

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education  
Advanced Level Examination  
June 2010

# Applied Science

# SC14

## Unit 14 The Healthy Body

Thursday 17 June 2010 1.30 pm to 3.00 pm

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a pencil and a ruler</li> <li>• a calculator.</li> </ul>
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### 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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

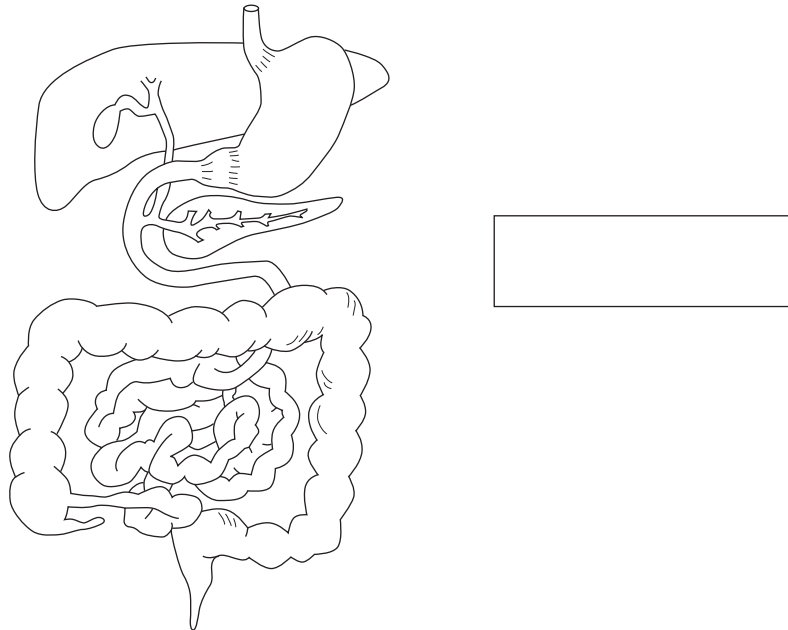


J U N 1 0 S C 1 4 0 1

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

- 1** A student visited her local health centre complaining of abdominal pain. After examining the student, a doctor decided that her problem was caused by constipation. This is a condition in which the faeces become unusually dry and hard, and are then difficult to move down the gut and out of the body.

**The human digestive system**



- 1 (a) (i)** In the box above, write the name of the structure in which faeces are stored before their removal from the body.  
Draw a line from the box to the structure you have named. (2 marks)

- 1 (a) (ii)** What happens to the material in the gut as it passes through the large intestine?

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 .....  
(2 marks)

- 1 (b) (i)** Describe how muscles work to move food along the gut.

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



1 (b) (ii) Fibre is mostly cellulose, an insoluble material found in plants. The human body cannot digest cellulose. Cellulose can absorb a significant amount of water. Suggest why foods that have a high fibre content make it easier for the muscles of the digestive system to function properly.

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.....

(2 marks)

1 (c) The doctor advised the student to make two significant changes to her diet in order to prevent the constipation from recurring.

Suggest what these **two** changes would have been.

1 .....  
2 .....

(2 marks)

1 (d) Vegans, whose diet contains no foods of animal origin at all, rarely suffer from constipation, but may have other difficulties maintaining a healthy diet.

Suggest what **two** of these difficulties are likely to be.

1 .....  
2 .....

(2 marks)

Turn over for the next question

12

Turn over ▶



**2** An aid worker in a refugee camp needed to monitor the levels of various vitamins in the refugees. This was to help supply the refugees with dietary supplements in the correct amounts to keep them healthy.

**2 (a) (i)** Describe how the level of vitamin D in a person may be detected.

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.....  
.....  
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*(2 marks)*

**2 (a) (ii)** State a value that could have been obtained if the test result was within the normal range for the level of vitamin D.

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*(1 mark)*

**2 (b) (i)** The aid worker found that vitamin D deficiency was more common in people whose clothing covered almost all of their bodies. Explain this observation.

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.....

*(2 marks)*

**2 (b) (ii)** Many of the children in the refugee camp showed symptoms of prolonged vitamin D deficiency. Describe the symptoms of vitamin D deficiency.

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.....

*(1 mark)*



2 (b) (iii) Explain how a shortage of vitamin D in the diet would cause these symptoms.

.....

.....

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(2 marks)

8

Turn over for the next question

Turn over ▶





**3 (c)** One of the residents snacked frequently on sugary sweets, biscuits and cakes. The student explained to the resident that his diet could lead to serious health problems. What would the student have said in her explanation?

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(3 marks)

10

**Turn over for the next question**

**Turn over ▶**



**4** A rowing coach was explaining the benefits of inspiratory muscle training (IMT) to a group of rowers.  
By improving the strength of the muscles responsible for inspiration (breathing in), he suggested that the rowers would be able to row more powerfully and tire less quickly.

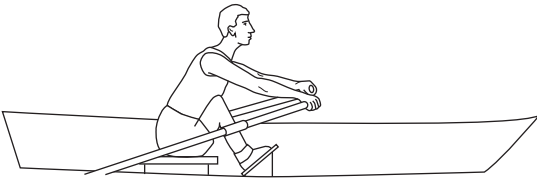
**4 (a) (i)** Name the muscles of the chest wall that contract during inspiration.

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*(1 mark)*

**4 (a) (ii)** Explain why the contraction of these muscles causes air to enter the lungs.

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.....  
*(3 marks)*

**4 (b) (i)** The diagram shows the position of a rower's body at the point of the stroke when he takes a breath.



Suggest why breathing in deeply is difficult when the rower is in this position.

.....  
.....  
.....  
.....  
*(2 marks)*





**4 (b) (ii)** Improving the strength of the muscles of the chest wall significantly reduced the levels of lactic acid in the blood of the rowers.  
Explain why this should be so.

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(3 marks)

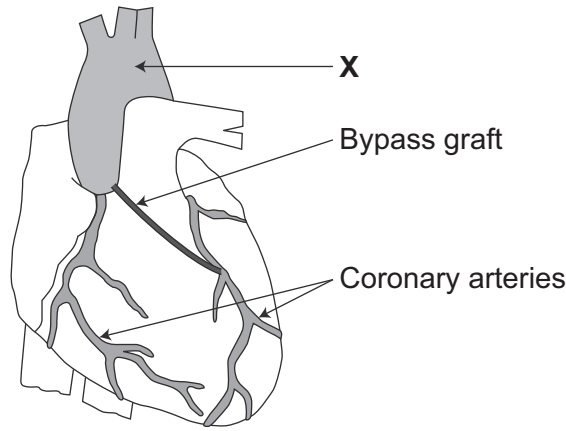
9

**Turn over for the next question**

**Turn over ▶**



**5** A nurse was explaining the principles of a coronary bypass operation to the family of a middle-aged man who was about to undergo the procedure. She showed them this diagram of a piece of blood vessel grafted between two blood vessels in order to bypass a blockage in one of the vessels supplying the heart muscle.



**5 (a) (i)** Name blood vessel **X**.

.....  
(1 mark)

**5 (a) (ii)** On the diagram, draw a line pointing to the most likely position of the blockage.

(1 mark)

**5 (a) (iii)** What would the nurse say to the family to explain why the bypass operation would improve the health of the patient?

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

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(5 marks)



**5 (b) (i)** The nurse also used a cholesterol meter to measure the man's blood cholesterol level. Explain the advantage of using a cholesterol meter rather than a dipstick.

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(2 marks)

**5 (b) (ii)** The man was found to have a fasting total cholesterol level of 8.4. Discuss how this value compares to normal levels.

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(2 marks)

<b>11</b>

**Turn over for the next question**

**Turn over ▶**



**6** A group of students carried out an investigation into the effect of caffeine on their urine output.  
For every kilogram of their body mass, each student drank  $10\text{ cm}^3$  of a caffeine solution. Each  $10\text{ cm}^3$  contained 5 mg of caffeine. They then measured their urine output over the following 2 hours.

**6 (a) (i)** Give **three** factors that should have been considered when selecting the group of students so that the data obtained would be as valid as possible.

1 .....

2 .....

3 .....

(3 marks)

**6 (a) (ii)** Suggest why the students drank  $10\text{ cm}^3$  of the caffeine solution per kilogram of their body mass, rather than them all drinking the same volume.

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(2 marks)

**6 (b)** The following week the students repeated the investigation in exactly the same way but this time the solution contained a placebo (a substance that has no effect) instead of caffeine.

What was the purpose of this second investigation?

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.....

(2 marks)

**6 (c)** The results for one of the students are given in the table.

	Cumulative urine output / $\text{cm}^3$			
	After 30 minutes	After 60 minutes	After 90 minutes	After 120 minutes
With caffeine	250	650	750	800
With placebo	100	250	600	800



6 (c) (i) Calculate the difference in the rate of urine output (in  $\text{cm}^3 \text{min}^{-1}$ ) between the caffeine treatment and the placebo during the first 60 minutes.

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(2 marks)

6 (c) (ii) Use the data in the table on **page 12** to draw conclusions concerning the effect of caffeine on urine output.

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.....  
.....

(2 marks)

6 (c) (iii) It was later suggested that the results of the experiment would have been more accurate if the caffeine had been administered to the students by injection rather than by being ingested. The students would also drink the same volume of water as liquid drunk in the original experiment.

Explain why injecting the caffeine would have made the results more accurate.

.....  
.....

(1 mark)

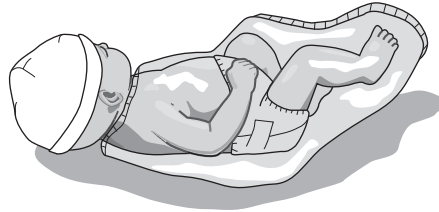
6 (d) What ethical considerations should be made when considering the design of an experiment of this sort, that involves human volunteers?

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.....

(2 marks)



- 7** A significant factor in the death of premature babies is hypothermia. In an effort to reduce this risk a doctor devised a “mini sauna”, a plastic bag into which the baby is put immediately after birth. This reduces the rate of evaporation of water from the baby’s skin and so makes hypothermia less likely.



- 7 (a)** Explain why water evaporating from the surface of the baby’s skin is likely to cause hypothermia.

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(2 marks)

- 7 (b) (i)** Nurses often need to monitor the level of oxygen in a baby’s blood.

Name a suitable piece of equipment that could be used to monitor the level of oxygen in a very small baby’s blood.

Explain the reason for your choice.

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(2 marks)

- 7 (b) (ii)** How should oxygen saturation of blood be written?

.....

(1 mark)

- 7 (b) (iii)** When a molecule of haemoglobin is fully saturated, how many atoms of oxygen is it carrying?

.....

(1 mark)



**7 (c)** The doctor who developed the “mini sauna” claimed that it reduced the death rate among premature babies by 30%.

54 premature babies died in a three-month period. If the mini-sauna had been in use, how many lives would have been saved each month, on average, if his claim was correct?

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.....

.....

(3 marks)

<b>9</b>

**Turn over for the next question**

**Turn over ▶**



**8** A middle-aged woman was diagnosed as having gallstones. This is a condition in which the gall bladder is unable to release bile into the digestive tract because of blockages caused by deposits of cholesterol.  
One of the symptoms of the woman’s condition was serious abdominal pain when she ate foods with a high fat content.

**8 (a) (i)** A nurse at a health centre gave the woman some information about the way in which her body uses bile.  
What would the nurse have said as an explanation of the role of bile in the digestion of fats?

.....  
.....  
.....

(2 marks)

**8 (a) (ii)** Bile also helps to control the pH in the intestine.  
Explain why it is important that the pH of the intestine is kept within narrow limits.

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.....  
.....

(3 marks)

**8 (b)** Without an adequate amount of bile entering her intestine, the woman was unable to digest her food properly. The nurse recommended that she avoided certain foods until after she underwent an operation that would remove the gallstones.

From the list below, identify **two** foods that the nurse would recommend that the woman should avoid, and suggest a replacement for each that would provide similar amounts of the other food groups present. Write your answers in the table.

- |                           |                                   |                       |                   |
|---------------------------|-----------------------------------|-----------------------|-------------------|
| Steamed rice;<br>chicken; | full-fat cheese;<br>double cream; | bacon;<br>naan bread; | fish;<br>bananas. |
|---------------------------|-----------------------------------|-----------------------|-------------------|

Food to be avoided	Replacement

(2 marks)

7
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**END OF QUESTIONS**

