OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

APPLIED SCIENCE G622

Monitoring the activity of the human body

Monday **16 JANUARY 2006** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully to make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	13	
2	13	
3	16	
4	16	
5	9	
6	8	
7	15	
TOTAL	90	

This question paper consists of 19 printed pages and 1 blank page.

Registered Charity Number: 1066969
[Turn over

For Examiner's Use

Answer all the questions.

1 Students were preparing a presentation about gas exchange and breathing.

(a) Fig.1.1 shows one slide they used.

Fig. 1.1

Label, using lines, the following structures on Fig. 1.1.

bronchiole bronchus trachea [3]

(b) Fig. 1.2 shows another slide the students used, representing the part of the lung where gas exchange takes place.

An image has been removed due to third party copyright restrictions

Details: An image showing an air-filled sac next to a blood vessel

Fig. 1.2

(i) Name the air-filled sac.

..... [1]

(ii) Name the process by which gases are exchanged between the air in the sac and the blood flowing in the capillaries.

..... [1]

(iii) Oxygen, carbon dioxide and water can move in both directions through the walls separating the air in the sac from the blood in the capillary.

1. Draw a short arrow on Fig. 1.2 to show the direction that more oxygen moves through the walls. [1]

2. State two structural features of the sac and capillary walls that allow gas exchange to take place.

.....

..... [2]

(c) Fig. 1.3 shows a work-sheet the students used in their presentation testing the idea of ventilation.

Ventilation

The following sentences describe how breathing movements cause air to enter the lungs.

Complete the sentences using words from the list.

Each word may be used once, more than once or not at all.

decreases diaphragm epiglottis increases lung rib-cage

The …… is raised by the contraction of intercostal muscles.

The …… is lowered.

The volume of the thorax …… .

As a result, pressure inside the thorax …… .

Air moves into the …… air space to balance the pressure.

Fig. 1.3

[5]

[Total: 13]

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Turn over for Question 2.

2 Ben has been admitted to the Accident and Emergency Department of a hospital.
He thinks he has broken his leg. The radiographer must reassure him and answer Ben's questions. The radiographer decides to use a conventional X-ray machine rather than using a CAT scanner.

Ben is interested in finding out about the X-ray machine that is going to be used and any risks involved.

(a) The radiographer explains to Ben the basic principles of X-ray radiography.

Use your scientific knowledge to describe what the radiographer would say.

In this question, two marks are available for a clear and ordered answer.

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..... [5]

Quality of Written Communication [2]

(b) The radiographer now tells Ben about the risks and benefits of using X-ray machines for accident investigation.

risks .....

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.....

..... [3]

benefits .....

.....

.....

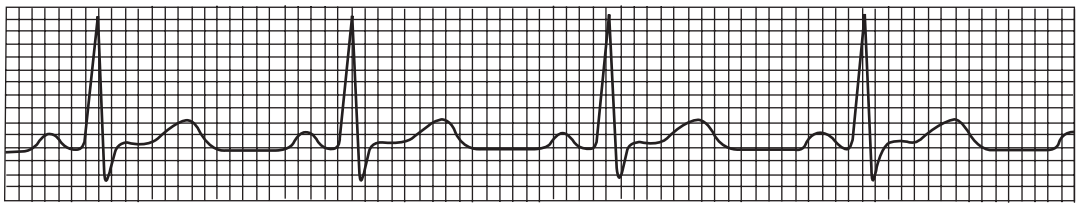
.....

..... [3]

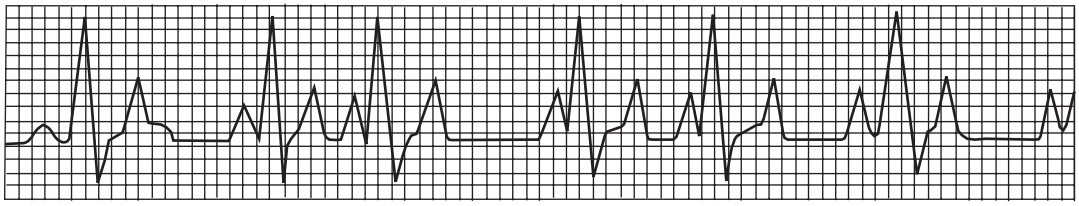
[Total: 13]

3 **(a)** Students investigating the behaviour of the human heart obtained ECG traces (electrocardiograms) for three patients. Their traces are shown below in Fig. 3.1.

trace **A**



trace **B**



trace **C**

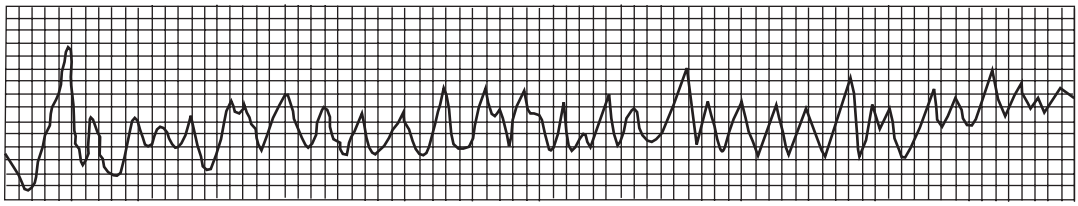


Fig. 3.1

The ECG trace for patient **A** shows normal heart activity.

(i) Give **two** differences between trace **B** and trace **A**.

.....

.....

.....

..... [2]

(ii) Name the heart condition shown by ECG trace **B**.

..... [1]

(iii) A patient in hospital may be connected to a monitor that shows his electrocardiogram continuously. If the monitor starts to show a graph similar to that for trace **C**, an alarm goes off.

1. Name the heart condition shown by the ECG trace **C**.

   ..... [1]

2. State and explain why it is important that the machine generates a warning sound when this type of heart condition is registered.

   .....

   .....

   .....

   ..... [2]

Question 3 continues on the next page.

(b) A diagram of a vertical section through the heart is shown to medical students. The diagram is shown in Fig. 3.2 with the labels removed.

A diagram has been removed due to third party copyright restrictions

Details: A diagram of a vertical section through the heart

Fig. 3.2

(i) Label, using lines, the positions of the following two structures on Fig. 3.2.

sinoatrial node (SAN) atrioventricular node (AVN) [2]

(ii) Describe how the SAN and the AVN control the cardiac cycle.

In this question, two marks are available for the quality of written communication.

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..... [6]

Quality of Written Communication [2]

[Total: 16]

4 Technicians at a health clinic tested blood samples taken from two runners to determine their blood lactic acid concentration.
Samples were taken, on each occasion, after the two runners had exercised for a set period of time at a different running speed.
The runners then trained for a period of six weeks.
The tests were then repeated on a second set of blood samples.
Some of the results are shown in Table 4.1.
'Pre' values are those obtained before training. 'Post' values are those obtained after training.

Table 4.1

runner		running speed (km / h)					
		11	12	13	14	15	16
		blood lactic acid (mmol / dm^3) at different running speeds					
runner 1	pre	2.7	3.1	3.7	4.1	4.7	5.8
	post	1.8	2.3	3.1	3.8	4.0	4.7
runner 2	pre	3.5	3.1	3.7	4.5	5.9	6.4
	post	2.1	2.9	3.1	3.8	4.6	5.2

(a) **(i)** What effect does running speed have on blood lactic acid concentration for runner 1?

.....

..... [1]

(ii) What effect did training have on the concentration of blood lactic acid recorded for both athletes?

.....

..... [1]

(b) One of the results does not follow the general pattern.
Identify this result and state how it is different.

result ..... [1]

how it is different.

.....

.....

..... [2]

(c) For health and safety reasons, the technicians had to complete a risk assessment form before taking the blood samples.

Imagine that you were one of the technicians.
Complete the form below.

Risk Assessment Form **Type of activity** **Blood test** **Date carried out** **16 January 2006**
Material/procedure: (brief description) [2]
Hazard: [1]
What could go wrong: [2]
Safety precautions: [3]
In case of accident: [2]
Risk (high/medium/low) explained: [1]

[Total: 16]

5 **(a)** The graph below shows blood pressure in different blood vessels within the circulatory system.

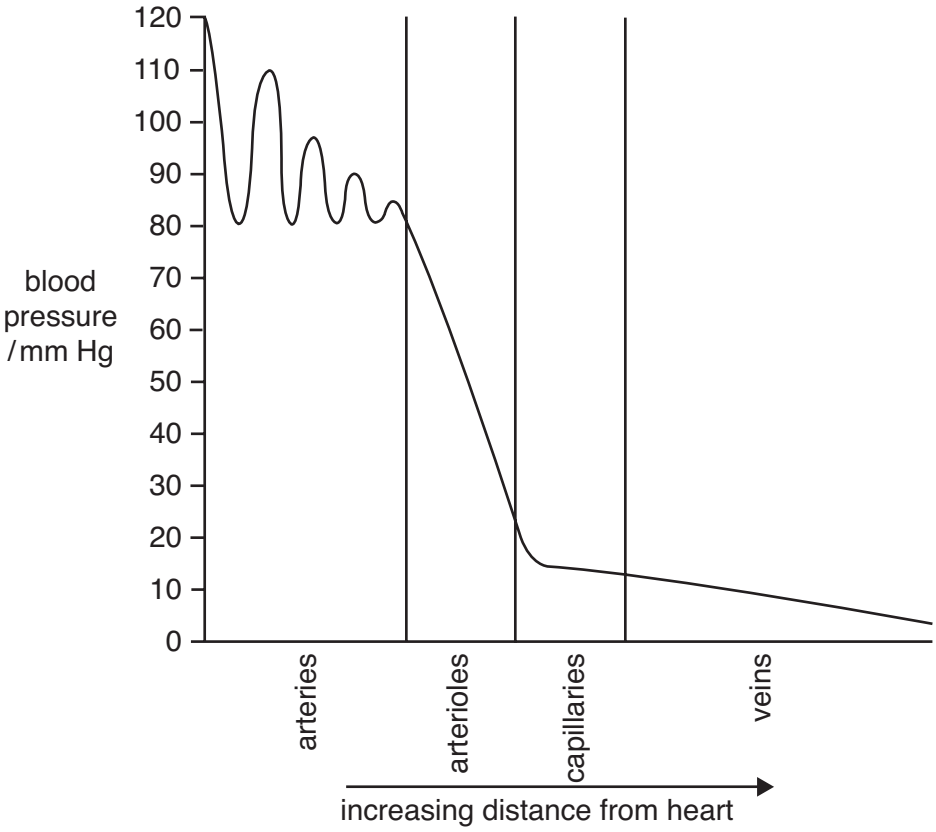

Fig. 5.1

Use information in Fig. 5.1 and your own biological knowledge to complete Table 5.1.

Table 5.1

feature	artery	capillary	vein
range of blood pressure / mmHg		21 – 13	
blood flow		smooth flow	
structure of walls			
presence of valves in wall		not present	

[8]

(b) An individual's blood pressure was recorded by a technician before and after carrying out a period of heavy manual work in a factory.

What piece of equipment would have been used to measure blood pressure?

..... [1]

[Total: 9]

6 Respiration is the process by which living things obtain energy for their activities.

(a) State **three** different processes going on within the human body which need a supply of energy.

(i) .....

(ii) .....

(iii) ..... [3]

(b) Aerobic respiration and anaerobic respiration take place in the human body. They both make energy available to body cells but the way they achieve this differs.
Write a sentence to describe these differences with respect to:

(i) substrates used;

.....

.....

..... [1]

(ii) products formed;

.....

.....

..... [1]

(iii) quantity of energy made available to a cell.

.....

.....

..... [1]

(c) Sports physiologists sometimes refer to a phenomenon known as 'oxygen debt'.

Explain what they mean by the term 'oxygen debt'.

.....

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.....

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..... [2]

[Total: 8]

7 Two volunteers took part in an investigation into the effect of exercise on heart rate.
They were asked to complete six 10-second sprints.
They were given a one-minute rest between sprints.
They were asked to make maximum effort during each sprint.

Table 7.1 shows some of the results that were obtained.

Table 7.1

sprint number	heart rate / beats per min	
	male	female
1	132	112
2	147	144
3	159	162
4	163	169
5	160	164
6	156	158

(a) Calculate the average heart rate for the male.
Show your working.

..... [2]

(b) Describe the **two** trends shown by the results in Table 7.1 for the male volunteer.
Refer to the data in your answer.

(i) trend 1

.....

.....

..... [1]

supporting data

.....

.....

..... [1]

(ii) trend 2

.....

.....

..... [1]

supporting data

.....

.....

..... [1]

(c) **(i)** **Use the data** to calculate and describe the **differences** between the heart rates for the male and female volunteers:

after sprint 1;

.....

.....

after sprint 6.

.....

..... [2]

(ii) What other piece of data would be needed to draw valid conclusions from part **(c)(i)**?

.....

..... [1]

Question 7 continues on the next page.

For Examiner's Use

(d) An individual can work out a value for their maximum heart rate (MHR), in beats per minute, using the following formula:

MHR = 220 – (age of individual in years)

This value can then be used to monitor how hard the individual should work when training.

(i) Use the above formula to calculate the MHR for an 18-year old.

..... beats per minute [2]

An athlete usually trains at between 70 and 85% of their MHR.

(ii) What is the minimum MHR value that an 18-year old athlete should use as a guide for their training?

Show your working.

..... beats per minute [2]

(iii) These values could be useful in monitoring a training programme for the athlete.

What comment might be made about the training programme if:

1. the athlete exercised with MHR values between the minimum and maximum calculated values;

.....

..... [1]

2. the athlete exercised with MHR values above the calculated maximum?

.....

..... [1]

[Total: 15]

END OF QUESTION PAPER