

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Education
January 2007
Advanced Level Examination



APPLIED SCIENCE
Unit 14 The Healthy Body

SC14

Thursday 1 February 2007 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.

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

Time allowed: 1 hour 30 minutes

Instructions

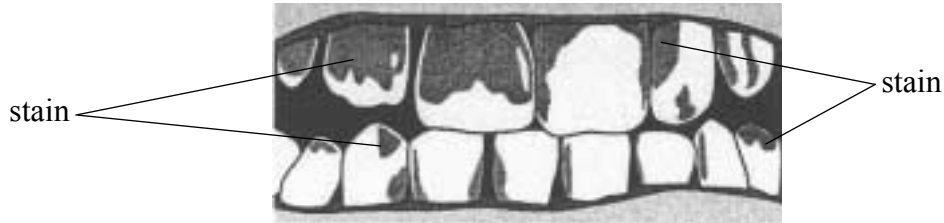
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

Information

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

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

- 1 A dental hygienist showed a patient how to use disclosing tablets. The picture shows the effect on the teeth of chewing disclosing tablets after eating some sweets. A dye in the tablets stains bacteria.



- (a) Give **one** advantage of using disclosing tablets.

.....
(1 mark)

- (b) What are the functions of incisors and molars in the digestive process?

Incisors

Molars

(2 marks)

- (c) Amylase is an enzyme found in our saliva. The substrate for amylase is starch. What is meant by the term *substrate*?

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(1 mark)

- (d) Explain how amylase is inactivated when it reaches the stomach. Your answer should contain ideas about enzyme action.

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(3 marks)

- (e) The stomach releases a variety of secretions that assist the digestive process.

The functions of the secretions have been shown in the table below.

Write the name of the secretion in the appropriate box.

Secretion	Function
	Protects stomach lining
	Digests proteins
	Kills bacteria

(3 marks)

10

Turn over for the next question

Turn over ▶

- 2 An 80-year-old man was shopping for some breakfast cereal. He selected some bran flakes. The nutritional panel from the cereal is given below.

	Typical values per 100 g	Per 30 g serving
Energy	1404 kJ	468 kJ
Protein	11.1 g	3.3 g
Carbohydrate of which sugars	64.6 g 18.9 g	19.4 g 5.7 g
Fat of which saturates	3.2 g 0.8 g	1.0 g 0.2 g
Fibre	14.5 g	4.4 g
Iron	16.1 mg (115% RDA*)	4.8 mg (35% RDA*)
Salt	1.4 g	0.4 g

* RDA – recommended daily allowance

- (a) Explain why this type of breakfast cereal would be suitable for an 80-year-old man.

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(4 marks)

- (b) The recommended daily energy intake for an 80-year-old man is 8266 kJ. Calculate the percentage energy intake a 30 g portion of bran flakes would provide.

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% energy intake

(2 marks)

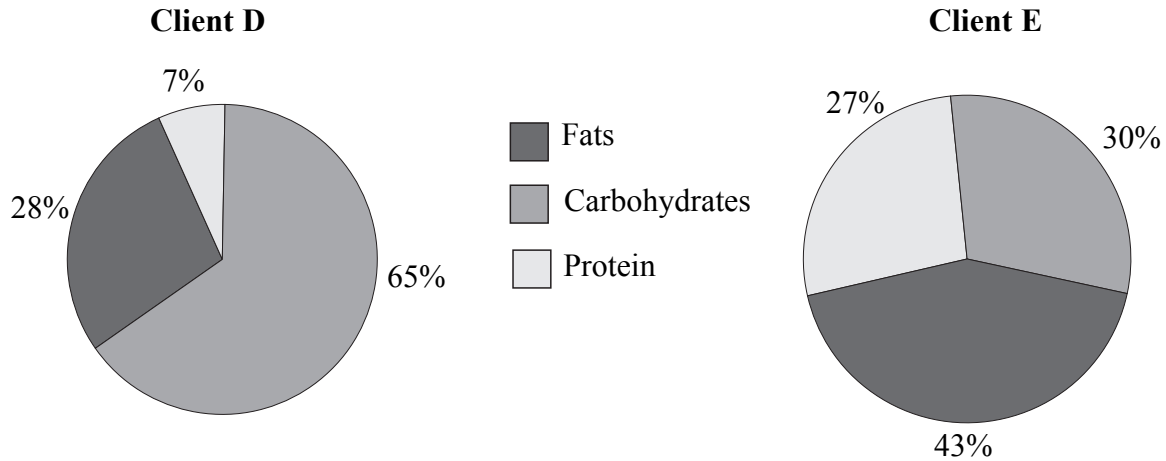
- (c) Calculate the RDA of iron.

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(2 marks)

3 A hospital dietician was reviewing some client information. She was looking at the reported percentage intakes of the main food groups for two clients **D** and **E**.



(a) Explain why she suggested that **Client D** should consider including more peas and beans (pulses) and oily fish in his diet.

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(4 marks)

(b) Explain why she suggested that **Client E** should reduce red meat, cheese and fried foods in his diet.

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(4 marks)

4 In 2005 it was estimated that 1 million people in the United Kingdom had diabetes but did not know they had it. Some high street chemists are offering diabetes tests.

(a) Describe a simple test that could be carried out to find out if someone has diabetes.

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(3 marks)

(b) Diabetes alters glucose homeostasis.

(i) Which part of the body detects increased glucose levels?

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(2 marks)

(ii) What is the body's normal response to increased glucose levels?

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(2 marks)

(iii) Where in the body and in what form is glucose stored?

Location.....

Storage form.....

(2 marks)

- (c) For a medical diagnosis of diabetes, a person may have an oral glucose tolerance test. Read the set of instructions for carrying out an oral glucose tolerance test.

Patient information

Having an oral glucose tolerance test

Before you arrive eat some breakfast.
On arrival, you will be given a sugary energy drink.
You need to drink some of this.
The nurse will take three or four blood samples from you when you have finished enough of your drink.

- (i) Evaluate the information given in the instructions. You should use ideas about accuracy to support your ideas with scientific explanations.

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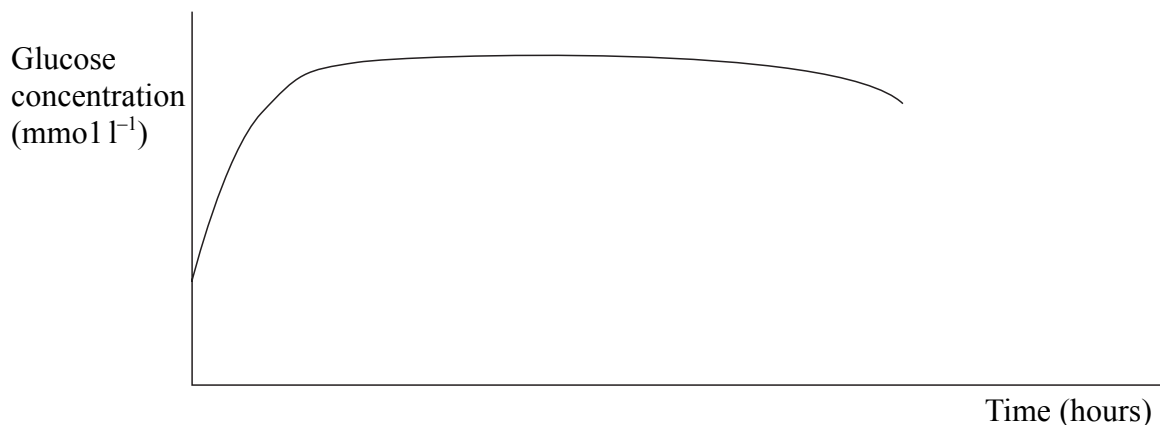
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(5 marks)

- (ii) The graph below shows the result of an oral glucose tolerance test for someone who has diabetes. Draw on the graph the expected response of a person who does **not** have diabetes.



(1 mark)

Question 4 continues on the next page

Turn over ▶

- (d) A man has recently been diagnosed as having diabetes. He visits a specialist nurse at his local health centre for advice on how to adjust his diet. He has brought with him a record of what he regularly eats and drinks.

Meal	Food record
Breakfast	Bacon, sausages, fried eggs, fried bread
Mid-morning snack	Chocolate biscuits
Lunch	Sandwich: white bread with butter, cheese filling Bag of crisps
Afternoon snack	Chocolate bar Full fat milk
Evening meal	Fried fish Portion of chips White bread and butter Apple tart and custard
Drinks	Cola (full sugar) Tea and coffee with sugar and full fat milk

- (i) Evaluate the dietary composition of the man's food record.

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(3 marks)

- (ii) Explain why someone with diabetes should include wholegrain foods and complex carbohydrates in their diet.

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(2 marks)

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Turn over ▶

- 5 The sports nutritionist at a cycling club was asked to explain to the cyclists why it is important for them to consume carbohydrate-rich foods when they are preparing for very long distance races (more than 100 miles).

The sports nutritionist first told them about aerobic respiration.

- (a) (i) Write the balanced symbol equation for aerobic respiration.

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(2 marks)

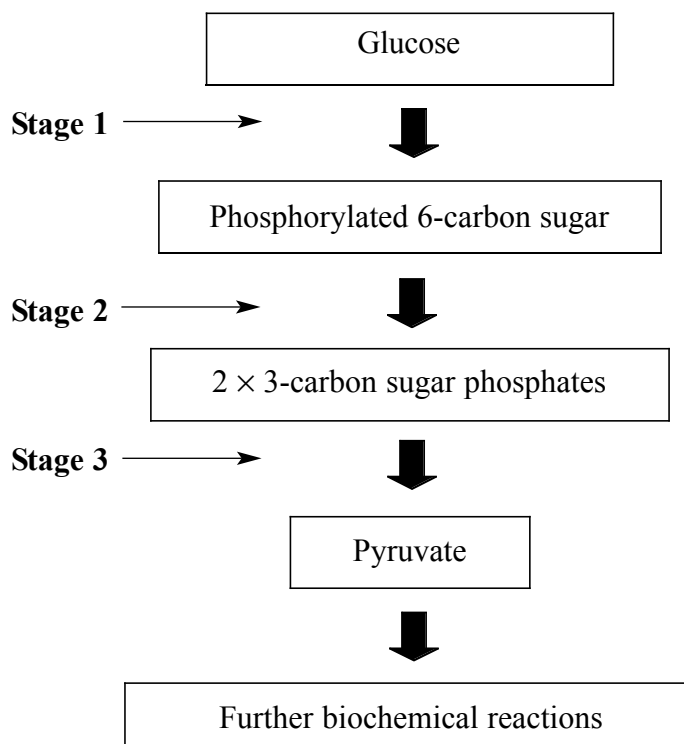
- (ii) Which body tissue has the highest rate of aerobic respiration when the cyclists are racing? Give a reason for your answer.

Tissue

Reason.....

.....
(2 marks)

- (b) Secondly, the sports nutritionist told the cyclists about glycolysis and the energy generated in this stage of aerobic respiration. The cyclists were given this diagram to look at.



(b) (i) Define the term *glycolysis*.

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(1 mark)

(ii) Where in a human cell does the process of glycolysis occur?

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(1 mark)

(iii) Identify the molecule needed at **Stage 1** on the diagram on **page 10** to produce the phosphorylated 6-carbon sugar.

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(1 mark)

(iv) Pyruvate is a 3-carbon compound which can diffuse into mitochondria. Why is it important for pyruvate to enter mitochondria?

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(1 mark)

(c) Finally the sports nutritionist told the cyclists that if they did not eat enough carbohydrate to fuel their energy demands, their bodies would use other sources of energy.

(i) Identify **one** other fuel source the body can use to generate ATP.

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(1 mark)

(ii) Identify a food group which would be a good source of this fuel.

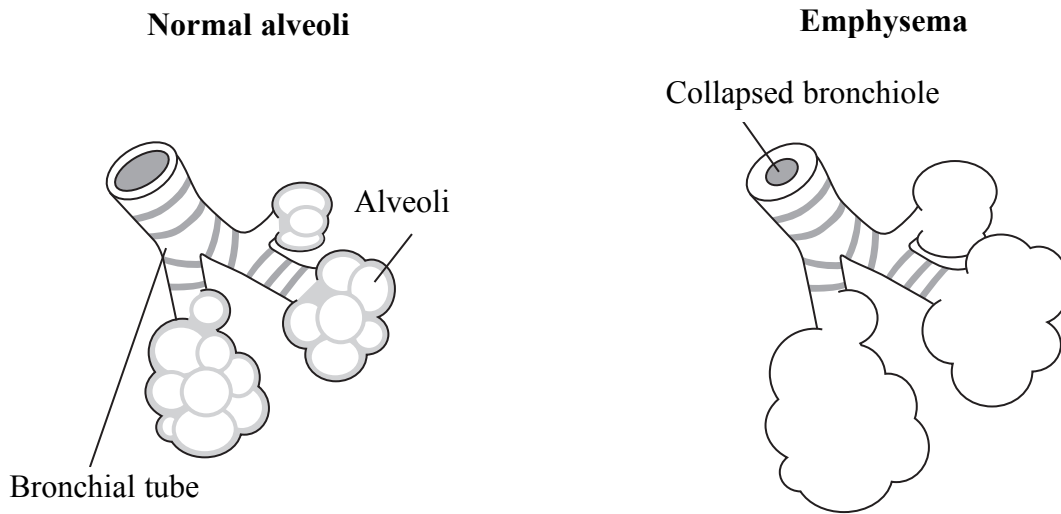
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(1 mark)

(d) The cyclists took part in some indoor static bike trials. Blood samples were taken from the cyclists at the end of the trials and were tested for the presence of lactic acid.

Explain why the cyclists who were most exhausted had the highest levels of lactic acid.

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(2 marks)

- 6 A woman who had smoked cigarettes for many years developed a lung disease called emphysema. The disease causes the walls of alveoli to break down. This is shown in the diagram below along with a diagram of normal alveoli.



- (a) Explain how emphysema affects lung surface area and how this affects the ability to oxygenate blood.

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(2 marks)

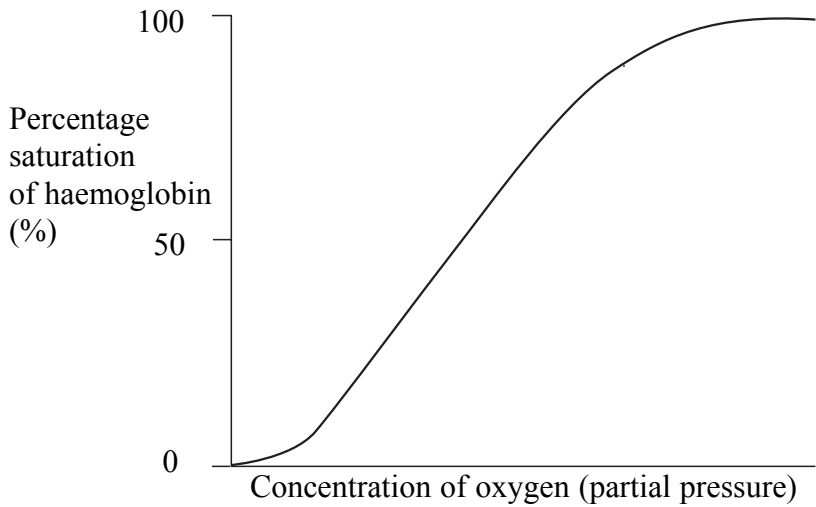
- (b) Haemoglobin is the molecule used to transport molecular oxygen (O_2) in the blood.

- (i) How many atoms of oxygen can one haemoglobin molecule carry when it is fully saturated?

.....

(1 mark)

- (ii) Mark an **L** on the graph below to show the region of the graph that represents the oxygen concentration of the lungs.



(1 mark)

- (iii) Any physical activity the woman does increases her production of carbon dioxide.

Draw a line on the graph above to show the effect of increased carbon dioxide levels in the blood.

(1 mark)

- (iv) Explain your answer to part (b) (iii).

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(2 marks)

- (v) Describe how the body detects and responds to increases in carbon dioxide levels in the blood.

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(4 marks)

Turn over ▶

7 Some university students took part in a physiology experiment as part of their biology degree. The experiment looked at how the body responds to drinking different volumes of water in a 10 minute period.

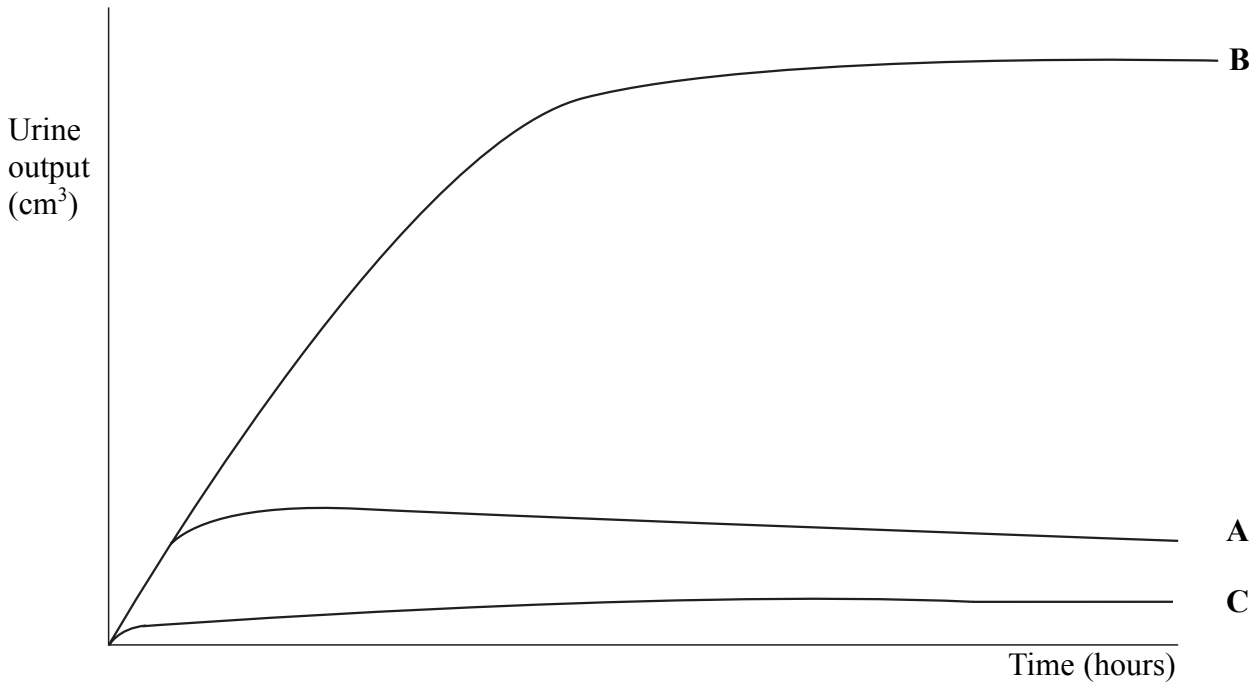
One group, **group A**, drank 100 cm^3 of water per person.

A second group, **group B**, drank 1500 cm^3 of water per person.

A third group, **group C**, did not drink any water.

The groups then had to collect their own urine samples every 20 minutes for 2 hours.

The graph below shows the results of their cumulative urine outputs.



(a) Discuss the results of this experiment.

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(4 marks)

(b) The students had read that antidiuretic hormone (ADH) is involved in regulating blood volume.

(i) Explain why the students in **group C** would have high levels of ADH in their blood.

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(1 mark)

(ii) How does ADH ensure that blood volume is maintained?

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(4 marks)

(c) People who produce large volumes of urine may be at risk of losing too much sodium. Identify **two** functions of sodium in the body.

Function 1

Function 2

(2 marks)

END OF QUESTIONS

There are no questions printed on this page