OCR
RECOGNISING ACHIEVEMENT

Friday 11 January 2013 – Afternoon

AS GCE APPLIED SCIENCE

G622/01 Monitoring the Activity of the Human Body

G611340113

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 30 minutes

G 6 2 2 0 1

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **90**.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.

  This means, for example, you should:
  - ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
  - organise information clearly and coherently, using specialist vocabulary when appropriate.
- You may use an electronic calculator.
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Mrs Armstrong had an accident and has a serious bone fracture in her pelvis.

During surgery implants are added.

Fig. 1.1 is an X-ray of Mrs Armstrong's pelvis taken after surgery.

The image shows the stainless steel implants.

Fig. 1.1

(a) X-ray radiography is described as 'non-invasive'.

Give **two** advantages, apart from cost, of non-invasive treatments compared with invasive treatments.

1 .....

.....

2 .....

.....

[2]

(b) Describe how X-ray radiography produces the image shown in Fig. 1.1.

You are **not** required to explain how an X-ray is generated.

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..... **[5]**

(c) Mrs Armstrong's doctors use a CAT scanner to find out if the muscles attached to her pelvis are damaged (Fig. 1.2).

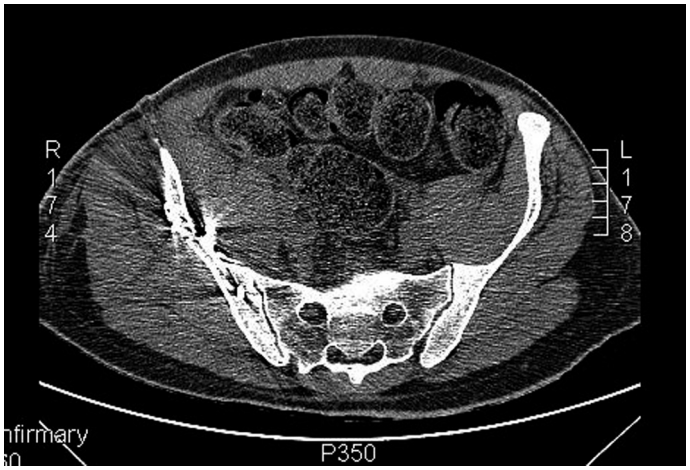

Fig. 1.2

(i) State why a CAT scanner is used.

.....

..... **[1]**

(ii) Explain why an MRI scanner is **not** used in the examination of Mrs Armstrong after her surgery.

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..... **[2]**

(d) The use of X-ray radiography has potential hazards.

Complete Table 1.1 to indicate one risk and a related safety precaution for the **radiographer**.

Hazard	Risk	Safety precaution
X-ray radiation		

[2]

Table 1.1

[Total: 12]

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Question 2 begins on page 6

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2 Tom is investigating the structure and function of the respiratory system.

(a) Tom finds an image showing the wall of the trachea (Fig. 2.1).

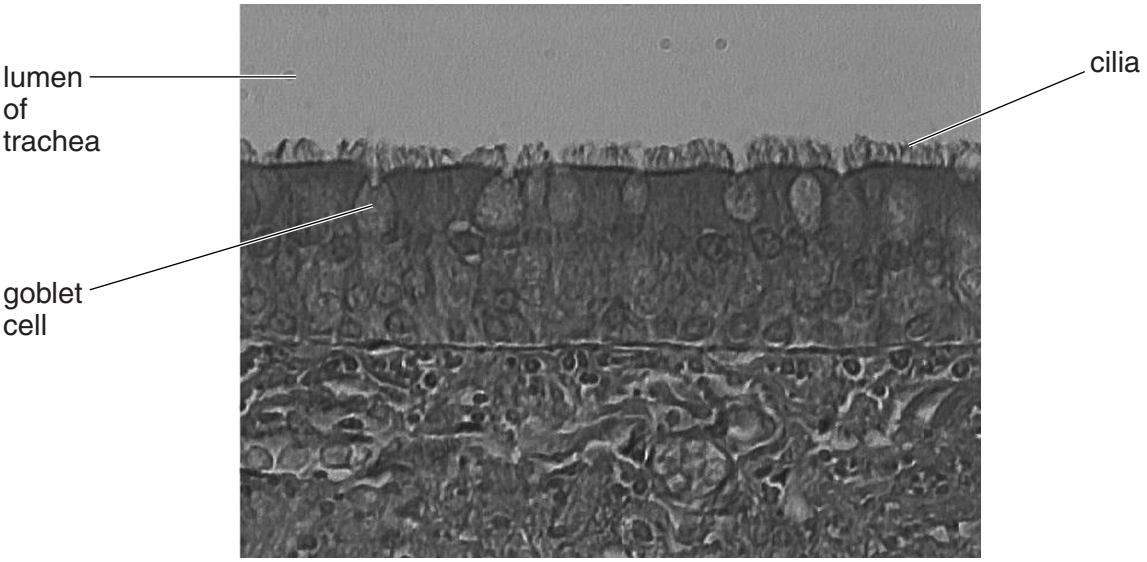

Fig. 2.1

(i) State and explain the function of the goblet cells and cilia.

goblet cells .....

.....

cilia .....

.....

[4]

(ii) Name one other structure found in the wall of the trachea and describe its function.

structure .....

function .....

.....

[2]

(b) Describe the process of **expiration**.

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..... **[5]**

(c) Tom decides to look at ventilation rates as part of his investigation.

He has his tidal volume and breathing rate measured **at rest** using a spirometer.

Tom's spirometer trace is shown in Fig. 2.2.

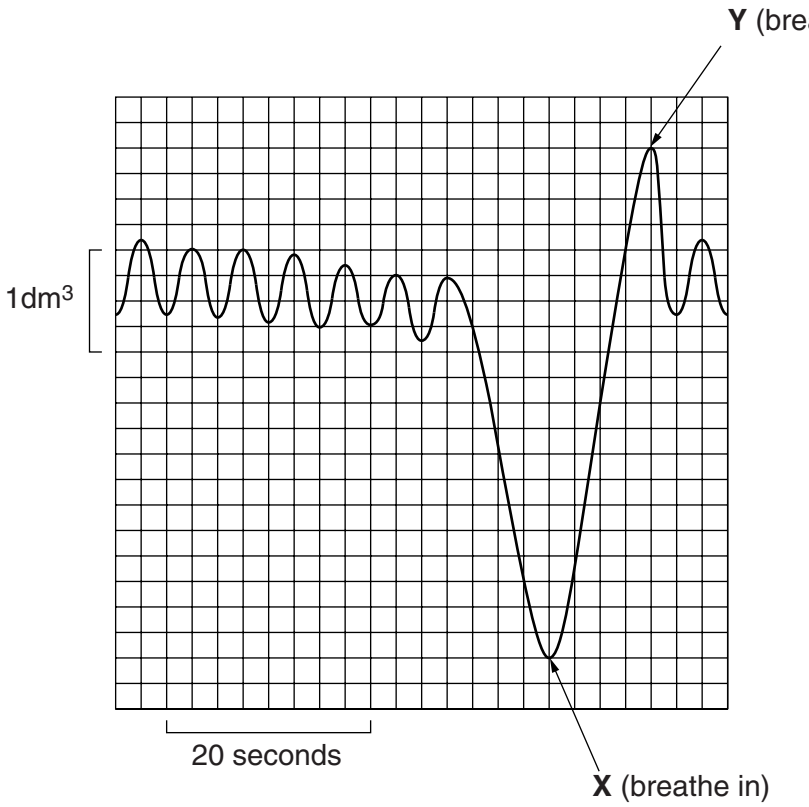

Fig. 2.2

Following a period of breathing at rest, Tom starts to breathe in as deeply as he can until point **X**. He then starts to breathe out as deeply as he can until he reaches point **Y**. Tom then returns to breathing at rest.

(i) Use the spirometer trace (Fig. 2.2) to calculate Tom's ventilation rate at rest.

ventilation rate = tidal volume × breathing rate

ventilation rate = ... $dm^3 min^{-1}$ **[3]**

(ii) What is Tom's vital capacity, as shown by the spirometer trace?

vital capacity = ... dm^3 **[1]**

(iii) Tom then undertakes some exercise while connected to the spirometer.

State **two** changes you would **expect** to see in Tom's breathing as a result of exercise.

change 1 .....

change 2 .....

[2]

(d) (i) State **two** features of the human respiratory surface that make the process of gas exchange efficient.

1 .....

2 .....

[2]

(ii) Explain how respiratory gases are exchanged between the blood and the gas exchange surface of the human lung.

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..... **[4]**

[Total: 23]

3 Diabetes is the name given to a group of metabolic disorders in which a person has high blood-glucose levels.

(a) Glucose appears in the urine of untreated diabetic persons when the blood-glucose concentration exceeds a critical value.

Put a (ring) around this critical value below.

3.0 mmol dm^{-3} **5.0 mmol dm^{-3}** **9.0 mmol dm^{-3}** **12.0 mmol dm^{-3}**

[1]

(b) There are differences between type 1 and type 2 diabetes.

Put a tick (✓) in the correct box or boxes for each row.

	Type 1 diabetes	**Type 2 diabetes**
Can be induced by obesity		
Islets of Langerhans malfunction		
Treated by dietary means in the early stages		

[2]

(c) Different tests are carried out to measure the severity of diabetes in patients.

The glucose tolerance test involves drinking a glucose solution to find out how quickly the glucose is cleared from the blood. A series of blood samples is taken.

The test can include the following stages:

- Fast for the previous 8–14 hours (water is allowed but no food).
- A 'zero time' baseline is calculated from the first blood sample.
- The person is then given a glucose solution to drink. The 'standard dose' given is 1.75 g of glucose per kg of body mass.
- Blood samples are taken at intervals to measure glucose concentrations.

(i) Why should the person not eat food before the test?

.....

..... **[1]**

(ii) Why is the 'zero time' baseline necessary?

.....

..... **[1]**

(iii) The 'standard dose' given is 1.75 g of glucose per kg of body mass.

A person has a body mass of 48 kg.

What mass of glucose should they drink to receive their 'standard dose'?

mass of glucose = ... g **[1]**

(iv) Fig. 3.1 shows the results of the test for three people.

Fig. 3.1

Use the data shown in Fig. 3.1 to support the following conclusions:

1. Person **A** does not have diabetes

.....

..... **[2]**

2. Person **B** is suffering from mild diabetes

.....

..... **[2]**

3. Person **C** is suffering from severe diabetes.

.....

..... **[2]**

(d) Biosensors can be used by people with type 1 diabetes to monitor their blood-glucose concentration.

(i) Describe how such people with type 1 diabetes use a blood-glucose biosensor.

.....

.....

.....

..... **[2]**

(ii) How do these results help people with type 1 diabetes to control their condition?

.....

..... **[1]**

(iii) It is essential that people with diabetes using these biosensors understand the risks before performing the test.

1. State **two** different hazards associated with blood sampling.

.....

.....

..... **[2]**

2. Describe **two** ways of minimising the risks from these hazards.

.....

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..... **[2]**

[Total: 19]

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Question 4 begins on page 14

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4 Fatima is 86 years old. She is complaining about pains in her chest and has been recently diagnosed with heart disease.

When Fatima was 40 years old, her pulse rate was within the typical range and she had normal blood pressure.

(a) State the expected pulse rate and blood pressure for Fatima when she was 40 years old.

pulse rate range ..... to ..... beats per minute

blood pressure value ..... / .....mmHg

[2]

(b) State what the two values for blood pressure represent.

.....

..... **[2]**

(c) Describe how to measure blood pressure using a **manual** sphygmomanometer.

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..... **[3]**

(d) Fatima's doctor took an ECG reading.

The result is shown in Fig. 4.1

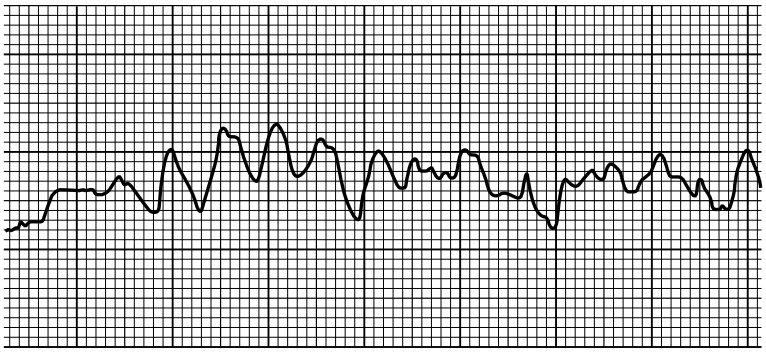

Fig. 4.1

State **two** differences between Fatima's ECG trace and that of a person with a normally-functioning heart.

1 .....

2 .....

[2]

(e) After Fatima receives emergency treatment, her doctor decides to carry out an ultrasound scan to examine her heart.

(i) Describe the principles of ultrasound scanning.

.....

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.....

..... **[3]**

(ii) State **two** advantages, apart from cost, of ultrasound scanning.

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.....

..... **[2]**

(iii) State **one** other medical application for ultrasound scanning.

..... **[1]**

(f) Fatima recovers after a few days in hospital, at which point Fatima and her family have a discussion with her doctor.

They consider the possibility of medical treatment in the near future.

Discuss the arguments for and against surgical medical treatment in cases such as these involving elderly patients with heart disease.

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..... **[3]**

[Total: 18]

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Question 5 begins on page 18

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5 Fig. 5.1 represents part of a skeletal muscle cell.

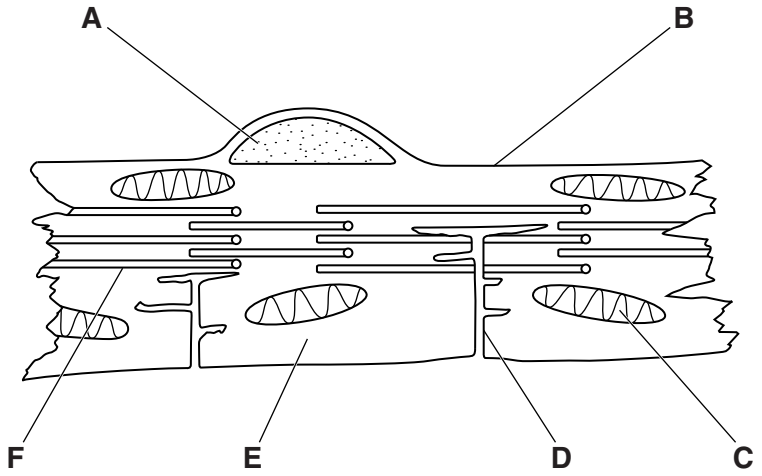

Fig. 5.1

(a) Complete Table 5.1 to show the correct site, **A**, **B**, **C**, **D**, **E** or **F**, where each of aerobic and anaerobic respiration take place in the skeletal muscle cell.

Site of cellular respiration	Label
aerobic	
anaerobic	

[2]

Table 5.1

(b) Complete Table 5.2 to show the differences between aerobic and anaerobic respiration.

Feature	Aerobic respiration	Anaerobic respiration
reactants	oxygen and glucose	.....
products	.....	lactate
number of ATP molecules produced per molecule of glucose	38	.....

[3]

Table 5.2

(c) Explain how oxygen and glucose reach the skeletal muscles.

.....

.....

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.....

..... **[3]**

(d) Four athletes had blood samples analysed by a sports physiologist before and after exercise. They completed the same type of exercise and for the same period of time.

The results were recorded in Table 5.3.

Athlete	Lactate concentration in blood / mmol dm^{-3}	
	Before exercise	After exercise
1	0.5	2.2
2	0.6	1.8
3	0.5	7.0
4	0.4	1.5

Table 5.3

One of the athletes has a respiratory problem. He has difficulty in taking in sufficient volumes of air into his lungs.

(i) Identify the athlete and state a reason for your choice.

.....

..... **[1]**

(ii) Explain how this condition may affect cellular respiration in his muscle cells.

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..... **[2]**

(e) The sports physiologist decides to take further measurements for the four athletes.

Explain how the sports physiologist would measure the athletes' **body temperatures** accurately.

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..... **[3]**

(f) Sports physiologists are also involved in testing athletes for drugs.

(i) State one performance-enhancing drug and one recreational drug that can be tested for by taking blood samples.

performance-enhancing drug .....

recreational drug .....

[2]

(ii) One type of illegal performance-enhancement involves the injection of red blood cells into an athlete's blood a few days before a sporting competition.

Describe how this enhances the performance of the athlete.

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..... **[2]**

[Total: 18]

END OF QUESTION PAPER