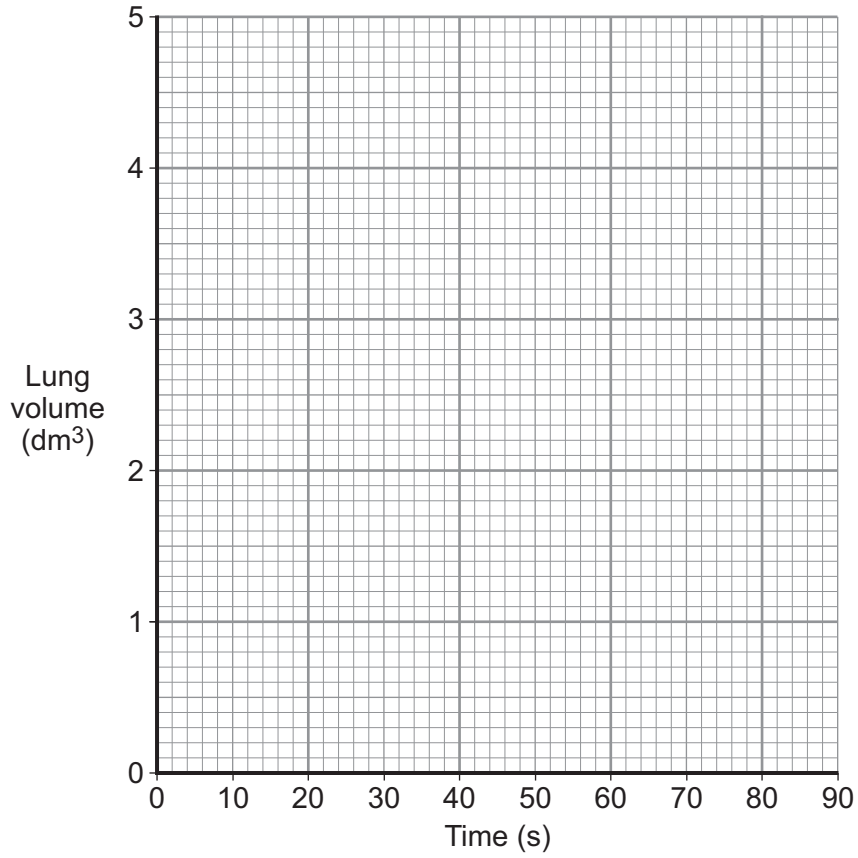
*(3 marks)*

**Question 1 continues on the next page**

After six weeks, the trainer repeated the spirometer tests to find out if the training had had any effect.

**1 (c)** On the graph below sketch the spirometer trace that you would expect to see if the exercises had improved the swimmer's breathing efficiency.




*(2 marks)*

**1 (d)** What would the team need to do throughout the six weeks to prove that any improvements in breathing efficiency were due to the special training exercises?

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*(3 marks)*

12

**Turn over for the next question**

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**ANSWER IN THE SPACES PROVIDED**

**2** A 19-year old student was spending some time in a hot, dry country. She was advised by a pharmacist to take salt tablets.

**2 (a)** Why did she need to include more salt (sodium chloride) in her diet in the hot, dry country than she did when at home in the UK?

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*(2 marks)*

**2 (b)** Select the value from those given which most closely corresponds to the level of sodium ions in mmol per litre, (mmol $l^{-1}$) in the blood of a healthy adult.

Put a tick in the correct box.

140 ☐ 1.4 ☐ 14.0 ☐ 14 ☐

*(1 mark)*

**2 (c)** The student used salt tablets to increase her intake of sodium ions, but she took more than the recommended dose.

Suggest **two** symptoms that she may have experienced as a result of the high sodium ion levels in her blood plasma.

1 .....

2 .....

*(2 marks)*

**2 (d)** How would her body have detected and removed the excess sodium ions?
In your answer, include details of the organ(s) and hormone(s) that regulate blood sodium ion levels.

You will be assessed on the quality of written communication in your answer to this question.

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*(5 marks)*

10

**Turn over for the next question**

**3** A nurse in an intensive care unit was looking after a child who was seriously ill. The nurse needed to monitor the level of oxygen in the child's blood.

**3 (a) (i)** Name the piece of equipment that the nurse should use.

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*(1 mark)*

**3 (a) (ii)** The reading from the equipment showed an oxygen saturation of 90%.
The equipment was accurate to ±2%.
Give the range of values within which the child's oxygen level actually lay.
Show your working.

Between .....% and .....%

*(2 marks)*

The level of oxygen in the child's blood was much lower than it should have been.

**3 (b) (i)** What would be the effect of a low level of oxygen on the amount of energy released in the child's body?

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*(1 mark)*

**3 (b) (ii)** Explain the effect that a very low level of oxygen would have on the process of respiration in the child's body.

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*(3 marks)*

**3 (c)** The nurse also measured the level of oxygen in the blood of a patient with emphysema.

Emphysema is a condition in which the walls of the alveoli become thicker and less elastic. The alveolar walls break down, reducing the number of alveoli, but increasing their size.

Explain the effect that emphysema would have on the level of oxygen in the blood of a person with the disease.

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*(3 marks)*

10

**Turn over for the next question**

**4** A health worker was showing a group of young mothers how they should brush their children's teeth.
The health worker wanted to ensure that the children's teeth did not decay so badly that they required extraction.

**4 (a)** What is the link between tooth decay and lack of regular brushing?

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*(1 mark)*

**4 (b)** Explain why poor dental hygiene causes the link that you have described.

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*(4 marks)*

**4 (c)** The health worker had recently read an article that suggested that dental decay in children had increased significantly over recent years. The table shows the number of children under the age of 17 who required hospital treatment for tooth extraction due to severe decay, in three different years.

| Year | Number of children admitted to hospital for tooth extraction in that year |
|---|---|
| 1997 | 20 000 |
| 2006 | 33 500 |
| 2008 | 36 000 |

**4 (c) (i)** Calculate the percentage increase in the number of children admitted for tooth extraction between 1997 and 2006.

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*(2 marks)*

**4 (c) (ii)** The scientists who carried out the study believed that it showed that tooth decay in children was increasing rapidly.
Critics of the study thought that this conclusion may not be justified.

Fully explain **two** aspects of the data in the table that could lead to the conclusion being considered unreliable.

1 .....

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2 .....

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*(2 marks)*

**4 (d)** Many older people lose their teeth because of gum disease, rather than tooth decay. How can gum disease be prevented?

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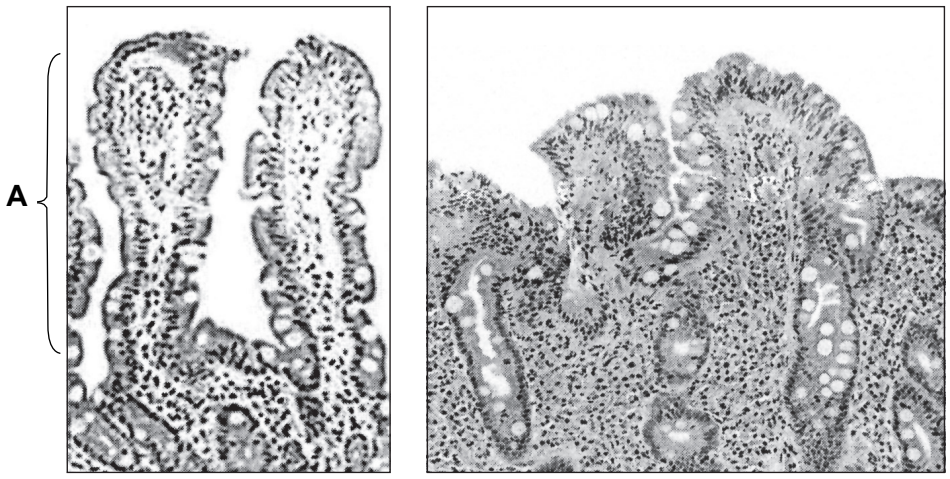
*(1 mark)*

**Turn over for the next question**

10

**5** A patient with suspected coeliac disease (CD) was undergoing a biopsy. A small piece of the intestine wall was removed and examined.
The diagram shows the appearance of a normal intestine wall compared to the intestine wall of a coeliac sufferer.

The photographs are both to the same scale.




Normal intestine wall  Coeliac intestine wall

**5 (a) (i)** Identify the structures labelled **A** on the diagram of the normal intestine wall.

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*(1 mark)*

**5 (a) (ii)** Describe the differences between the normal and coeliac intestines that are visible in the diagrams.

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*(2 marks)*

**5 (a) (iii)** Patients with CD have difficulty in absorbing digested food.
Use information from the diagrams to explain why.

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*(2 marks)*

**5 (b)** Rotavirus causes diarrhoea in young children. It is possible that children who have been infected several times with rotavirus are more likely to develop CD.
A research assistant is investigating the link between rotavirus infection and CD.
What key points must he consider when he plans his investigation?

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*(3 marks)*

8

**Turn over for the next question**

**6** The manufacturer of a new type of spread claimed that, when used instead of butter, the spread could lower blood cholesterol levels. A hospital dietician was trying to decide if the benefits of the new spread justified the expense of providing it for all of the hospital's patients.

**6 (a) (i)** Describe **one** way in which the blood cholesterol level can be measured.

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*(2 marks)*

**6 (a) (ii)** State the range within which a normal value for blood cholesterol should lie.

.....mmol per litre

*(1 mark)*

**6 (b)** Suggest the health benefits for the hospital patients if they use a cholesterol-lowering spread instead of butter.

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*(2 marks)*

**6 (c)** Providing the spread increased the cost of feeding each patient by 25p each day.
The hospital has to feed, on average, 500 patients each day.
A year is 365 days long.

**6 (c) (i)** How much extra will it cost the hospital to provide the spread for all its patients for a year?

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*(1 mark)*

**6 (c) (ii)** The hospital treats on average 25 000 patients each year.
During the year, on average, 30% of patients in the hospital receive drugs to lower their blood cholesterol levels. The cost of a cholesterol-lowering drug is £152.00 for each patient each year.

How much does it cost per year to provide cholesterol-lowering drugs to the patients who need them?

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*(1 mark)*

**6 (c) (iii)** The hospital dietician decided against using the new spread. Many of the medical staff disagreed with her.

Suggest **two** reasons that the medical staff could have given in support of their argument for using the new spread.

1 .....

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2 .....

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*(2 marks)*

**6 (d)** Give **one** other dietary change that the hospital dietician could make that would help to improve the cardiovascular health of her patients.

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*(1 mark)*

**10**

**Turn over for the next question**

**7** A dietician was working in a town that had been declared a health action zone. One of his objectives was to increase the amount of fresh fruit and vegetables eaten by children who are 5 to 11 years old.

**7 (a)** What are the current guidelines on the amount of fruit and vegetables needed for good health?

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*(1 mark)*

The dietician carried out a survey to find out how much fresh fruit the children in the town were eating. The results of the survey are given in the table.

| **Average number of pieces of fruit eaten each day** | 0 | 1 | 2 | 3 | 4 | 5+ |
|---|---|---|---|---|---|---|
| **Percentage of children in the survey eating that amount of fruit** | 12 | 54 | 28 | 4 | 2 | 0 |

The dietician concluded that the schoolchildren were eating an unhealthy diet.

**7 (b)** Critically evaluate this conclusion.

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*(4 marks)*

The mothers of children in this age range were offered the opportunity to learn more about the dietary needs of their children.

**7 (c)** What would the dietician have said to explain to the mothers why certain foods are important for their children?

You will be assessed on the quality of written communication in your answer to this question.

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*(5 marks)*

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**Turn over for the next question**

**8** A nurse at a health centre was giving a student advice about how to manage his diabetes.
She told him that it was important to monitor his blood glucose level regularly.

**8 (a) (i)** Explain why it is important that a diabetic should regularly monitor their blood glucose level.

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*(2 marks)*

**8 (a) (ii)** Describe **one** simple method that the student could use to measure his blood glucose level.

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*(1 mark)*

**8 (b)** The student's blood glucose level must be kept as constant as possible. The nurse advised him that he should take special care with his diet. What would the nurse suggest to help him to do this?

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*(3 marks)*

The nurse explained that blood glucose level is controlled by hormones.

**8 (c)** Write a clear explanation of how hormones regulate the level of glucose in the blood of a healthy person.

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*(4 marks)*

10

**END OF QUESTIONS**

**There are no questions printed on this page**

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