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
June 2014

Applied Science SC14

Unit 14 The Healthy Body

Friday 13 June 2014 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

A

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 woman has been diagnosed as having diabetes. She visits the diabetes clinic for a check-up. A nurse checks the woman's fasting glucose levels by taking a urine sample.

1 (a) (i) Describe how the nurse could check the woman's urine glucose levels.

[3 marks]

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1 (a) (ii) Urine tests have an advantage over blood tests because they are non-invasive.

What does **non-invasive** mean?

[1 mark]

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1 (b) The nurse explains that blood glucose levels in the body are normally maintained by insulin and glucagon.

1 (b) (i) Circle the normal range for fasting blood glucose concentrations (in mmol l^{-1}).

[1 mark]

1.5–3.5 3.5–7.5 7.5–11.5 13.5–17.5

1 (b) (ii) State the function of insulin and of glucagon in the maintenance of normal blood glucose levels.

[2 marks]

Insulin .....

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Glucagon .....

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1 (b) (iii) Explain why maintenance of blood glucose levels is an example of negative feedback.

[2 marks]

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9

Turn over for the next question

2 A university student is investigating nutrition in children. He discovers that, for many children, the intake of calcium and iron is too low.

2 (a) Give **two** consequences for children of a diet low in calcium and **two** consequences of a diet low in iron.

[4 marks]

Calcium

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2 .....

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Iron

1 .....

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2 (b) The student also discovers that, for many children, the level of salt in the diet is too high.

Give **two** consequences of having too much salt in the diet.

[2 marks]

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2 .....

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2 (c) During the investigation, it was found that childhood obesity rates were rising rapidly.

2 (c) (i) Suggest what effects being obese as a child might have on a person's future health.

[4 marks]

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2 (c) (ii) Suggest **two** reasons why childhood obesity rates are rising rapidly.

[2 marks]

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12

Turn over for the next question

3 In the two days before a race such as a marathon, athletes are advised to 'carb load'. This means including lots of foods like bread, pasta and rice in their diet.

During the marathon it is difficult for the athletes to eat food and instead they eat glucose.

3 (a) Explain why eating the following foods is beneficial to athletes.

3 (a) (i) Bread, pasta and rice.

[4 marks]

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3 (a) (ii) Glucose.

[3 marks]

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3 (b) (i) Explain, by making reference to physiological processes, why an athlete would produce only a small volume of dark coloured urine after a marathon race.

The quality of your written communication will be assessed in your answer.

[5 marks]

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Extra space (if needed) .....

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Question 3 continues on the next page

3 (b) (ii) Why does the body need to conserve water during a period in which little is drunk?
[2 marks]

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14

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

4 Digestion relies on enzyme activity throughout the gut. A scientist investigated the rate of activity of protease, an enzyme found in the stomach.

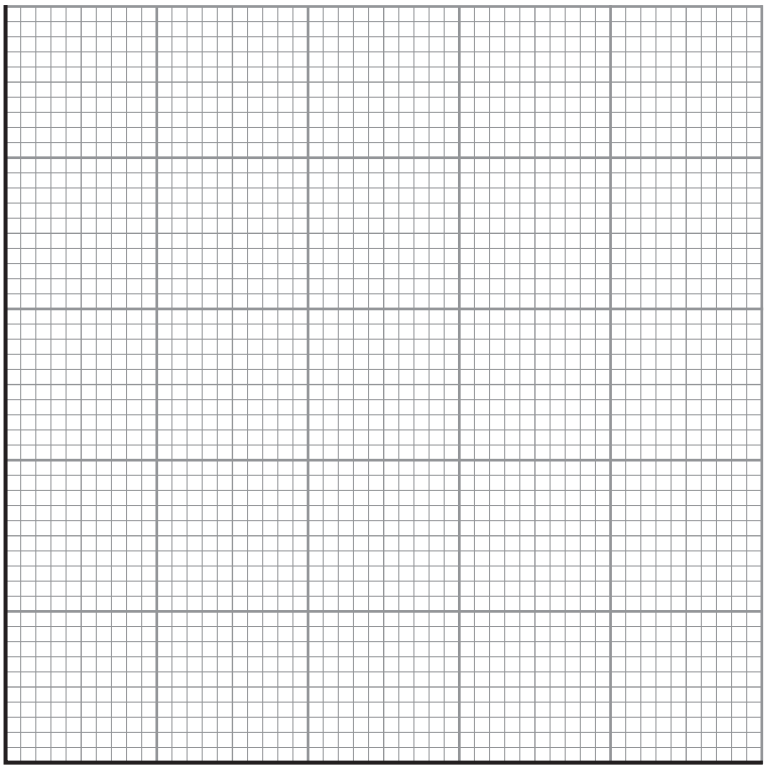
Table 1 shows the results of experiments she carried out at different pH values. All other variables were kept constant.

Table 1

pH	Reaction rate (arbitrary units)
1	88
2	64
3	43
4	22
5	10
7	2
8	0

4 (a) (i) Plot the results of the experiments on the grid below. Draw a line of best fit to complete the graph.

[3 marks]



4 (a) (ii) What does your graph tell you about the effect of pH on the activity of protease in the stomach?

[2 marks]

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4 (b) How would the scientist know if she had completely denatured the enzyme at any point in the experiment?

[2 marks]

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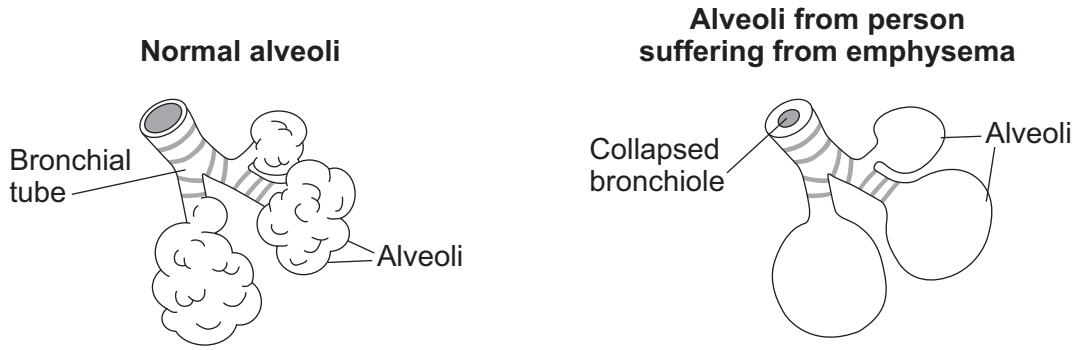
7

Turn over for the next question

5 An elderly man suffers from emphysema. This is a condition in which the walls of the alveoli are damaged and weakened, as shown in **Figure 1**.

Figure 1



5 (a) (i) Use information from **Figure 1** to describe how emphysema affects the size and number of alveoli.

[2 marks]

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5 (a) (ii) Explain why these changes significantly reduce the amount of gas exchange that takes place at the alveoli.

[2 marks]

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5 (b) The elderly man attended a chest clinic where he underwent various breathing tests. The doctor measured his vital capacity using a spirometer.

5 (b) (i) Define **vital capacity**.

[1 mark]

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5 (b) (ii) Describe how a spirometer is used to measure a person's vital capacity.

[2 marks]

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5 (c) Explain how the thorax and diaphragm cause the movement of air into the lungs.

[4 marks]

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11

6 A sports scientist was asked to investigate the effect of increasing the levels of exercise on the cardiovascular system of athletes. She used a heart rate monitor that detects pulse and blood pressure. The athletes jogged for different lengths of time on a running machine.

6 (a) (i) How could the sports scientist select the athletes to ensure the data were valid? State **two** criteria.

[2 marks]

1 .....

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2 .....

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6 (a) (ii) State **two** other factors that she could consider to ensure that the data collected during the investigation would be valid and reliable.

[2 marks]

1 .....

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2 .....

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6 (b) The sports scientist decided to measure the basal metabolic rate (BMR) of her chosen athletes. This is the minimum amount of energy required to maintain essential body processes. Knowledge of their BMR can help athletes to regulate their diet.

She decided to use indirect calorimetry to determine the BMR of her subjects.

6 (b) (i) Describe how the sports scientist could determine the BMR of an athlete using indirect calorimetry.

[4 marks]

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6 (b) (ii) Indirect calorimetry is considered to be a better method than direct calorimetry for determining BMR.
Give **one** reason for this.

[1 mark]

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6 (c) Two of the athletes have their BMR measured. Both are 30-year-old males. Both weigh 90 kg. One of the athletes is 1.70 m tall and the other is 1.90 m tall.

Suggest why the shorter athlete was found to have a higher BMR than the taller athlete.

[2 marks]

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11

7 An athlete was training for an important race. He knew it would be essential for his muscles to receive as much oxygen as possible during the race.

People who live at high altitude have more red blood cells per unit volume of blood than people living at sea level. The athlete decided that he should spend time training at high altitude in order to increase his number of red blood cells.

7 (a) Suggest why spending time training at high altitude would increase the number of red blood cells in the athlete's body.

[2 marks]

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7 (b) As a result of high altitude training the athlete became ill.
Comment on the ethical implications of providing medical treatment for someone who has been training at high altitude.

[2 marks]

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7 (c) In hospital, it was found that the athlete had a stroke volume of 80 cm^3. Stroke volume is the amount of blood that the heart pumps out at each contraction.

Calculate the volume of blood that will pass through the left side of the heart each hour with an average heart rate of 72 beats per minute.

[2 marks]

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Volume of blood per hour = ... $cm^3 hour^{-1}$.

7 (d) Once the athlete had made a full recovery, he went back into full-time training. He was told by his coach that he needed his muscles to respire aerobically for as long as possible.

7 (d) (i) Write a balanced equation for aerobic respiration.

[2 marks]

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Question 7 continues on the next page

7 (d) (ii) Describe how the energy in glucose is converted into a form that can be used for cell activity.

The quality of your written communication will be assessed in your answer.

[5 marks]

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Extra space (if needed) .....

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7 (e) The athlete knew he would have to follow a training programme to ensure that his cardiovascular and respiratory systems were working as efficiently as possible for aerobic respiration.

Why is it better for his muscles to respire aerobically and not anaerobically?

[3 marks]

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16

END OF QUESTIONS

There are no questions printed on this page

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