Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Education
Advanced Level Examination
January 2011

Applied Science SC14

Unit 14 The Healthy Body

Wednesday 2 February 2011 1.30 pm to 3.00 pm

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.

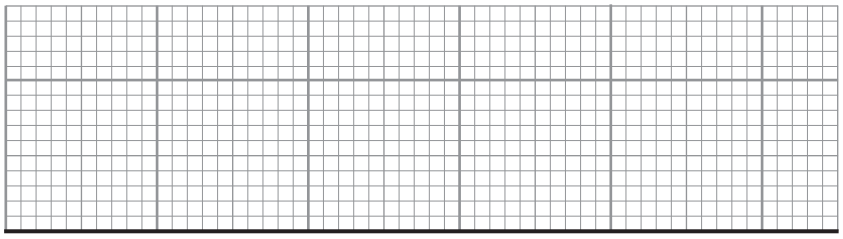
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You will be marked on your ability to
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.
- You are expected to use a calculator where appropriate.

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

1 A pharmacist was asked by a female customer for some advice about chest pain. The customer believed the pain was caused by indigestion. The pharmacist suspected that the customer might have a heart condition. The pharmacist suggested that the customer should visit a doctor.

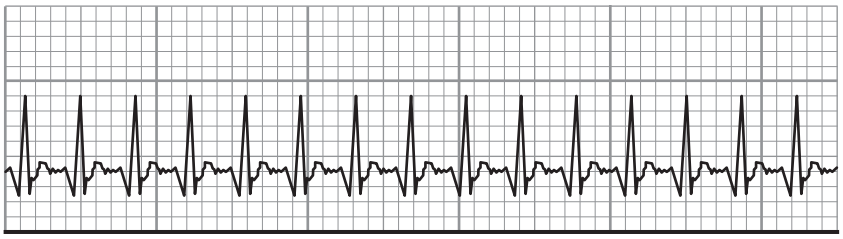
The doctor carried out an electrocardiogram (ECG) on the woman.

1 (a) (i) Sketch the kind of trace on the section of graph grid below that you would expect to see if the woman were suffering from ventricular fibrillation.



(1 mark)

1 (a) (ii) The ECG trace below shows the pattern of electrical activity of a healthy heart during the cardiac cycle.



Describe the sequence of events that take place during a single cardiac cycle.

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(5 marks)

1 (b) (i) After visiting her doctor, the woman returned to the pharmacy with a prescription for some medication for a heart condition.
The pharmacist told the woman that the medication dilated the blood vessels that supply the heart muscle.

Why would dilation of these blood vessels reduce her chest pain and other symptoms?

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(2 marks)

1 (b) (ii) The development of the medication prescribed for the woman's condition involved a clinical trial using a group of volunteers.

Describe **one** ethical issue that may arise when human subjects are used in clinical trials.

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(1 mark)

1 (b) (iii) How should the issue you have described be addressed?

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(1 mark)

10

Turn over for the next question

2 A middle-aged man was relaxing after a round of golf when he began to find it difficult to speak clearly and could not raise his right arm. The club's first aider thought that the man's symptoms could have been caused by a stroke.

A stroke can be caused by a blood clot in one of the blood vessels in the brain.

2 (a) Suggest why a stroke prevents the brain from functioning correctly.

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(2 marks)

2 (b) Give the symbol equation for the reaction which releases energy inside brain cells.

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(2 marks)

2 (c) (i) Name the blood vessels from which oxygen and glucose pass into cells.

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(1 mark)

2 (c) (ii) Describe the structure of these blood vessels.

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(2 marks)

2 (d) The first aider explained to the man's friends why certain lifestyle choices would help them to reduce their own risk of having a stroke.

Use your knowledge of how diet and other named factors affect the cardiovascular system to suggest what the first aider might have told them.

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

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(5 marks)

12

Turn over for the next question

3 Thirty female college students wanted to find out if taking vitamin C would help them to avoid catching influenza (flu).

They also wanted to find out if extra vitamin C in their diet was more effective than extra vitamin C taken in tablet form.

The students were divided into three groups.

- 10 students took one 500 mg vitamin C tablet each day.
- 10 students added two large oranges (about 500 mg vitamin C) to their diet each day.
- 10 students continued to eat their normal diet with no extra vitamin C.

None of the students were smokers. Apart from the extra oranges eaten by some, they all ate roughly the same diet as each other during the investigation.

They continued their investigation for six weeks.
During this time each student kept a count of the number of days on which they experienced flu-like symptoms.

At the end of six weeks, the students collected all their data in a table. Each student from each group recorded how many days she had flu-like symptoms.

	Number of days on which flu-like symptoms were experienced by each student		
Student	**Group who took vitamin C tablets**	**Group who ate the extra oranges**	**Group who took no extra vitamin C**
1	1	0	3
2	1	0	1
3	1	3	1
4	0	14	3
5	5	0	1
6	0	10	1
7	3	2	1
8	2	1	1
9	1	0	1
10	1	1	2

3 (a) (i) From the description of the investigation, give **two** factors that helped to ensure that the results were reliable.

1 .....

2 .....

(2 marks)

3 (a) (ii) From the description of the investigation, give **one** factor that could make the results unreliable.

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(1 mark)

3 (b) (i) One of the students claimed the extra oranges gave better protection against flu than the vitamin C tablets.

What data in the table on **page 6** supports this argument?

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(1 mark)

3 (b) (ii) Critically evaluate how effective each source of vitamin C is in protecting the students against the flu virus. Use calculations to support your argument.

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(4 marks)

3 (c) What did the third group of students, who did not take any extra vitamin C, contribute to the investigation?

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(1 mark)

9

4 A technician was working in a hospital pathology laboratory. Part of his job involved the culture of cells from samples to determine whether they were normal or diseased.

The cells were kept in conditions as close as possible to those in the human body.

4 (a) (i) How does the human body ensure that its cells are kept in a suitable environment?

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(2 marks)

4 (a) (ii) The technician cultured some cells at a pH value of 7.85 by mistake.
Compare this value to the normal range of blood pH.

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(1 mark)

4 (b) (i) The technician was asked to make up a nutrient solution in which the cells would grow.

- Each culture would require 12 cm^3 and he would have to make enough solution for 120 cultures.
- He was provided with a concentrated stock nutrient solution that contained 20% nutrient.
- The cell culture needed to be made up in 1% nutrient solution.

Describe how the technician should use the stock solution to make up enough solution at the correct 1% concentration.

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(3 marks)

4 (b) (ii) Suggest **two** other conditions, excluding pH and nutrient levels, that the technician will need to control if the cells are to grow successfully.

For each of these conditions explain why it is important that it is maintained at a constant level.

Condition .....

Explanation .....

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Condition .....

Explanation .....

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(4 marks)

4 (b) (iii) The technician monitored the conditions in the cultures throughout the experiment. Explain why this was essential if the cells were to grow normally.

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(2 marks)

12

Turn over for the next question

5 A fitness instructor was explaining to one of her clients why muscles may become painful during vigorous exercise.

5 (a) (i) Name the substance that builds up in muscles during a period of very strenuous exercise.

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(1 mark)

5 (a) (ii) In which part of the cell does the reaction that produces this substance take place?

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(1 mark)

5 (b) The client told the fitness instructor that she was recovering from a prolonged attack of myalgic encephalopathy (ME). This is a condition in which a person suffers from extreme fatigue. Recent studies have shown that this condition is sometimes linked to faults in the electron transport chains in the mitochondria.

Use your knowledge of the function of electron transport chains to explain why people with ME feel exhausted even when they are doing very little.

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(3 marks)

5 (c) (i) The fitness instructor also advised the client about the need to maintain a healthy level of cholesterol in the blood.

Draw a ring around the value for total fasting cholesterol that lies within the normal range for an adult.

5.4 mol litre^{-1} **54 mmol litre^{-1}** **5.4 mmol litre^{-1}** **54 mol litre^{-1}**

(1 mark)

5 (c) (ii) The client's total fasting cholesterol level was found to be well below the normal range. What health effects might this have if the level remained continually low?

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(2 marks)

5 (d) The client regularly attended a clinic where her fasting cholesterol level was measured using a cholesterol meter.
Explain why the clinic used the cholesterol meter rather than a dipstick test.

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(2 marks)

10

Turn over for the next question

6 An 18-year-old student of Applied Science was a promising gymnast. She was able to use her knowledge to make decisions regarding her nutrition during training and before competitions.

The student knew that specific foods were required for good muscle development and energy.

6 (a) (i) Name the food group that is required for good muscle growth.

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(1 mark)

6 (a) (ii) Give **one** example of a food that provides a large amount of energy.

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(1 mark)

6 (b) (i) The gymnast's trainer told her that she should take in 110 kJ of energy per kg of body weight each day.

The gymnast's weight was 48 kg.
What was her weekly energy requirement?

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..... kJ

(1 mark)

6 (b) (ii) The gymnast was aware that she should have as little body fat as possible to perform well in her sport. To keep her weight as low as possible, she ate too little food to provide the energy that she needed.

State and explain **one** health problem, other than a lack of energy, that the gymnast was likely to experience if she continued to eat too little food to provide the energy she needed.

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(2 marks)

6 (c) The trainer decided to measure the gymnast's basal metabolic rate (BMR).

Describe how the trainer could have determined the gymnast's BMR in a specialised laboratory using a direct method.

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

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(5 marks)

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Turn over for the next question

7 A school nurse thought that one of the Year 2 children was showing signs of type 1 diabetes.
She mentioned her concern to the child's mother, who took the child to the doctor.
A dipstick test showed that there was glucose in the child's urine.

7 (a) (i) The child underwent a full glucose tolerance test, and was found to have a fasting glucose level of 9.5 mmol litre^{-1}.

Explain the significance of this result.

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(2 marks)

7 (a) (ii) Suggest **one** of the signs that could have alerted the school nurse to the possibility that the child had diabetes.

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(1 mark)

7 (b) The child's mother did not understand why the child was ill and was concerned that her other children might catch diabetes from the affected child.

What could the school nurse have said to explain the cause of the child's diabetes and to reassure the mother that her other children could not catch it?

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(3 marks)

7 (c) The child's treatment required an injection of her medication several times each day. The medication supplied a protein molecule that the child's body was not making for itself.

The child's mother was very unhappy about this. The school nurse explained that it was not possible to take the medication in tablet form.

Why is this type of medication ineffective if taken as tablets?

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(2 marks)

8

Turn over for the next question

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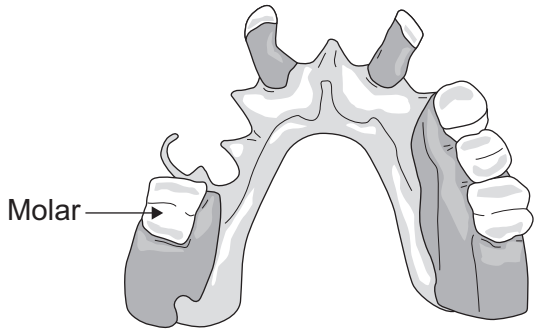
ANSWER IN THE SPACES PROVIDED

8 A dental technician was making a dental plate for a patient who had had several of his teeth extracted. The plate contained false teeth to replace the ones that had been lost.



8 (a) (i) There are three different types of teeth on the plate. One type has been labelled as an example.
On the diagram above, add labelled lines to identify the other two types of teeth.
(2 marks)

8 (a) (ii) The technician made sure that the surface of the false molar had the same shape as the top surface of the original tooth.

Why was it important to do this?

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(1 mark)

Question 8 continues on the next page

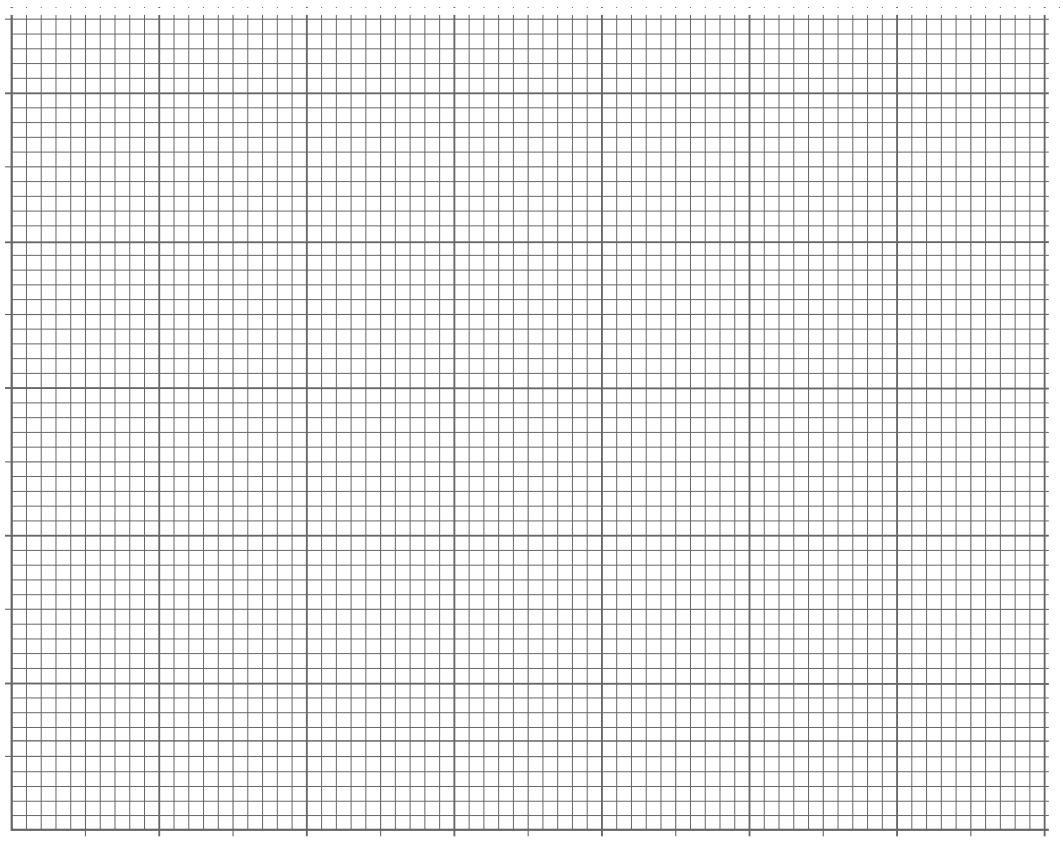
8 (b) The technician was investigating the most effective way of cleaning dental plates.

A dental plate was brushed for different lengths of time after eating, and then the amount of food debris left behind was measured.

The results of the investigation are given in the table.

Time spent brushing (seconds)	**Food debris remaining after brushing (µg)**
0	450
5	300
10	220
30	100
45	65
60	50

8 (b) (i) On the grid below, plot these data using appropriate scales.



(3 marks)

8 (b) (ii) Use these results and your knowledge of how tooth decay takes place to explain how and why people with some false teeth should clean their dental plates.

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(3 marks)

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END OF QUESTIONS

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