Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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5	
6	
7	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2013

Applied Science SC14

Unit 14 The Healthy Body

Friday 14 June 2013 9.00 am to 10.30 am

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 nurse ate a meal containing carbohydrates at 6.00 am. She then ate nothing for the next five hours.
Table 1 shows the concentration of glucose in her blood at hourly intervals after the meal.

Table 1

Time of day	Concentration of glucose in blood (mg per 100 cm^3 of blood)
6.00 am	90
7.00 am	120
8.00 am	70
9.00 am	85
10.00 am	110
11.00 am	80

1 (a) Explain the rise in the concentration of glucose in her blood between 6.00 am and 7.00 am.

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(1 mark)

1 (b) The concentration of glucose in her blood fell between 7.00 am and 8.00 am.
Explain why.

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(2 marks)

1 (c) Describe how hormones changed the concentration of glucose in her blood between 8.00 am and 11.00 am.

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(4 marks)

7

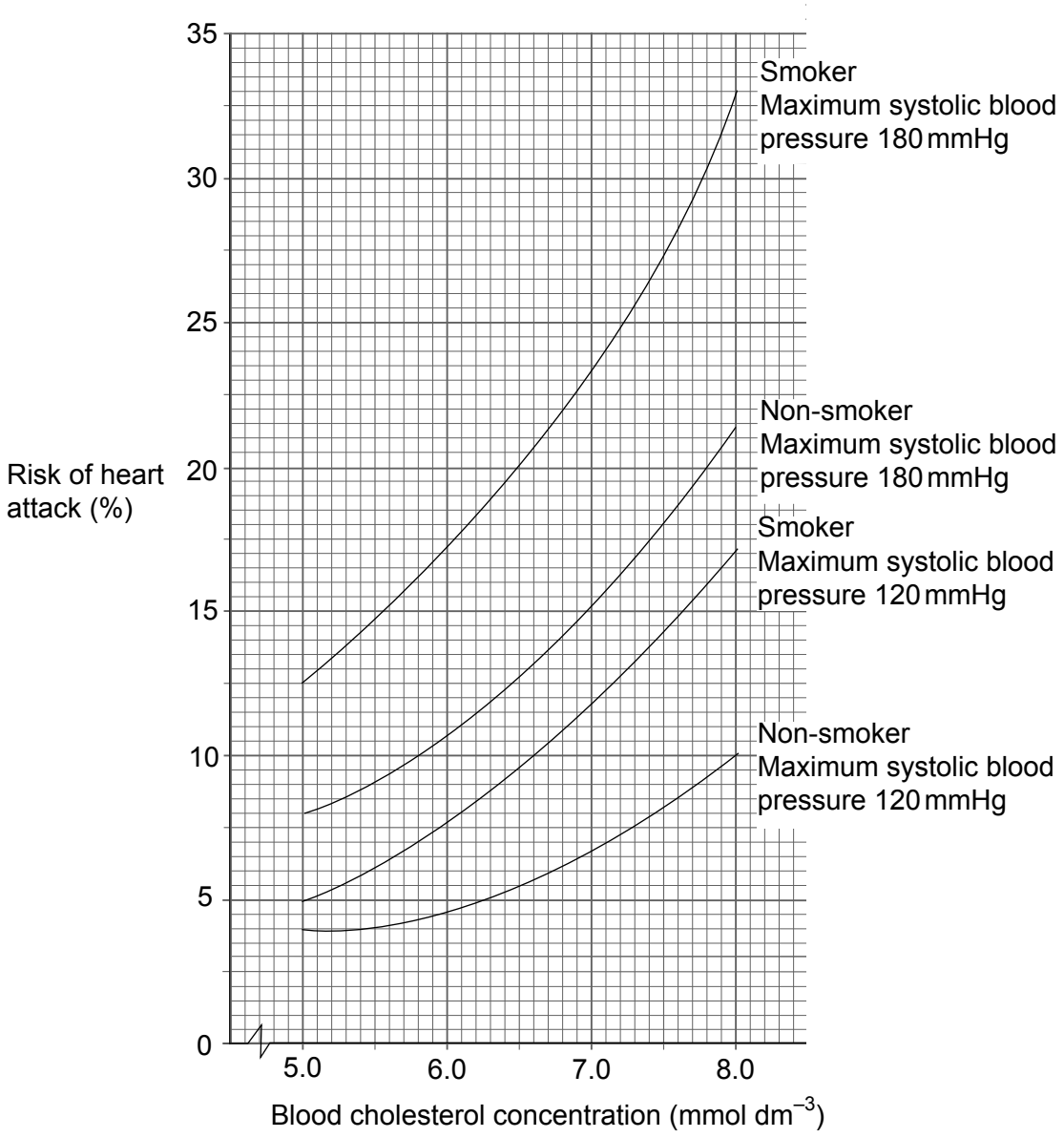
Turn over for the next question

2 A health promotion team visited a workplace to raise awareness of risk factors associated with coronary heart disease (CHD) and the over-50 age group. Several risk factors influence the onset of CHD. These include:

- systolic blood pressure higher than 180 mmHg;
- smoking;
- high cholesterol.

Figure 1 shows the risk of a 52-year-old male having a heart attack during the next 10 years, in relation to all three risk factors.

Figure 1



2 (a) Using **Figure 1**, describe the effect of smoking and high systolic blood pressure on the risk of having a heart attack for a 52-year-old male.

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(2 marks)

2 (b) (i) A 52-year-old smoker has a systolic blood pressure of 180 mmHg. His blood cholesterol concentration has changed from 6.0 mmol dm^{-3} to 7.0 mmol dm^{-3}.

At the same time his 52-year-old colleague who is a non-smoker has a blood cholesterol concentration of 7.0 mmol dm^{-3}. His systolic blood pressure has changed from 120 mmHg to 180 mmHg.

Use data from **Figure 1** to determine which 52-year-old has increased his risk of having a heart attack more. Justify your answer.

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(3 marks)

Question 2 continues on the next page

2 (b) (ii) Having a high blood cholesterol concentration is a risk factor for a heart attack.

Explain how having a high blood cholesterol concentration could increase the risk of a heart attack.

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(4 marks)

2 (c) Cigarette smoke contains nicotine. Nicotine increases the stickiness of blood platelets. Suggest how nicotine could increase the risk of cardiovascular disease.

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(2 marks)

11

3 A trainee dental hygienist is revising the process of digestion in the mouth.

3 (a) (i) Identify and describe **two** different digestive processes that take place in the mouth.

Process 1 .....

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Process 2 .....

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(4 marks)

3 (a) (ii) Name the digestive enzyme found in the mouth.

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(1 mark)

3 (a) (iii) Which molecule does the enzyme found in the mouth digest?

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(1 mark)

3 (a) (iv) Name the molecule produced in this digestive process.

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(1 mark)

Question 3 continues on the next page

3 (b) As part of his course, the trainee dental hygienist has to visit schools to teach pupils the importance of good oral hygiene.

Describe how he could assess, in school, how good a pupil is at brushing their teeth.

You will be assessed on the quality of written communication in your answer.

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Extra space (if needed) .....

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(5 marks)

12

4 A 17-year-old student suffers from cystic fibrosis. This condition causes the mucus produced in the body to be unusually thick and sticky. The student attends a weekly clinic. Nurses at the clinic use a pulse oximeter to determine the oxygen saturation of his blood. This helps the nurses to monitor how effectively his blood is oxygenated.

4 (a) (i) What is the normal range for oxygen saturation of the blood?

..... %

(1 mark)

4 (a) (ii) The nurses used a pulse oximeter to determine oxygen saturation of the student's blood.
Why is it an advantage to use a pulse oximeter rather than other methods of measuring oxygen saturation of the blood?

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(1 mark)

Question 4 continues on the next page

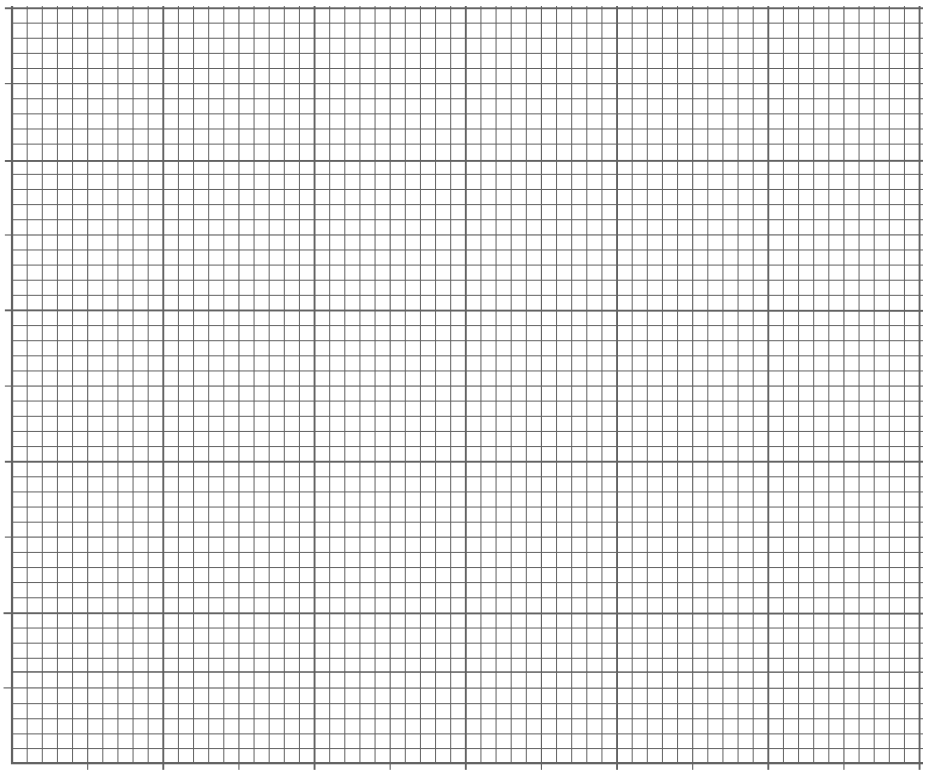
4 (b) The nurses used the pulse oximeter to determine oxygen saturation of the student's blood at different partial pressures of oxygen in inhaled air.

Table 2 shows the results of this test. Also shown in **Table 2** are the results for a person who does not suffer from cystic fibrosis.

Table 2

Partial pressure of oxygen in inhaled air (mmHg)	Percentage saturation of blood with oxygen / %	
	Cystic fibrosis patient	Non-cystic fibrosis patient
20	8	46
60	60	95
80	65	100
100	66	100
120	66	100

4 (b) (i) Plot the data in **Table 2** on the grid.



(3 marks)

4 (b) (ii) Use your graph to determine the percentage saturation for the cystic fibrosis patient at a partial pressure of 40 mmHg.

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Percentage saturation = ... %

(1 mark)

4 (b) (iii) Why does cystic fibrosis affect oxygen uptake by the blood?

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(2 marks)

4 (b) (iv) A sample of blood taken from the non-cystic fibrosis patient contains 20 cm^3 of oxygen at a partial pressure of 80 mmHg.

Use the data in **Table 2** to calculate how much oxygen there will be in the same volume of the cystic fibrosis patient's blood at the same partial pressure.

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Volume of oxygen =..... cm^3

(2 marks)

4 (c) The lining of the digestive system is normally coated in mucus. When eating a meal, people with cystic fibrosis must take tablets containing digestive enzymes.

Suggest why.

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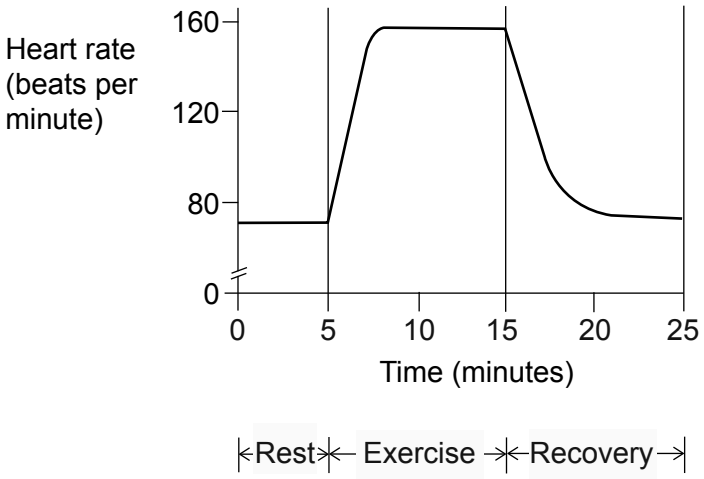
(2 marks)

12

5 A woman was investigating her own fitness levels. **Figure 2** shows her heart rate before, during and after exercise.

Figure 2



5 (a) (i) Explain the change in heart rate during the first two minutes of exercising.

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(2 marks)

5 (a) (ii) The woman noticed that her fitness had increased and yet her resting heart rate had decreased. Her personal trainer said that prolonged training often results in a decrease in resting heart rate although cardiac output remains the same.
Cardiac output is the amount of blood one ventricle pumps out in one minute.

Suggest how training helps resting heart rate to fall while cardiac output remains the same.

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(2 marks)

5 (b) Her personal trainer suggested it would be useful to know the woman's *basal metabolic rate* (BMR) because it could help her plan an appropriate diet.

Define basal metabolic rate.

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(1 mark)

5 (c) (i) Her personal trainer referred her to a sports nutritionist who suggested that the best way to determine basal metabolic rate was by indirect calorimetry.

How could the sports nutritionist determine the woman's BMR using indirect calorimetry?

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(4 marks)

5 (c) (ii) Indirect calorimetry is considered better than direct calorimetry when determining BMR.

Give **one** reason why.

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(1 mark)

5 (d) The test results showed that the woman was taking in too few calories. The sports nutritionist recommended that she should increase her intake of complex carbohydrates.
Name **one** suitable food the woman could include in her diet.

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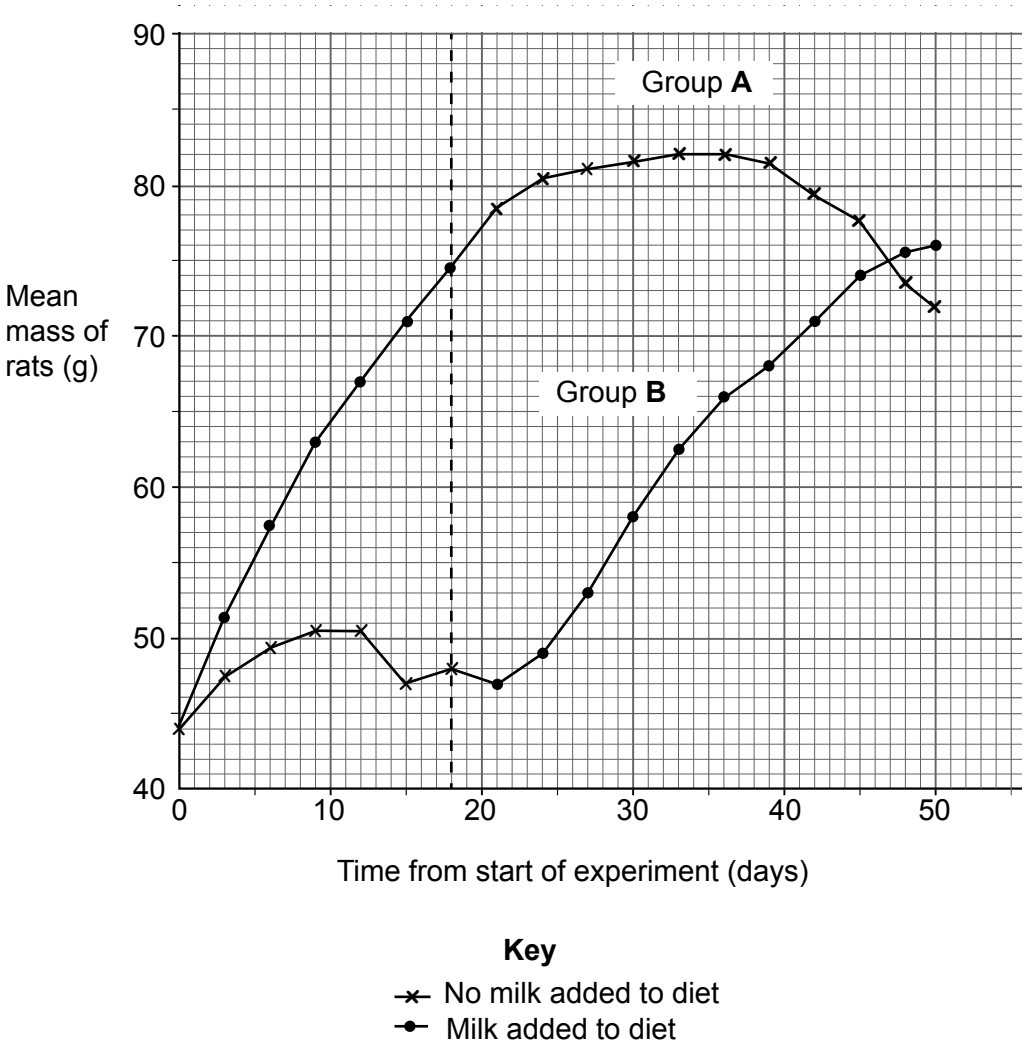
(1 mark)

11

6 A scientist was testing the hypothesis that small amounts of vitamins and minerals are essential in the diet.
Two groups of rats, Group **A** and Group **B**, were fed a diet containing starch, sucrose, protein and fat. These substances were all pure.
He added $2cm^3$ of milk to the daily diet of Group **A**.
After 18 days, he swapped the diets of the two groups.
His results are shown in **Figure 3**.

Figure 3



6 (a) (i) As a control, the diets of the two groups were swapped over after 18 days.
Explain the purpose of this control.

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(2 marks)

6 (a) (ii) Describe what **Figure 3** shows happening to each group after day 18.

Group **A** .....

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Group **B** .....

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(2 marks)

6 (b) The scientist decided to test human volunteers.

Give **one** ethical consideration that should be made when considering the design of an experiment that involves human volunteers.

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(1 mark)

6 (c) During the volunteer selection process all candidates kept a food diary.
One woman was rejected from the study because of her poor diet. Some of the data from the diary of this woman are given in **Table 3**, with the recommended daily allowance (RDA).

Table 3

	Energy (kJ)	**Protein (g)**	**Vitamin C (mg)**	**Iron (mg)**	**Calcium (mg)**
RDA	9000	53	60	15	1200
Woman's intake	7200	58	180	6	1200

6 (c) (i) State **two** changes that could be made in order to improve the woman's diet.

Change 1 .....

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Change 2 .....

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(2 marks)

Question 6 continues on the next page

6 (c) (ii) The diary showed that the woman ate lots of low-fat cottage cheese and oranges as part of her diet.
What evidence in **Table 3** supports this?

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(2 marks)

6 (d) (i) The scientist referred the woman to her doctor for blood tests. The doctor decided to ask for a haematocrit test.

Describe how the test would be done and what it would show.

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(3 marks)

6 (d) (ii) The blood tests indicated that her haemoglobin level was low.

State the blood disorder this could lead to and describe the treatment for the disorder.

Blood disorder.....

Treatment .....

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(2 marks)

14

7 An elderly man started feeling short of breath, even when walking short distances.
He noticed that sometimes his lips became a bluish colour.
He was referred to the hospital where a doctor diagnosed chronic obstructive pulmonary disease (COPD).
COPD occurs when the patient has both chronic bronchitis and emphysema.
In COPD the bronchioles narrow and the alveolar walls become damaged and weakened.

7 (a) (i) Suggest how damaged alveolar walls might affect the size and number of alveoli.

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(2 marks)

7 (a) (ii) Suggest how COPD could reduce the amount of gas exchange in the alveoli.

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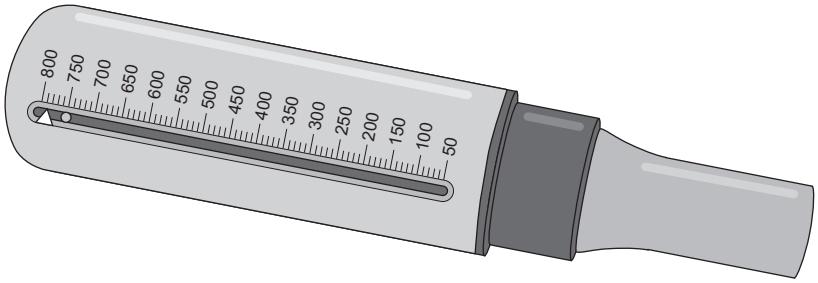
(2 marks)

Question 7 continues on the next page

7 (b) Doctors tested the elderly man's lung function to diagnose chronic obstructive pulmonary disease. As part of these tests, they used a peak flow meter, as shown in **Figure 4**.

Figure 4



7 (b) (i) The peak flow meter in **Figure 4** measures the *peak expiratory flow rate.*

What does peak expiratory flow rate mean?

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(1 mark)

7 (b) (ii) Use your knowledge of what a peak flow meter measures to explain how it shows that the elderly man's peak expiratory flow rate is lower than normal.

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(3 marks)

7 (c) The doctor told the elderly man to breathe from an oxygen cylinder for 14 hours a day to allow his cells to respire aerobically rather than anaerobically.
Explain the differences between aerobic respiration and anaerobic respiration, and why aerobic respiration is more effective than anaerobic respiration in cells.

You will be assessed on the quality of written communication in your answer.

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Extra space (if needed) .....

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(5 marks)

13

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED