

**Thursday 12 January 2012 – Afternoon**

**AS GCE APPLIED SCIENCE**

**G622** Monitoring the Activity of the Human Body

Candidates answer on the Question Paper.

**OCR supplied materials:**

None

**Other materials required:**

- Electronic calculator
- Ruler (cm/mm)

**Duration:** 1 hour 30 minutes




|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- 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 Rosie has severe pain in her hip and is booked to visit the consultant at her local hospital. Before meeting the consultant, Rosie has an X-ray taken.

(a) The X-ray technician is required to tell Rosie about the risks and benefits of X-rays before the X-ray equipment is used for diagnosis.

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

**risks**

1. risk .....

explanation .....

.....

2. risk .....

explanation .....

.....

**benefits**

1. benefit .....

explanation .....

.....

2. benefit .....

explanation .....

..... [4]

(b) (i) The consultant looks at the X-ray and decides that he needs further information. He decides to perform an ultrasound scan of Rosie's back and hip.

Describe one feature of the images produced by an ultrasound scanner.

.....

..... [1]



2 A patient went to the GP complaining of tiredness and weight loss. The GP suspected diabetes as a possible diagnosis.

(a) (i) State one possible cause of type 1 diabetes and one possible cause of type 2 diabetes.

type 1 diabetes .....

type 2 diabetes ..... [2]

(ii) State how the two types of diabetes are treated.

type 1 diabetes .....

.....

type 2 diabetes .....

..... [2]

(b) The GP refers the patient to the hospital for a glucose tolerance test.

State **two** features of the glucose tolerance test.

.....

.....

.....

..... [2]

- (c) People with diabetes monitor their blood-glucose levels on a regular basis. A digital biosensor can be used for this as shown in Fig. 2.1.



Fig. 2.1

Describe how a person with diabetes would use a biosensor to obtain a blood-glucose reading.

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

- (d) The following article is about the link between ‘early onset’ diabetes and obesity in children and young adults:

*Obese children are very prone to many health issues. Children who are obese have a much higher chance of developing early onset diabetes. A study found that obese children were up to two times more likely to have diabetes than children of the same age that weren't overweight.*

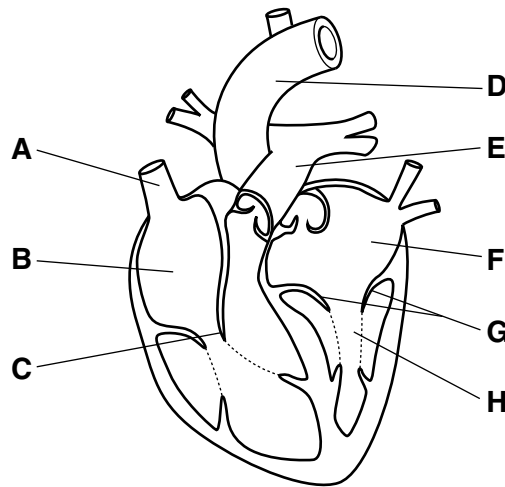
State how obesity in children can cause early onset diabetes.

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

[Total: 8]

3 The human heart is a pumping organ within the circulatory system.

Fig. 3.1 shows a vertical section of the heart.



**Fig. 3.1**

(a) With reference to Fig. 3.1 complete the labels below.

Two labels have been completed for you.

- A vena cava
- B .....
- C .....
- D aorta
- E .....
- F .....
- G .....
- H .....

[3]

(b) Describe what happens to the valves in the heart when the ventricle walls contract.

.....

.....

.....

..... [2]

(c) State why veins have valves.

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

(d) Describe the effects of the hormone adrenaline on the heart.

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

(e) The control of the cardiac cycle involves a number of steps.

The list of statements (A to I) represents some of the steps. The statements are not in the correct order.

- A ventricles contract
- B medulla (in the brain) releases nerve impulses
- C sinoatrial node (SAN) receives the impulses
- D sinoatrial node (SAN) releases impulses more frequently
- E atria contract
- F impulses transmitted along sympathetic neurones
- G impulses pass over the atria of the heart
- H atrioventricular node (AVN) relays impulses to the ventricles
- I atrioventricular node (AVN) receives the impulses

Put the list of statements A to I in order.

Write the correct letter in each of the boxes. Three have been done for you.

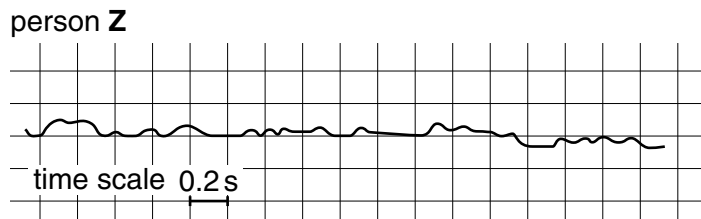
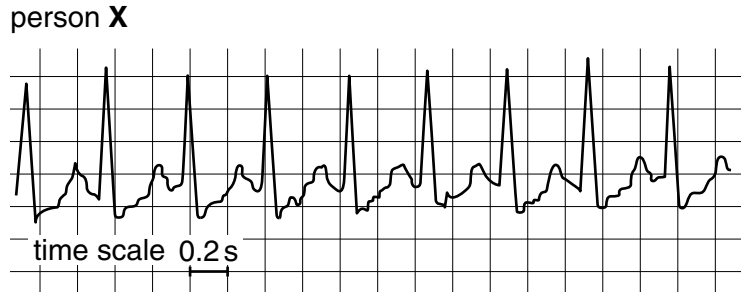
|          |  |  |  |  |          |  |  |  |          |
|----------|--|--|--|--|----------|--|--|--|----------|
| <b>B</b> |  |  |  |  | <b>G</b> |  |  |  | <b>A</b> |
|----------|--|--|--|--|----------|--|--|--|----------|

[3]

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

This machine was used to obtain heart readings for three people (X, Y and Z). The readings are shown below.

The time scale is indicated.



(i) What is the name of the machine used to obtain the readings?  
 ..... [1]

(ii) Person Y is healthy.  
 Calculate the heart rate in beats per minute for person Y.  
 Show your working.

heart rate = ..... beats per minute [2]



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

Describe two differences between trace **X** and trace **Y**.

- 1. ....  
.....
- 2. ....  
..... [2]

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

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

(v) What could happen to person **Z** if they were untreated?

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

(g) Blood pressure readings can be taken using a digital sphygmomanometer as shown in Fig. 3.2.



Fig. 3.2



(i) Explain how to measure blood pressure using a digital sphygmomanometer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) The 120 and 80 values seen on the digital screen of the sphygmomanometer in Fig. 3.2 indicate the recorded blood pressure (mmHg).

State the **term** used to describe each value.

|         |       |
|---------|-------|
| 120mmHg | ..... |
| 80mmHg  | ..... |

[2]

[Total: 25]

4 A group of students study the structure and function of the respiratory system. They also find out how to monitor breathing in patients.

(a) One of the students has partly completed Table 4.1 to compare the features of different parts of the respiratory system.

Put a tick (✓) or cross (✗) in the remaining boxes to indicate the presence (✓) or absence (✗) of a given feature.

Table 4.1

|                  | feature   |              |               |       |
|------------------|-----------|--------------|---------------|-------|
|                  | cartilage | goblet cells | smooth muscle | cilia |
| trachea          | ✓         | ✓            | ✓             | ✓     |
| bronchus         |           |              |               |       |
| large bronchiole |           |              |               |       |
| alveolus         |           |              |               |       |

[3]

(b) Name the process by which the exchange of gases takes place between the alveoli and the blood capillaries.

..... [1]

(c) Explain why blood capillaries and alveoli are very close together.

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

(d) Complete the sentences about inspiration of air into the lungs.

Choose words from the list.

The words may be used once, more than once or not at all.

|                  |                  |                       |
|------------------|------------------|-----------------------|
| <b>contract</b>  | <b>decreases</b> | <b>downwards</b>      |
| <b>increases</b> | <b>inwards</b>   |                       |
| <b>outwards</b>  | <b>relax</b>     | <b>stays the same</b> |
| <b>upwards</b>   |                  |                       |

During inspiration, the diaphragm and external intercostal muscles .....

The diaphragm moves ..... and the rib cage moves .....

and ..... The volume of the rib cage and lungs .....

The lung pressure ..... Air is drawn into the lungs. [4]

(e) A second student partly completes another data table, Table 4.2.

This table shows the tidal volume and vital capacity of lungs in healthy adults.

(i) Complete Table 4.2.

**Table 4.2**

|                       | <b>gender</b>  | <b>volume / dm<sup>3</sup></b> |
|-----------------------|----------------|--------------------------------|
| <b>tidal volume</b>   | male or female | 0.4 – 0.5                      |
| <b>vital capacity</b> | male           |                                |
|                       | female         |                                |

[2]

- (ii) A spirometer can be used to measure tidal volume and vital capacity.

Explain why a patient attached to a spirometer should wear a nose clip.

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

- (iii) State the instructions given to the patient to obtain values to measure vital capacity.

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

- (f) The lung ventilation of a person at rest can be found by multiplying the tidal volume ( $\text{dm}^3$ ) by the breathing rate ( $\text{breaths min}^{-1}$ ).

- (i) Complete Table 4.3. Give the units for lung ventilation and insert the missing values for Arthur and Ranjit.

**Table 4.3**

|               | tidal volume / $\text{dm}^3$ | breathing rate / $\text{breaths min}^{-1}$ | lung ventilation /<br>..... |
|---------------|------------------------------|--|-----------------------------|
| <b>Arthur</b> | 0.5                          | 12   | .....                       |
| <b>Ranjit</b> | 0.2                          | .....                                      | 6.0                         |

[3]

- (ii) Ranjit is a COPD (Chronic Obstructive Pulmonary Disease) patient.

How does his tidal volume compare to the typical value-range for males?

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

- (iii) Ranjit is asked by the students to use a peak flow meter, Fig. 4.1. This piece of equipment is also used to investigate lung performance.

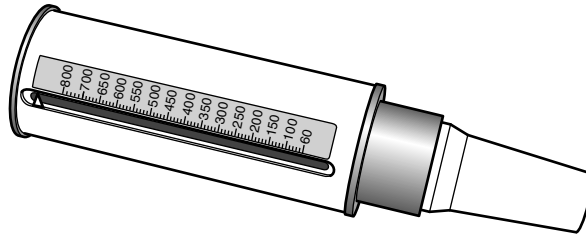


Fig. 4.1

What aspect of lung performance does this meter measure?

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

- (iv) State three instructions **given to patients** to make sure that they use the peak flow meter correctly.

1. ....  
.....  
2. ....  
.....  
3. ....  
..... [3]

- (v) State a typical peak flow value for a normal adult.

Write the correct value and units.

value = ..... units ..... [2]

- (vi) Ranjit uses a bronchodilator (inhaler) to reduce the symptoms of Chronic Obstructive Pulmonary Disease, COPD.

This equipment delivers medicine so that the airways are opened wider.

How will this affect the **oxygen** and **carbon dioxide** levels in Ranjit's blood?

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

[Total: 27]

- 5 As part of an investigation into exercise, Pete has agreed to work with a research physiologist.

He has the concentration of three substances measured in his muscles when at rest and after sprinting, using exercise equipment, Fig. 5.1.



Fig. 5.1

The results are shown in Table 5.1.

Table 5.1

| substance   | concentration of substance / $\mu\text{mol g}^{-1}$ muscle tissue |                 | percentage change (%) |
|-------------|---|-----------------|-----------------------|
|             | at rest   | after sprinting |                       |
| ATP         | 4.0   | 3.2             | -20.0                 |
| glycogen    | 83.6  | 55.1            | -34.1                 |
| lactic acid | 1.3   | 28.7            | .....                 |

- (a) (i) Calculate the percentage change for lactic acid using the data from Table 5.1.

Show your working.

percentage change = ..... % [2]

- (ii) Describe and explain the changes in concentration taking place in the substances listed after sprinting.

Support your explanations using data from the table.

**ATP**

change .....

explanation .....

.....

**glycogen**

change .....

explanation .....

.....

**lactic acid**

change .....

explanation .....

..... [6]

- (b) Why must lactic acid be removed or broken down within the body after exercise?

.....

..... [1]

- (c) Muscle cell contraction is directly affected by the rate of respiration and ATP levels.

State two other biological processes in the body directly affected by ATP levels.

1. ....

2. .... [2]

- (d) The research physiologist takes a sample of Pete’s blood. The blood is analysed to provide information about his level of fitness.

State two features of Pete’s blood sample that are likely to be examined for this purpose.

1. ....

2. .... [2]



- (e) Describe two **risks** for the research physiologist when taking the blood sample. State an associated **safety precaution** for each risk.

| risk to the research physiologist | safety precaution |
|-----------------------------------|-------------------|
| 1.                                |                   |
| 2.                                |                   |

[4]

[Total: 17]

END OF QUESTION PAPER





