

Centre Number						Candidate Number				
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Other Names										
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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 2012

Applied Science

SC14

Unit 14 The Healthy Body

Friday 15 June 2012 9.00 am to 10.30 am

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



J U N 1 2 S C 1 4 0 1

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

1 As part of a community health campaign, a nurse has been asked to talk to several groups about keeping the heart healthy.

1 (a) During a talk to a group of elderly people, the nurse tells the group about blood pressure. He says that during the cardiac cycle, blood pressure may be higher in the aorta than in the pulmonary artery.

State what causes the difference in blood pressure in the aorta and in the pulmonary artery.

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(1 mark)

1 (b) One elderly person has read that blood pressure increases with age. She understands that the increase in blood pressure is the result of changes in the elasticity of the tissue in the walls of the arteries.

How would the nurse explain how this elastic tissue helps to even out the blood pressure in an artery?

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(2 marks)

1 (c) A second elderly person has heart valve problems. He informs the nurse that he has problems with his atrioventricular valves.

Explain the function of the atrioventricular valves.

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(2 marks)



1 (d) In a talk to a group of young parents, one parent asks the nurse how the heart works.

Describe the route taken by a red blood cell from when it enters the heart from the lungs, to when it leaves the heart to return to the lungs.

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(4 marks)

1 (e) Another parent knows that the heart rate increases when a person exercises. She does not know how the body produces this increase in heart rate.

Explain what is happening in the body to produce this increase in heart rate during exercise.

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(3 marks)

12

Turn over for the next question

Turn over ▶



2 While visiting the doctor for a routine check-up, a woman is told that she is clinically obese. She is advised to lose weight and lower her cholesterol levels to maintain good health.

2 (a) (i) What is the normal level of blood cholesterol? Circle the correct answer.

0.4 mmol/litre 4.0 mmol/litre 40 mmol/litre 400 mmol/litre

(1 mark)

2 (a) (ii) State **three** effects that being clinically obese might have on her health.

Effect 1

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Effect 2

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Effect 3

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(3 marks)

2 (b) The woman is tested for diabetes.

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

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(2 marks)

2 (c) Dieticians recommend that lipid intake should be about 30% of energy intake. The recommended energy intake for most women aged 19 to 39 is 8100 kJ per day. The energy content for a lipid is 37.8 kJ g^{-1} .

Calculate the recommended lipid intake per day for these women.

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Recommended lipid intake per day = g

(2 marks)



- 3 A trainee midwife is learning about the development of a fetus during pregnancy. She analyses the data in **Table 1** which shows the rate of oxygen transported to and from a 1 kg fetus during pregnancy.

Table 1

Blood vessel	Rate of oxygen transported ($\text{cm}^3 \text{min}^{-1}$)
Umbilical artery	30.9
Umbilical vein	48.1

- 3 (a) Calculate the rate of oxygen uptake for a fetus with a mass of 3.3 kg. Assume that the rate of oxygen uptake is proportional to the mass of the fetus.

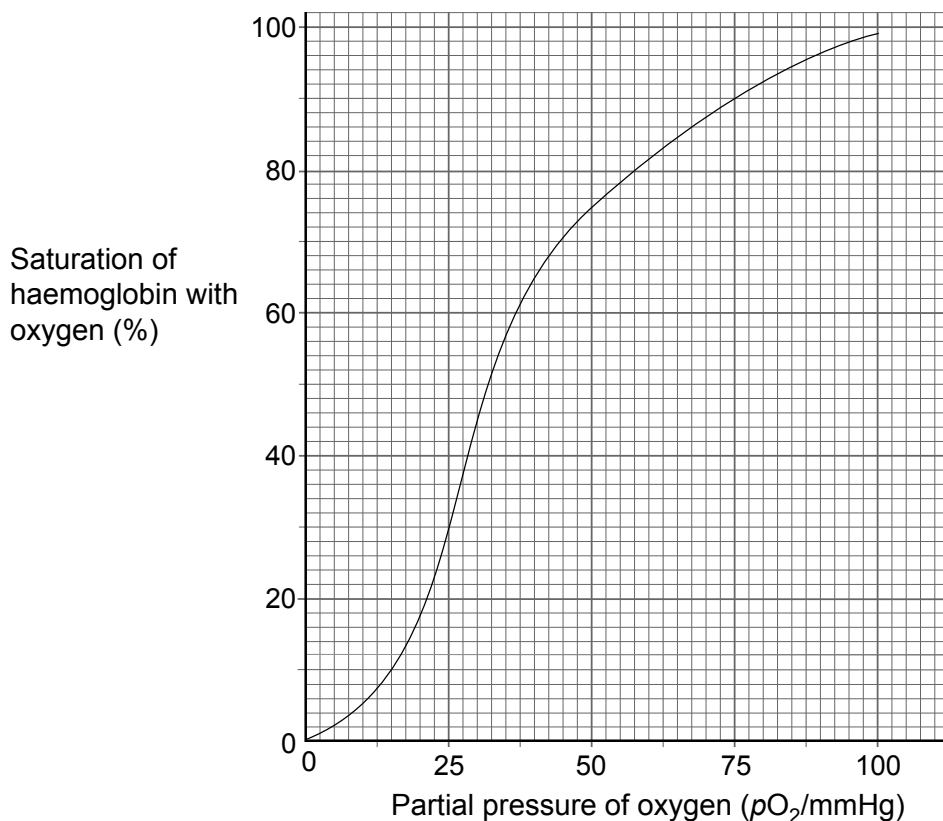
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Rate of oxygen uptake = $\text{cm}^3 \text{min}^{-1}$
 (2 marks)

Oxygen saturation is a vital sign of health.

Data for haemoglobin saturation was obtained from analysing pregnant women using a pulse oximeter. The data was used to produce the oxygen dissociation curve shown in **Figure 1**.

Figure 1



3 (b) What does the oxygen dissociation curve in **Figure 1** show?

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(2 marks)

3 (c) (i) Explain why there would be an advantage to a fetus in having an oxygen dissociation curve shifted to the left of the one shown in **Figure 1**.

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(1 mark)

3 (c) (ii) If a pregnant woman undertakes strenuous activity, the dissociation curve will shift to the right of the curve shown in **Figure 1**.

State the advantage of this to the woman.

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(1 mark)

6

Turn over for the next question

Turn over ▶



4 The basal metabolic rate (BMR) is the minimum amount of energy that the body releases to maintain essential body processes. Knowledge of BMR can help to regulate an athlete’s diet. A sports science student decided to investigate BMR.

4 (a) (i) Describe how the student could determine the BMR of an athlete using direct calorimetry.

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(4 marks)

4 (a) (ii) The student reads that indirect calorimetry is considered to be a better method of determining BMR than direct calorimetry.

State **one** advantage of indirect calorimetry.

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(1 mark)

4 (b) A second student investigated the effect of increasing cardiovascular activity on heart rate. Volunteers rested for five minutes before their heart rates were measured using a heart-rate monitor. The volunteers ran on a treadmill for various lengths of time, after which their heart rates were measured using the heart-rate monitors.

4 (b) (i) Why were the heart rates measured before exercising?

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(1 mark)



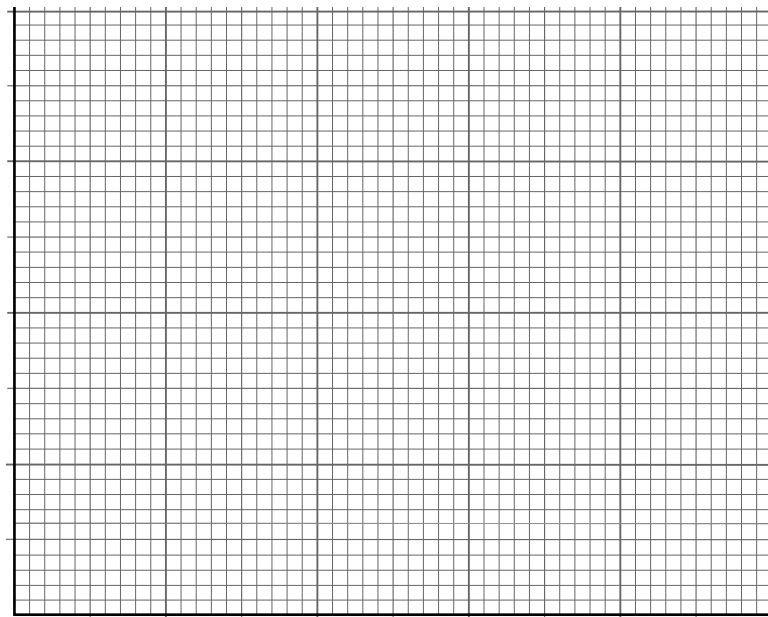
The mean heart rates of the volunteers in different period of exercise are shown in **Table 2**.

Table 2

Time spent running (min)	Mean heart rate (beats per minute)
0	72
1	100
2	106
3	118
4	130
5	142
6	130
8	128
10	128

4 (b) (ii) Plot the data from **Table 2** on the grid below and draw a line of best fit.

Mean heart
rate (bpm)



Time spent running (min)

(3 marks)

4 (b) (iii) Describe and explain the trend shown by the graph.

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(2 marks)

Turn over ▶



4 (c) (i) State **two** factors that the student would have to consider when selecting volunteers to make the data valid.

Factor 1

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Factor 2

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(2 marks)

4 (c) (ii) State **two further** factors, other than how volunteers are selected, that the student would have to consider to ensure that the data was valid and reliable.

Factor 1

.....

Factor 2

.....

(2 marks)

15



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ▶



5 (a) An Applied Science student is revising for an exam. She constructs a summary table of the enzymes used in digestion.

Complete **Table 3**.

Table 3

Enzyme	Where active	Substrate	Product(s)
Pepsin		Protein	Small peptides
	Mouth	Starch	Maltose
Lipase	Small intestine	Triglycerides	

(3 marks)

5 (b) The student reads that enzyme action in the intestine is helped by the action of bile.

How does bile help digestion?

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(3 marks)

5 (c) Why are the tongue, the teeth and saliva vital to the digestion process?

Tongue

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Teeth

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Saliva

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(3 marks)



5 (d) The student noted that because teeth are vital to the digestion process, it is important to look after them.

Good dental hygiene is important, otherwise teeth can decay and cavities can develop along with gum disease (gingivitis).

Describe how tooth decay, cavities and gingivitis can be caused.

Tooth decay

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Cavities

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Gingivitis

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(3 marks)

5 (e) On further investigation, the student reads that adding fluoride to the water supply may help to protect teeth and gums from decay.

Currently the area she lives in does not add fluoride to the water.

The student discovers that it would only cost 25p per day per 5000 people to add fluoride to the local water supply.

A village has a population of 10250. How much would it cost to add fluoride to their water supply for one year? (one year = 365 days)

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Cost =

(2 marks)

14

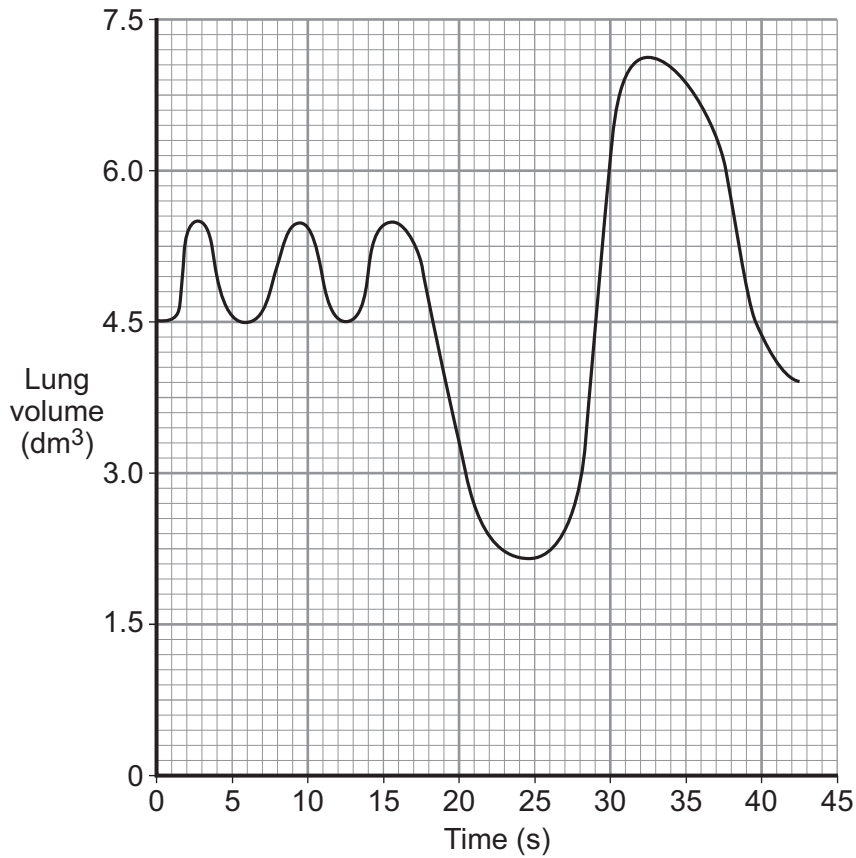
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- 6 The fitness of a group of adults was checked before they took part in a clinical trial. As part of the fitness tests, their tidal volume was measured using a spirometer. **Figure 2** shows a trace from one of the people assessed.

Figure 2



- 6 (a) Use the trace in **Figure 2** to calculate the volume of air that normally enters this person's lungs in 30 seconds.

.....

Volume =
 (2 marks)

- 6 (b) (i) State **one** ethical concern there may be when carrying out a clinical trial.

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(1 mark)



6 (b) (ii) A team had to submit their plans for a clinical trial to an ethics committee, who had to give their permission for the trial to go ahead.

Why is it important that investigations are approved by an ethics committee?

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(2 marks)

6 (c) The person with the trace shown in **Figure 2** could not be used in the clinical trial because the fitness test revealed they had mild emphysema.

What information would a doctor give to this person about the effects of emphysema on the lungs, and how lifestyle changes could prevent the emphysema becoming worse? You will be assessed on the quality of your written communication in your answer.

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(5 marks)

6 (d) A second person was removed from the trial because they smoked. Smoking cigarettes coats the alveoli with tar. Describe how this affects the efficiency of the respiratory system.

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(2 marks)

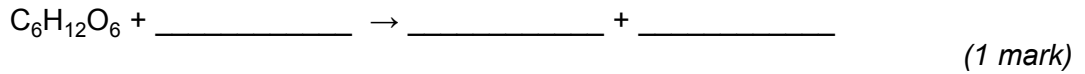
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Turn over ▶



7 A runner was training for a half-marathon race. He asked his biology teacher to explain what happens during respiration.

7 (a) Complete and balance the equation for aerobic respiration:



7 (b) Tick the appropriate boxes in **Table 4** to show some of the features of the respiratory pathways.

Table 4

Features	Respiratory pathway		
	Glycolysis	The Krebs cycle	Electron transport system
Occurs in the mitochondria			
Occurs in anaerobic respiration			
Carbon dioxide produced			

(3 marks)

7 (c) The runner entered the half-marathon race to raise money to supply food to refugees in Africa. The refugees have severely restricted food intake and their body uses its own protein as an energy source in respiration.

7 (c) (i) How is protein used as an energy source in respiration?

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(2 marks)

7 (c) (ii) Suggest why starving refugees are at high risk of suffering from heart failure.

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(2 marks)

END OF QUESTIONS

8

