OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

APPLIED SCIENCE

G622

Monitoring the Activity of the Human Body

OCE/23654

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:
- Electronic Calculator
- Ruler (cm/mm)

Tuesday 12 January 2010
Morning

Duration: 1 hour 30 minutes

G6222

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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**.
-  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.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Sports scientists need to monitor the levels of fitness of athletes, including muscle activity and cellular respiration. Cellular respiration is the process by which every living cell obtains energy for its activities. Athletes respire to carry out a number of processes including muscle cell contraction.

(a) State three **other** processes in the human body that need a supply of energy.

1. .....

2. .....

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

(b) What are the **sites** of aerobic and anaerobic respiration in a muscle cell?

aerobic respiration .....

anaerobic respiration ..... **[2]**

(c) The muscle cells of athletes can carry out aerobic and anaerobic respiration.

Complete the sentences below with the correct **words or numbers** from the list.

2 24 38 76

carbon dioxide glucose glycogen

lactic acid lipid oxygen phosphate water

Aerobic respiration has the **potential** to produce as many as …… ATP molecules for each molecule of …… oxidised. However, anaerobic respiration results in the **net** production of …… ATP molecules. Each ATP molecule is formed by a phosphorylation reaction between ADP and phosphate. In addition to ATP, the products of aerobic respiration include …… and …… . Anaerobic respiration in muscle cells results in the formation of …… as well as ATP. During physical activity, the stores of …… are broken down and used for cellular respiration in muscle cells. **[7]**

(d) It is possible to analyse an athlete's blood to find out what is happening in their muscles during exercise and to indicate fitness levels.

Three athletes had blood samples analysed before and after a period of exercise. They completed the same type of exercise and for the same period of time. The following results were recorded.

Table 1.1

blood samples taken	**concentration of lactic acid in blood / mmol dm^{-3}**	
	before exercise	after exercise
athlete 1	0.6	2.0
athlete 2	0.4	1.8
athlete 3	0.5	7.5

Use the data in Table 1.1 to answer **(i)** to **(iii)**.

(i) State the effect of exercise on blood lactic acid concentrations for athletes 1 and 2.

.....

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

(ii) Athlete 3 may have a problem with either his respiratory system or circulatory system. State one problem for each system and explain how the problem will affect cellular respiration in his muscle cells.

1 respiratory system problem .....

.....

explanation .....

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

2 circulatory system problem .....

.....

explanation .....

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

[Total: 18]

2 A man is experiencing severe back pain and has an appointment to see a specialist at his local hospital. He has an X-ray taken before meeting the specialist.

(a) The X-ray staff tell the man about the risks and benefits of X-rays before this scanning technique can be used for diagnosis.

State two benefits and two risks of using **X-rays** to make a diagnosis.

benefits

1. .....

2. .....

risks

1. .....

2. ..... **[4]**

(b) Describe the basic principles of medical X-ray radiography.

.....

.....

.....

.....

.....

.....

.....

.....

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

(c) The specialist looks at the X-ray and cannot make a diagnosis. She decides to send the man for an MRI scan of his back, neck and pelvis.

Why does the specialist request an MRI scan?

.....

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

(d) The specialist could use a **CAT scan** to explore the problems with the man's back and pelvis, particularly if osteoporosis is suspected.

A risk assessment must be carried out before using a CAT scan to find out if this technique would be appropriate for the man.

Complete Table 2.1 to show two potential hazards, their risks and the safety precautions used to reduce such risks with a CAT scanner.

Table 2.1

Risk assessment form			
Purpose: to use a CAT scanner Patient: ……			
Example	**Hazard** to be considered	**Risk** to the patient	**Safety precaution** needed
1			
2			

[6]

[Total: 16]

3 Nurses study the structure and function of the human heart. This major organ is used to pump blood around the body.

Fig. 3.1 shows a vertical section of the heart.

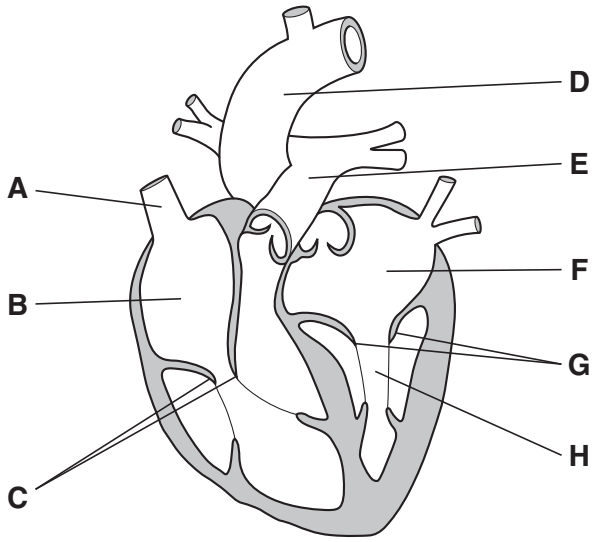


Fig. 3.1

(a) Using Fig. 3.1, complete the labels below.

Four labels have been completed for you.

A vena cava

B right atrium

C .....

D aorta

E .....

F left atrium

G .....

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

(b) State one feature in Fig. 3.1 that shows that the heart is viewed from the front. Give a reason for your answer.

.....

.....

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

(c) Name a hormone that affects the heart rate and describe its effect.

hormone .....

effect of hormone on heart rate .....

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

(d) Describe how the nervous system controls the heart rate.

You must make reference to the sinoatrial node (SAN) in your answer.

.....

.....

.....

.....

.....

.....

.....

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

(e) The electrical activity of the heart can be monitored using a special machine.

The electrical activity of the hearts of three people, **A**, **B** and **C**, are shown in Fig. 3.2.

The time scale is indicated.

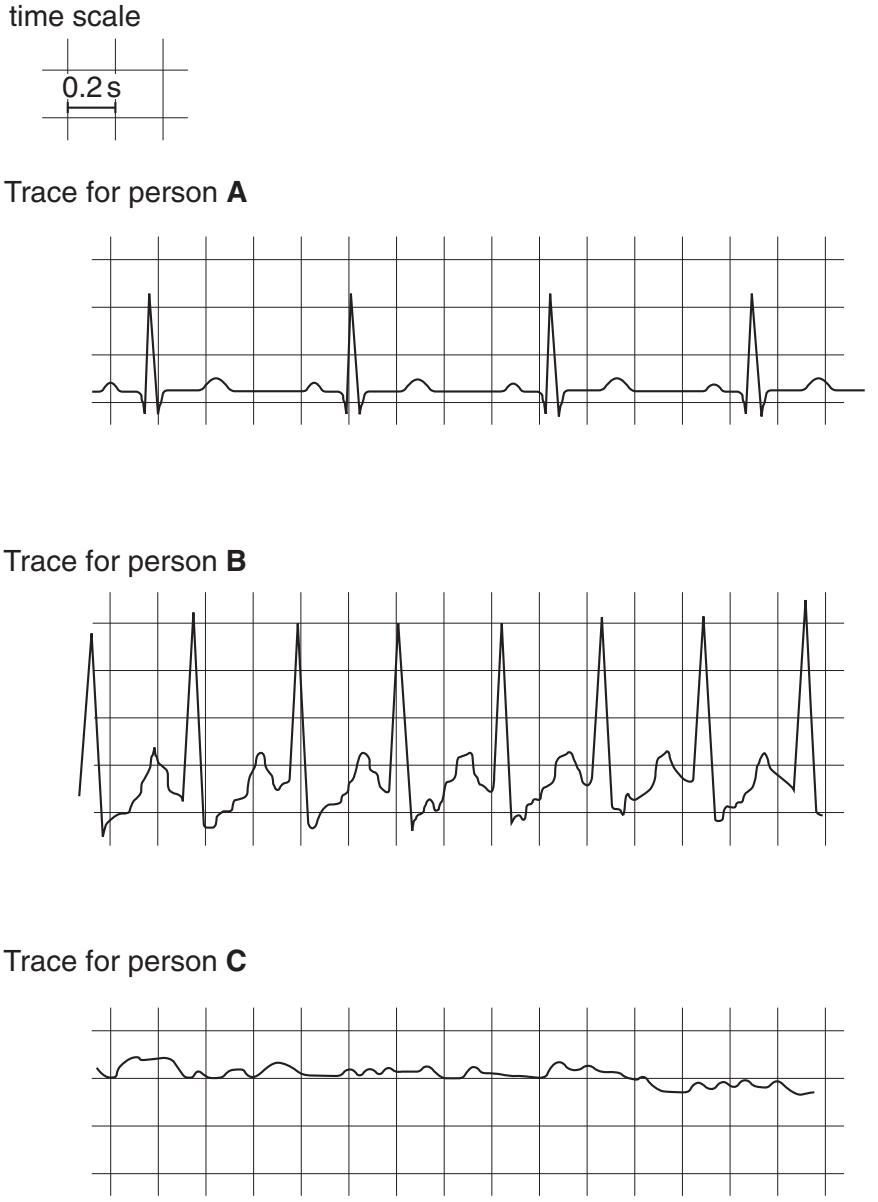


Fig. 3.2

(i) What is the name of the machine used to obtain the readings?

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

(ii) Person **A** is healthy.

Using Fig. 3.2, calculate the heart rate in beats per minute for person **A**.

beats per minute = ... **[2]**

(iii) Person **B** has tachycardia.

Using Fig. 3.2, describe **two** differences between the trace for person **B** and the trace for person **A**.

.....

.....

.....

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

(iv) What condition would cause the trace for person **C**?

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

(v) What could happen to person **C** if this condition was untreated?

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

[Total: 16]

4 Susan exercises at a local gym on a regular basis to increase her fitness levels.

She has her **ventilation rate** measured at **rest** using a spirometer.

Susan's spirometer reading is shown in Fig. 4.1.

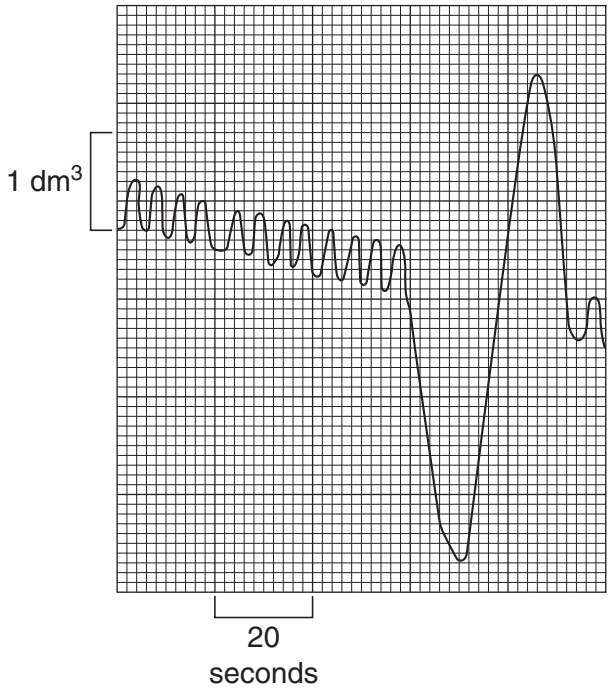


Fig. 4.1

Following a period of breathing at rest, Susan was asked to breathe **in** as deeply as she could and then to breathe **out** as deeply as she could.

(a) Using the spirometer trace, Fig. 4.1, for Susan **at rest**, calculate her ventilation rate.

ventilation rate = tidal volume × breathing rate

tidal volume = ... dm^3

breathing rate = ... breaths per minute

ventilation rate = ... $dm^3 min^{-1}$ **[4]**

(b) Susan exercised while connected to the spirometer.

State two **changes** you would **expect** to see in the spirometer trace as a result of this exercise.

1. .....

.....

2. .....

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

(c) What is Susan's vital capacity, as shown by the original spirometer trace?

..... dm^3 **[1]**

(d) Susan uses a peak-flow meter after her tests using the spirometer.

(i) What does a peak-flow meter measure?

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

(ii) Describe how to use a peak-flow meter.

.....

.....

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

(iii) Asthma is a chronic, inflammatory, lung disease. It can result in a 'narrowing of the airways'.

Describe and explain the effect of asthma on the peak-flow rate.

.....

.....

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

(e) (i) The respiratory system has different parts including:

A alveolus

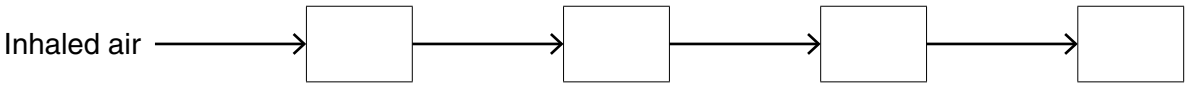
B bronchus

C large bronchiole

D trachea

What is the route followed by **inhaled** air?

Put the correct letters (**A**, **B**, **C** or **D**) in each box.



[3]

(ii) Table 4.1 shows a number of features found in the respiratory system.

Put a tick (✓) in each box if the feature is present or a cross (✗) if the feature is absent.

Table 4.1

	feature			
part	cartilage	cilia	mucus secreting cells	smooth muscle
alveolus				
bronchus				
large bronchiole				
trachea				

[4]

[Total: 19]

5 People with diabetes are frequently tested so that their blood-glucose levels are monitored.

(a) What is the cause and the treatment of **type 1** diabetes?

cause .....

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

(b) What is the cause and the treatment of **type 2** diabetes?

cause .....

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

(c) What is the link between 'early onset' diabetes and obesity in children and young adults?

.....

.....

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

(d) The **glucose tolerance test** involves drinking glucose to find out how quickly it is cleared from the blood.

The test can include the following stages:

- The person should have been **fasting** for the previous 8-14 hours (water is allowed but no food).
- The test often starts early in the morning and a 'zero time' baseline is calculated from the first blood sample.
- The person is then given a glucose solution to drink. The standard dose is 1.75 g of glucose per kilogram of body mass.
- Blood samples are taken at intervals to measure glucose levels in the blood.

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

.....

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

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

.....

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

(iii) A person has a mass of 50 kilograms. How much glucose should they drink to receive the 'standard dose'?

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

(iv) Fig. 5.1 shows the blood-glucose tolerance readings for three people, **X**, **Y** and **Z**.

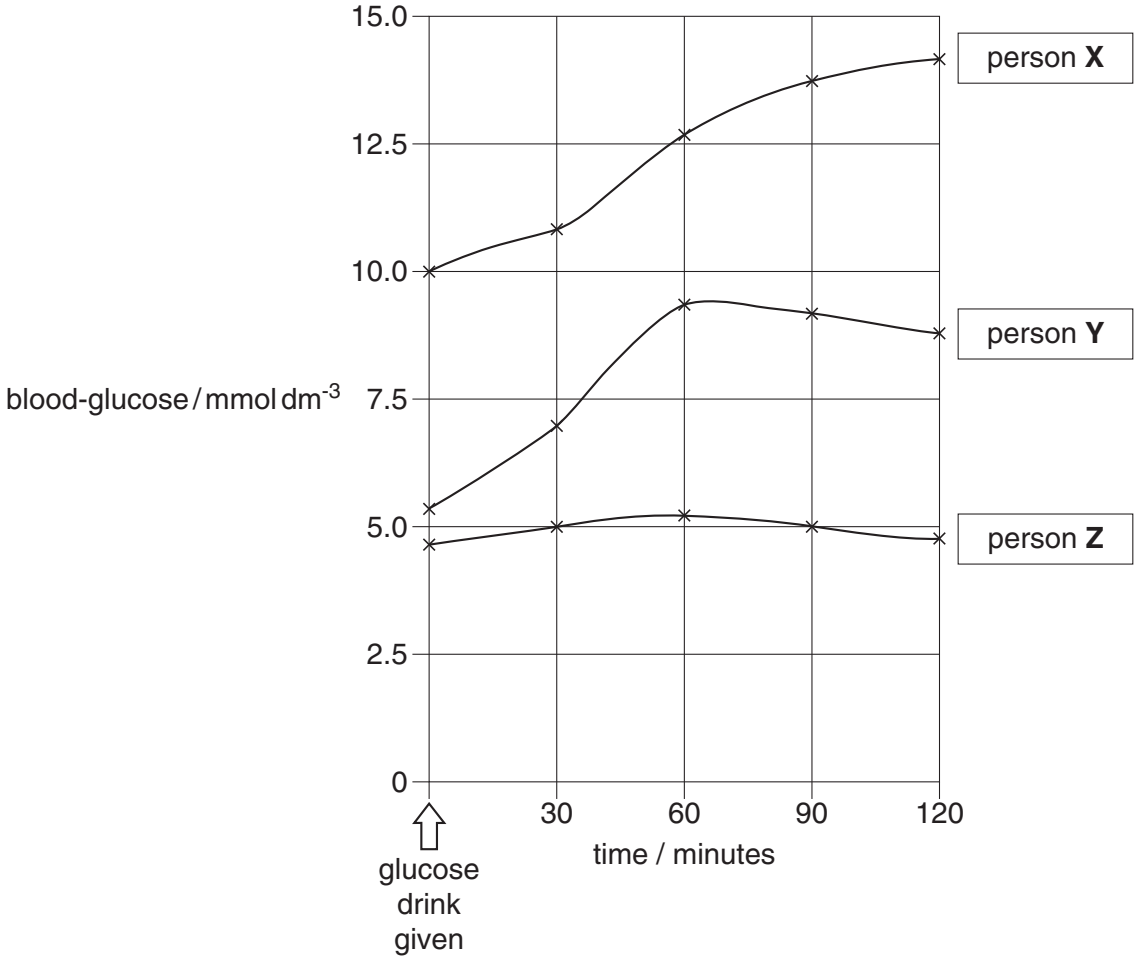


Fig. 5.1

Which one of the people **X**, **Y** and **Z**, is normal, which one has mild diabetes and which one has severe diabetes?

What is the evidence for your conclusions?

1 Person …… is normal.

evidence for conclusion .....

.....

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

2 Person …… has mild diabetes.

evidence for conclusion .....

.....

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

3 Person …… has severe diabetes.

evidence for conclusion .....

.....

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

(v) Outline the way biosensors are used to monitor blood-glucose levels.

.....

.....

.....

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

(e) It is essential to complete a risk assessment when carrying out blood sampling.

(i) Describe **two** different hazards associated with blood sampling.

1. .....

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

(ii) Describe **two** ways of keeping the risks from these hazards to a minimum.

1. .....

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

[Total: 21]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE