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	
TOTAL	

General Certificate of Education
Advanced Level Examination
January 2012

Applied Science SC14

Unit 14 The Healthy Body

Monday 30 January 2012 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** questions in the spaces provided.

1 Many patients staying in hospital often have to have their blood oxygen levels monitored by healthcare professionals.

1 (a) (i) Name the piece of equipment used to monitor the levels of oxygen in a patient's blood. State why this is a useful way of measuring the levels of oxygen in the blood.

Equipment.....

Reason.....

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(2 marks)

1 (a) (ii) What unit is used when measuring oxygen saturation in a patient's blood?

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(1 mark)

1 (a) (iii) How many oxygen molecules is a haemoglobin molecule carrying when it is fully saturated?

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(1 mark)

1 (b) People with cystic fibrosis produce excess mucus in their airways. Explain why people with cystic fibrosis have a reduced level of oxygen saturation in their blood.

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(2 marks)

1 (c) (i) What is the normal range of blood pH?

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(1 mark)

1 (c) (ii) A patient leaving hospital is encouraged to exercise regularly by his physiotherapist. During exercise, the blood pH value can fall. Explain why.

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(2 marks)

1 (c) (iii) Respiratory acidosis is a term used when the pH of the blood falls due to disease. Suggest a disease that may cause respiratory acidosis.

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(1 mark)

10

Turn over for the next question

2 A 79 year old man decides to research his family history. He discovers that his brother died as a baby in the 1930s from rickets. On further research he learns that rickets can be caused by a lack of vitamin D in the body.

2 (a) (i) What is the main symptom of rickets?

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(1 mark)

2 (a) (ii) What is the normal level of vitamin D in the blood?

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(1 mark)

2 (a) (iii) Describe how vitamin D levels in the body are measured.

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(2 marks)

2 (a) (iv) Give **two** examples of foods that are an important source of vitamin D.

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(2 marks)

2 (a) (v) Apart from diet, how else can the body obtain vitamin D?

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(1 mark)

2 (b) The man is concerned about his health now that he is getting older. He decides to keep a diary of the food he eats during the week just before he visits the doctor for a check up.

The table shows the food eaten by the man in a typical day, and its nutritional content.

Meal	Food	Mass (g)	Energy (kJ)	Protein (g)	Fat (g)
Breakfast	Crumpets	50	460	4.5	0.9
	Margarine	20	520	0.0	14.0
	Jam	20	218	0.0	0.0
	Coffee/milk	25	70	0.8	0.9
Lunch	Brown bread	50	460	4.5	0.9
	Cheese	30	510	7.6	10.3
	Tea/milk	25	70	0.8	0.9
Dinner	Fish	100	834	19.6	10.3
	Chips	100	990	3.8	9.0
	Mushy peas	50	24	2.5	0.0
	Tea/milk	25	70	0.8	0.9

2 (b) (i) The recommended daily allowance (RDA) of energy for a 79 year old man is 9930 kJ. How much more energy should this man be taking in to reach his RDA?

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(1 mark)

2 (b) (ii) The World Health Organisation recommends that no more than 30% of a person's energy should come from fats in the diet.

100 g of fat provides 3500 kJ of energy.

What percentage of the man's energy comes from fat?

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(2 marks)

2 (b) (iii) The typical day's diet in the table provides sufficient protein for the 79 year old man but would not be sufficient for a 15 year old.

Why do teenagers need more protein than the elderly?

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(2 marks)

12

3 (a) (i) Blood glucose concentration is regulated by two hormones, insulin and glucagon. Both these hormones are produced in the Islets of Langerhans.
Complete the table to show the precise source of each hormone and its role.

Hormone	Source	Role
Insulin		
Glucagon		

(2 marks)

3 (a) (ii) Diabetes is a disease that can lead to an increase in blood glucose concentration. Some diabetics need insulin injections.

Insulin is a protein so it cannot be taken orally. Explain why.

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(1 mark)

3 (a) (iii) A woman was suspected of having diabetes. What symptoms might she show?

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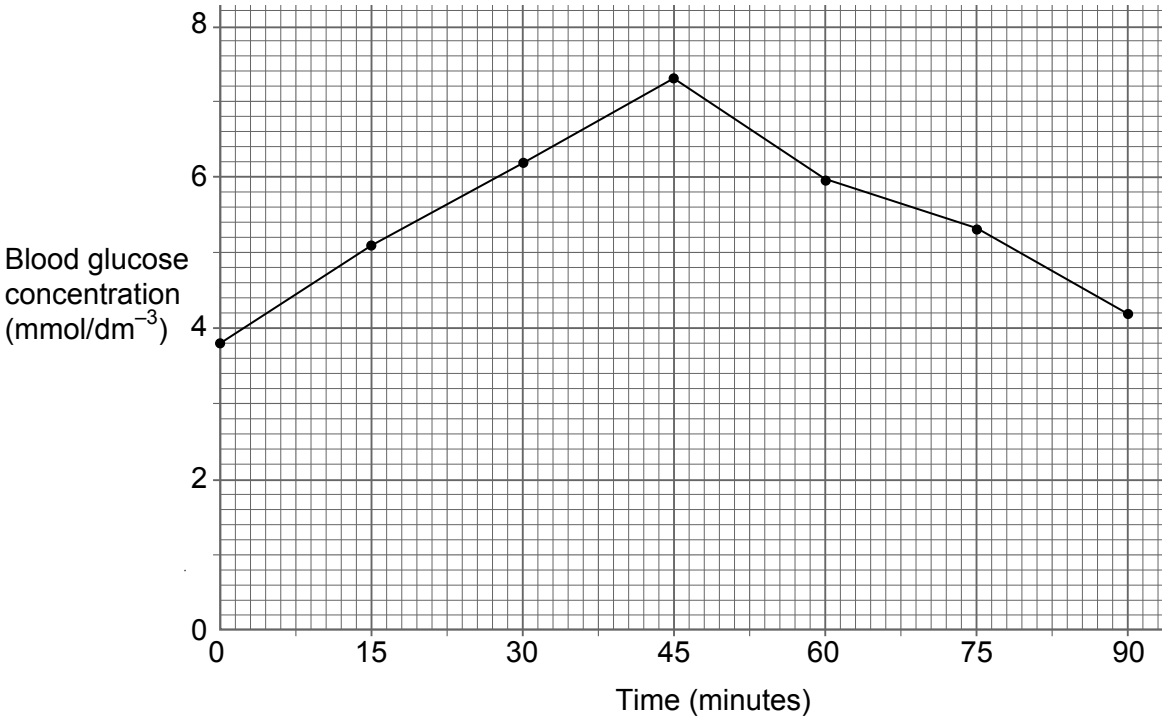
(2 marks)

Question 3 continues on the next page

3 (b) A doctor decided to give the woman a glucose tolerance test. This was done by a healthcare worker. The woman was given a solution of glucose to drink and her blood glucose concentration was measured regularly over the next 90 minutes. The results are shown in the graph.



3 (b) (i) The doctor concluded that the woman did **not** have diabetes. Explain how the graph supports this diagnosis.

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(2 marks)

3 (b) (ii) Explain how processes in the body produced the results shown in the graph.

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(2 marks)

3 (b) (iii) A man is diagnosed with Type II diabetes and is advised to control this by adapting his diet and lifestyle. His healthcare worker suggests many changes.
Two suggestions were:

Suggestion 1: Replace refined sugars with complex carbohydrates.

Suggestion 2: Increase the amount of cardiovascular exercise taken.

Explain why the healthcare worker made these suggestions.
You will be assessed on the quality of written communication in your answer.

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(5 marks)

14

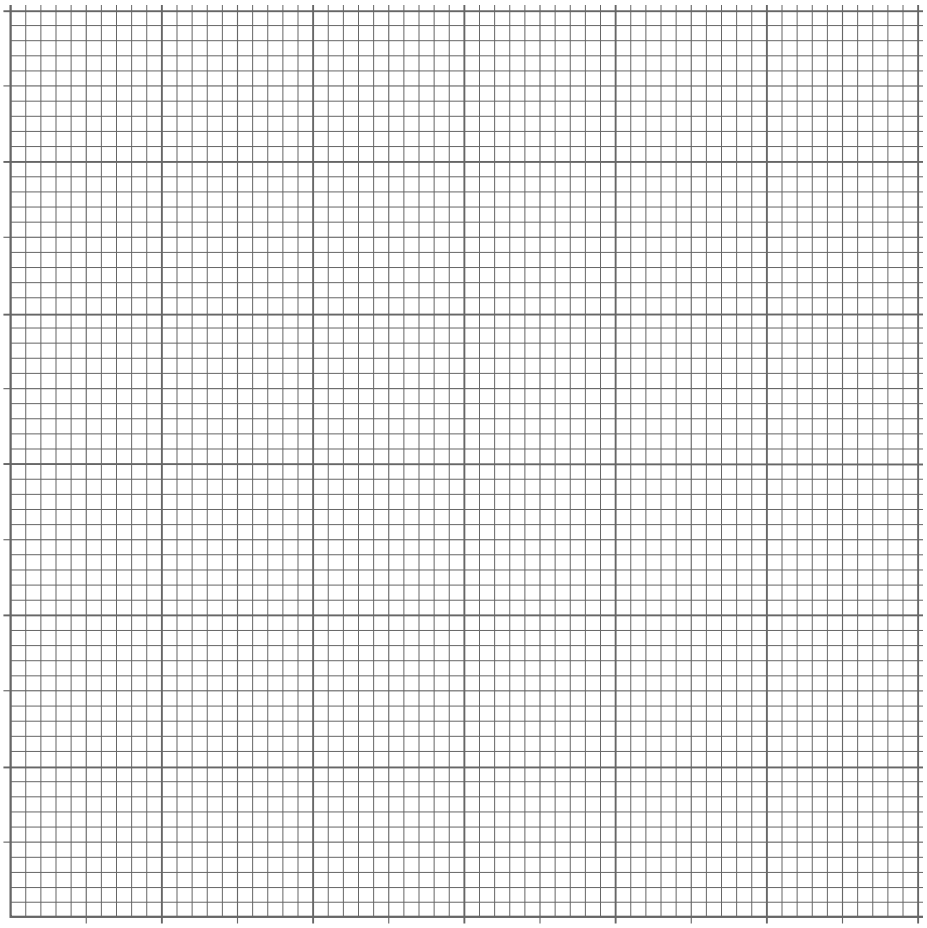
Turn over for the next question

4 Digestion occurs in the small intestine. A research scientist investigated the activity of lipase, one of the enzymes found in the small intestine. She did this by adding lipase enzyme to some milk in a test tube. The test tube was checked every minute and the time it took for the lipids in the milk to be digested was recorded. The table below shows the results of experiments carried out at different pH values. All other variables were controlled.

pH	Time taken for digestion/minutes
5	20
6	16
7	5
8	2
9	7
10	14
11	23

4 (a) (i) Construct a graph and plot the results of the experiment on the grid below. Draw a line of best fit.

Time/ minutes



pH

(3 marks)

4 (a) (ii) Explain what the graph indicates about the effect of pH on lipase activity.

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(2 marks)

4 (b) (i) Describe how you would carry out a similar experiment to investigate the effect of temperature on lipase activity.

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(4 marks)

4 (b) (ii) State the precautions you would take to ensure your results were reliable and accurate.

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(3 marks)

4 (c) Lipase activity can be increased by the presence of bile salts.
Explain how bile salts increase lipase activity in the small intestine.

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(2 marks)

14

5 *Campylobacter jejuni* is a bacterium. It causes one of the most common forms of diarrhoea in humans. In rare cases, the nervous system may be affected and this can lead to paralysis of the diaphragm. Breathing difficulties result and the patient may die.

5 (a) Explain how paralysis of the diaphragm will lead to breathing difficulties.

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(2 marks)

5 (b) The diarrhoea caused by the bacterium is caused when water is not reabsorbed during the process of digestion. In which part of the digestive system is water mainly absorbed?

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(1 mark)

5 (c) A patient admitted into hospital with severe *Campylobacter* food poisoning has his urine output measured. His urine output was found to be below normal. The doctor explained that this was due to dehydration from the diarrhoea and the action of a particular hormone.

Name the hormone involved and explain why the action of this hormone caused the man to have a below average urine output.

Hormone .....

Explanation .....

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(3 marks)

5 (d) On the next ward, a man is admitted with asbestosis. Asbestosis is a lung disease caused by inhaling asbestos fibres. In this condition, lungs become scarred and fibrous and this reduces the lung elasticity and thickens the alveoli. The main symptom is shortness of breath.

5 (d) (i) Suggest how reduced elasticity of the lungs causes difficulty in breathing.

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(1 mark)

5 (d) (ii) Apart from reduced elasticity, suggest how the other changes reduce the efficiency of gas exchange.

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(2 marks)

5 (e) People with asbestosis are at greater risk of developing lung cancer. The time between asbestos exposure and cancer occurrence is 20 to 30 years.

5 (e) (i) Suggest why the link between asbestosis and lung cancer has been difficult to prove.

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(1 mark)

5 (e) (ii) Other than asbestos exposure, suggest **one** other factor that may increase the risk of developing lung cancer.

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(1 mark)

11

Turn over for the next question

6 A research scientist is investigating the effect of low-fat spreads as part of a healthy diet. As part of the research she decides to measure total cholesterol levels in a blood sample taken from a volunteer.

6 (a) (i) What is the normal range of fasting total cholesterol in the blood?

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(1 mark)

6 (a) (ii) The scientist used a cholesterol meter to measure the volunteer's total cholesterol level. State **two** advantages of measuring total cholesterol level with a cholesterol meter rather than a dipstick.

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(2 marks)

6 (b) The volunteer was found to have a high initial fasting total cholesterol level. What are the effects on health of having a continually high fasting total blood cholesterol level?

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(2 marks)

5

7 (a) Write a balanced symbol equation for aerobic respiration.

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(2 marks)

7 (b) (i) Aerobic respiration takes place in several stages. Name the stages that take place in the mitochondria.

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(2 marks)

7 (b) (ii) Anaerobic respiration is the process of making energy in cells without oxygen. How many molecules of ATP are made per glucose molecule during anaerobic respiration?

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(1 mark)

7 (c) A male runner and his twin sister are training for the London marathon. He decides he wants to concentrate on optimal nutrition as well as following an exercise programme. He asks a nutritionist for advice on the best diet for himself and his sister to follow. The nutritionist tells him it would be useful to first calculate his basal metabolic rate (BMR).

7 (c) (i) Define the term *basal metabolic rate*.

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(1 mark)

7 (c) (ii) Explain why the male runner's BMR is likely to be higher than that of his twin sister.

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(1 mark)

Question 7 continues on the next page

7 (c) (iii) In order to calculate his BMR, the male runner was told to rest for a period of time and was then asked to breathe through a spirometer for 8 minutes.

During this time he used 3 dm^3 oxygen.

When 1 dm^3 oxygen is used in respiration, 20.17 kJ of heat energy are released.

Calculate the athlete's metabolic rate.

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(2 marks)

7 (d) Both runners expect to lose some body fat during their marathon training. Explain how the body uses fat in respiration.
You will be assessed on the quality of written communication in your answer.

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(5 marks)

14

END OF QUESTIONS