

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
June 2009
Advanced Level Examination



APPLIED SCIENCE
Unit 14 The Healthy Body

SC14

Thursday 11 June 2009 9.00 am to 10.30 am

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

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show your working of your calculations.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You are expected to use a calculator where appropriate.

For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3		7	
4		8	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



J U N 0 9 S C 1 4 0 1

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

1 A mother was concerned that her 7-year-old daughter was overweight. She had heard a discussion on the radio that outlined the future health implications for children who ate a poor diet and did not take enough exercise.

She asked a dietician for advice in helping her daughter to have a long and healthy life.

1 (a) (i) The dietician said that a healthy diet contains different food groups in varying proportions.

State the food group that provides the body with the materials for growth and repair.

Suggest a specific food that would supply a significant amount of this group.

Food group

Specific food

(2 marks)

1 (a) (ii) When the child was weighed she was found to be 5 kg heavier than her height suggested she should be.

State **three** ways in which her diet could be adjusted so that this excess weight would be lost.

1

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2

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3

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(3 marks)



1 (a) (iii) Give **two** possible long-term health consequences to the child of her continuing to gain excess weight throughout her childhood.

1

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2

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(2 marks)

1 (b) The mother was aware that her daughter’s dietary needs would change as she grew older.

Describe and explain **two** ways in which the dietary needs of the girl would be different in five years’ time.

1

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2

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(4 marks)

11

Turn over for the next question

Turn over ▶



2 A middle-aged man had been suffering from headaches. He visited his doctor's surgery to have a health check. His blood pressure, at 155/98 mmHg, was higher than it should have been.

2 (a) (i) Name the hormone that normally regulates the re-absorption of water by the kidneys.

.....
.....
(1 mark)

2 (a) (ii) Which organ secretes this hormone?

.....
(1 mark)

2 (a) (iii) Describe how this hormone causes a rise in a person's blood pressure.

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.....
(3 marks)

2 (b) The doctor suggested that the man should take a diuretic drug that acts on the kidneys. The drug increases the volume of water lost in the urine, so reducing the blood pressure.

The drug that the doctor prescribed works by increasing the amount of sodium ions lost through the kidney, which in turn causes a greater loss of water.

In view of this increased loss of sodium ions from the body, suggest **one** possible side-effect that this drug could have.

.....
.....
(1 mark)



2 (c) The man's daily urine output before treatment was found to average 1.5 litres. The diuretic drug increased his urine output by 5%. Calculate the increase in the volume of water being lost through his urine each day after he had been taking the drug.

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(1 mark)

2 (d) The drug reduced the man's systolic blood pressure from 155 mmHg to 135 mmHg.

Suggest **two** ways in which the man might benefit from having a lower systolic blood pressure.

1

2

(2 marks)

2 (e) (i) Name **one** part of the body other than the kidney where a substantial amount of water is reabsorbed.

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(1 mark)

2 (e) (ii) Suggest the effect that the diuretic drug might have on the amount of water absorbed at this part of the body. Explain your answer.

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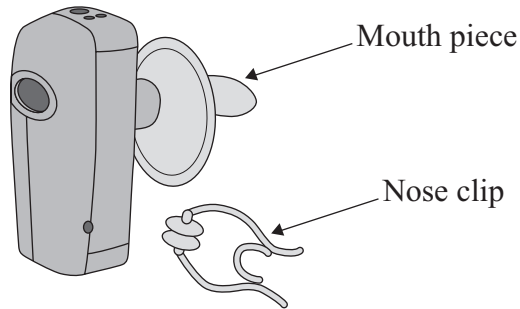
(3 marks)



- 3 A recently-appointed football coach was developing new training techniques to improve the performance of his team. He needed to know the players' current levels of fitness so that he would be able to see whether his methods were effective.

He began by measuring their basal metabolic rate (BMR).

To do this he used an indirect calorimeter such as the one shown. Each footballer was asked to put on the nose clip and then breathe in and out through the calorimeter, which calculates the BMR automatically.



- 3 (a) (i) What does BMR measure?

.....

(1 mark)

- 3 (a) (ii) Before their BMR was measured, the footballers were asked to fast for 12 hours. Explain why fasting makes the measurement of BMR as accurate as possible.

.....

(2 marks)



- 3 (a) (iii) Give **two** other conditions that must be carefully controlled during the measurement of BMR, and explain why each control is necessary in order to produce an accurate measurement.

Condition 1

.....

.....

Condition 2

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.....

(4 marks)

- 3 (b) After the footballers had been training for 3 months, the measurement of their BMR was repeated.

The table shows the BMR values for two of the team members, **A** and **B**, before and after the training period, together with their age, height and weight.

Footballer	Height (cm)		Weight (kg)		BMR		
	age	before	after	before	after	before	after
A	19	178	178	171	169	3156	3156
B	27	171	171	184	186	3258	3264

The trainer decided that footballer **B** had shown more benefit from the training. Use data from the table to support this decision.

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(3 marks)



4 A radiographer was looking at images taken of the digestive system of an elderly woman. The woman had been suffering from severe abdominal pain for several weeks.

The images showed that a cancer was growing in the woman’s stomach. The cancer was located where the oesophagus joins the stomach. It covered 15% of the surface of the inside of her stomach, and also prevented the normal contraction of the muscles in her stomach wall.

4 (a) Use the information above, together with your biological knowledge, to explain how the presence of the cancer would affect the mechanical and chemical breakdown of food in the woman’s stomach.

Effect on mechanical breakdown
.....
.....

Effect on chemical breakdown
.....
.....

(4 marks)

4 (b) Stomach cancer is sometimes linked to the presence of a bacterium, *Helicobacter pylori*, in the stomach. The bacterium is thought to infect stomach ulcers, which later become cancerous.

4 (b) (i) How does the stomach normally protect itself against the entry of bacteria?

.....
.....

(1 mark)



4 (b) (ii) A team of doctors gave people who had stomach ulcers an antibiotic to kill *Helicobacter pylori*. They found that fewer people developed stomach cancer. Describe a suitable experimental method that the team of doctors could have used in order to find out if the antibiotic was helping to reduce the risk of stomach cancer.

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(4 marks)

9

Turn over for the next question

Turn over ▶



5 A young man was in intensive care in a hospital after a road traffic accident. His intensive care nurse ensured that the oxygen levels in his blood were monitored continuously using a pulse oximeter.

5 (a) (i) In what form is oxygen transported around the body?

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(1 mark)

5 (a) (ii) What is the normal range of oxygen saturation levels in the arteries?

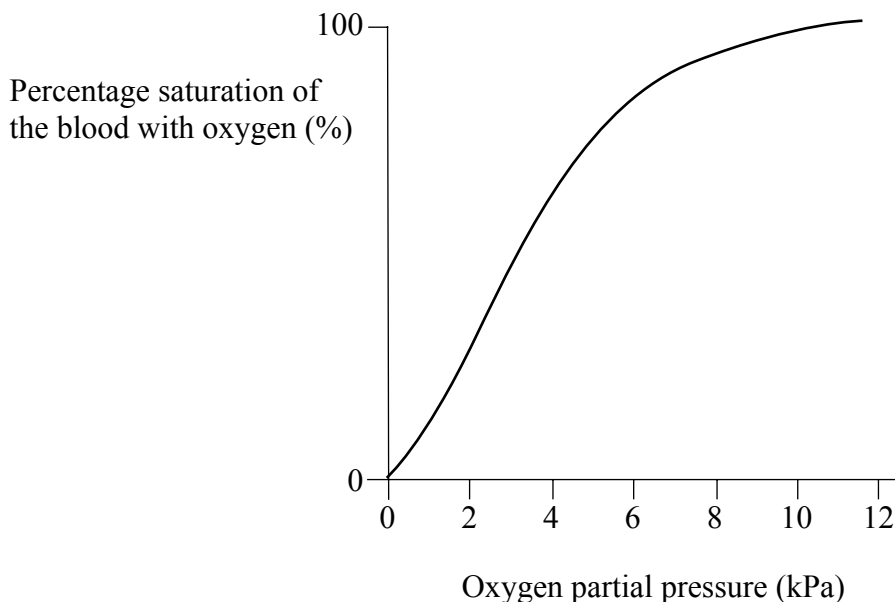
.....
(1 mark)

5 (a) (iii) Write down the abbreviation for oxygen saturation.

.....
(1 mark)

5 (b) The graph shows an oxygen dissociation curve for human haemoglobin in an atmosphere containing 0.03% carbon dioxide.

5 (b) (i) On the graph, sketch the curve that would be obtained if the atmosphere contained 0.3% carbon dioxide. (2 marks)



5 (b) (ii) What is the name given to the effect of decreasing pH on the dissociation of oxygen from haemoglobin?

.....
(1 mark)



5 (b) (iii) Explain why it is important that the level of oxygen supplied to the young man's brain remains high.

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(2 marks)

5 (c) The nurses in the intensive care ward were careful to ensure that the young man's body temperature remained constant.

How would an increase in body temperature affect the dissociation curve shown in part (b)?

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(2 marks)

10

Turn over for the next question

Turn over ▶



6 A cereal manufacturer read an article in a scientific journal which stated that a substance found in oats, if eaten on a regular basis, would lower the level of cholesterol in the blood.

He decided to develop a new oat-based breakfast cereal. He would advertise it by promoting its health benefits. He knew that he would have to carry out experiments to find out more about the effects that oats have on human blood cholesterol levels.

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

..... mmol/l
(1 mark)

6 (a) (ii) State **two** possible health problems that could result from having continually high cholesterol levels.

1
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2
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(2 marks)

6 (b) A group of scientists worked for the cereal manufacturer. They designed an experiment to find out more about how eating oats affects human blood cholesterol levels. They recruited a group of 36 male volunteers, all with slightly raised blood cholesterol levels but who were otherwise healthy.

Half of the group were given oat bran to include in their diet for eight weeks, while the other half were given wheat bran to eat over the same period of time. The fasting total cholesterol levels for both groups were measured before and after the experiment.

What other factors should the scientists take into account when designing this experiment in order to ensure that the results of the experiment will be valid?

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(3 marks)



6 (c) Describe how the scientists should measure the fasting total cholesterol levels of the volunteers in order to obtain results that are as accurate as possible.

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(3 marks)

9

Turn over for the next question

Turn over ▶



7 An elderly woman broke her wrist. A health visitor was asked to advise her how to increase her bone density.

7 (a) Which mineral plays the most significant part in the structure of bone?

.....
(1 mark)

7 (b) The health visitor suggested that the woman should drink more milk in order to increase her bone density.

One 300 ml glass of milk contains 230 mg of this important mineral.

The woman's blood volume was 5 litres, and she absorbed 80% of the mineral from the milk.

How much more of this mineral is present in 1 litre of her blood after she has drunk 300 ml of milk?

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(2 marks)

7 (c) A blood test showed that the woman had a low level of vitamin D.

How could the woman modify her lifestyle in order to increase her vitamin D level without taking vitamin capsules as a supplement?

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(2 marks)

7 (d) The woman bought some vitamin D supplement capsules, which each contained 10 µg of the vitamin. She decided to take 2 capsules daily.

The recommended daily allowance (RDA) for vitamin D is 5 µg. Comment on the woman's decision in terms of the likely effect on her health.

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(3 marks)



8 A student had been experiencing unusual symptoms of restlessness, irritability and weight loss. Her doctor decided that she was suffering from an excess of the hormone thyroxine.

8 (a) What is the source of thyroxine in the body?

..... (1 mark)

8 (b) State the role of thyroxine in the body.

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..... (1 mark)

8 (c) Explain how the body controls the level of thyroxine in the blood.

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..... (5 marks)

Question 8 continues on the next page

Turn over ▶



8 (d) The doctor prescribed medicine to treat her condition.
She required 5 mg per kilogram of body mass, twice a day.
Her weight was 53 kg.

8 (d) (i) The medicine was a suspension containing 100 mg of the active ingredient in every 5 ml. Calculate the volume of this suspension that she would require for each dose.

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(2 marks)

8 (d) (ii) Suggest why the student required regular blood tests while she was receiving the medication.

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(1 mark)

10

END OF QUESTIONS

