

Wednesday 16 May 2018 – Afternoon

AS GCE APPLIED SCIENCE

G622/01 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 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

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 George is a student.

He is studying cellular respiration and he knows that this is the process by which the human body obtains its energy for different activities.

George starts by comparing features of energy linked to cellular respiration with those linked to burning of fuels.

(a) (i) Complete Table 1.1.

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

Energy feature	Cellular respiration	Burning of fuels
Released by living organisms		
Requires a flame for ignition		
Released as heat		
Release always needs oxygen		
Released as light		

Table 1.1

[5]

(ii) State the name of the molecule used by cells to provide an immediate source of energy for biological processes.

..... [1]

(iii) Humans need to respire to perform energy-requiring processes.

Give **three** examples of these energy-requiring processes.

1

2

3

[3]

- (b) George also knows that the circulatory and respiratory systems play a part in the process of cellular respiration.

Monitoring a person's circulatory and respiratory systems, and analysing their blood, provides information about their state of health and their fitness levels.

Complete Table 1.2 below, stating **six** features which would be monitored to provide information about a person's **health** and **fitness levels**.

	Feature of system indicating the person's state of health	Feature of system indicating the person's fitness levels
The circulatory system		
The respiratory system		
The blood		

Table 1.2

[6]

[Total: 15]

- 2 A team of researchers is investigating the effect of sleep on breathing and blood pressure. The researchers carry out experiments on a number of volunteer patients. Some readings are taken using a polysomnogram as shown in Fig. 2.1.

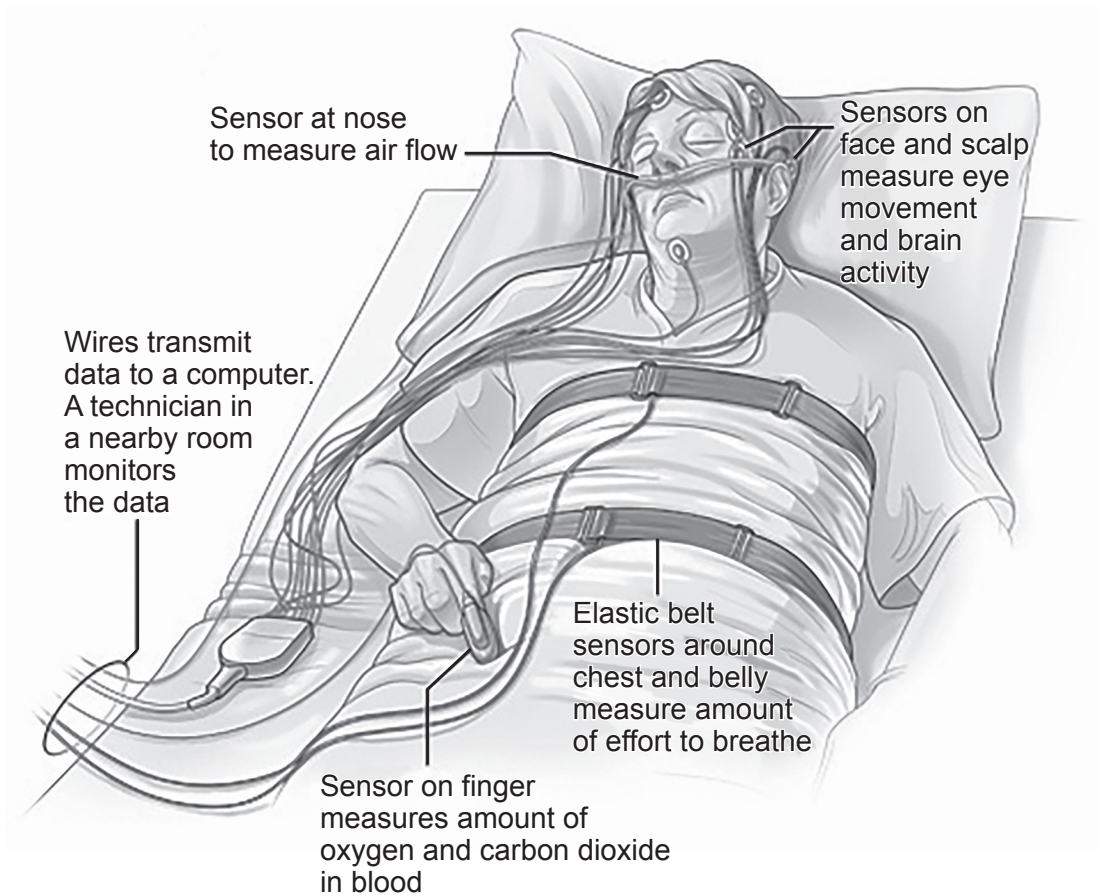


Fig. 2.1

- (a) Breathing is usually monitored with a spirometer.
- (i) State **three** differences between how a spirometer and the polysomnogram are used to monitor breathing.
- 1
- 2
- 3

[3]

(ii) Explain why it is **not** possible to measure vital capacity when the patient is asleep.

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

(iii) The brain activity for one patient indicates that he is in deep sleep and resting.

State the normal breathing rate for an adult **and** suggest the likely change to this rate when the patient is sleeping.

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

(b) One of the patients suffers from sleep apnea.

This condition is caused by the relaxation of smooth muscles at the back of the throat leading into the trachea.

The trachea becomes blocked for short periods of time while the patient is asleep.

Describe **and** explain the effect of this condition on both the oxygen **and** carbon dioxide levels in the blood.

Oxygen levels

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

Carbon dioxide levels

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

- (c) Lower blood pressures are often recorded when a person is sleeping.

Fig. 2.2 shows the blood pressure recorded during sleep for one of the patients.

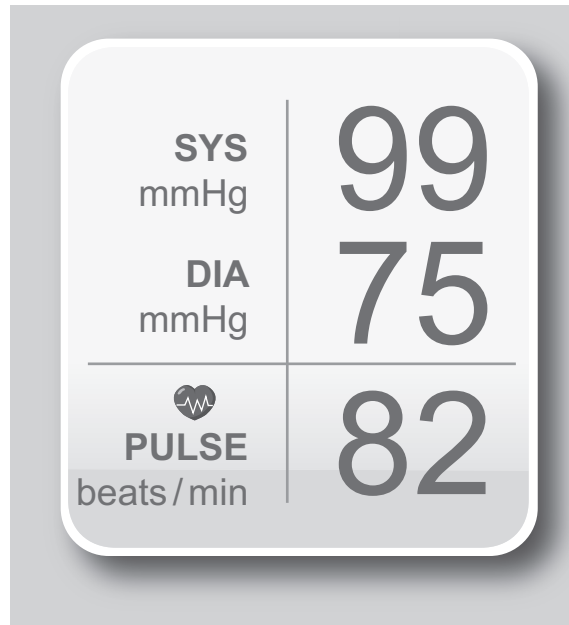


Fig. 2.2

- (i) Complete Table 2.1 by calculating the difference between the systolic and diastolic readings shown in Fig. 2.2 and those for a typical 40 year old male.

Blood pressure	Values for a typical 40 year old male (mmHg)	Difference (mmHg)
Systolic
Diastolic

Table 2.1

[2]

- (ii) Suggest why it is an advantage for a person's blood pressure to lower during sleep.

.....

 [2]

(iii) The finger sensor shown in Fig. 2.1 is called a pulse oximeter.

This equipment was used to monitor the pulse reading for the patient automatically.

A reading of 82 beats per minute was recorded (Fig. 2.2).

Compare this value with the typical range for pulse rates.

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

(iv) The finger sensor can also record body temperature when the patient is sleeping.

State the normal body temperature value **and** explain why this value drops during sleep.

Normal body temperature °C

Explanation

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

(v) Suggest why using a finger sensor is more reliable than a clinical thermometer for monitoring the body temperature when a patient is sleeping.

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

[Total: 22]

3 Anatazja is a laboratory technician.

She is collecting and analysing blood samples from five patients.

Anatazja is using a microscope to estimate blood cell counts for each 1 mm³ sample.

(a) The results of the blood analysis are shown in Table 3.1.

Patient	Number of blood cells mm ⁻³ blood	
	White blood cells (number ×10 ³)	Red blood cells (number ×10 ⁶)
A	6.2	4.4
B	5.8	5.0
C	7.1	5.3
D	14.2	4.8
E	7.2	3.0
Mean

Table 3.1

(i) Complete the mean values in Table 3.1.

Show your working.

[2]

(ii) The normal range for blood cells counts 1 mm⁻³ blood is as follows:

Adapted from 'How to find normal values', from 'Understanding Your Lab Test Results', www.cancer.org, American Cancer Society. Item removed due to third party copyright restrictions. Link to material: <https://www.cancer.org/treatment/understanding-your-diagnosis/tests/understanding-your-lab-test-results.html>

Explain why it may be misleading to compare the mean values calculated in Table 3.1 with the normal ranges.

.....

 [2]

(iii) One of the patients is diagnosed with anaemia and another patient with leukaemia.

Using Table 3.1, identify each patient. Give a reason for each of your answers.

.....

.....

.....

..... [2]

(b) Anatazja also cultures the blood samples in petri dishes to identify any microbes present.

She is carrying out a microbial analysis of the blood.

A typical microbe culture, grown on agar jelly in a petri dish, is shown in Fig. 3.1.

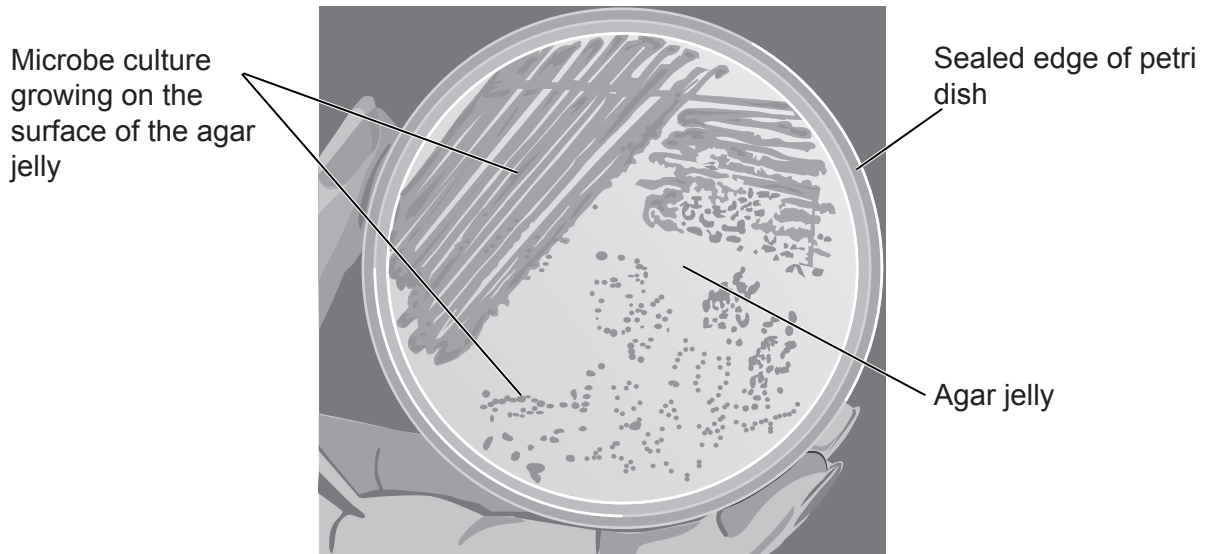


Fig. 3.1

(i) Anatazja follows a series of steps to obtain a microbe culture.

The list of steps, shown in Table 3.2, is **not** in the correct order.

Step	Action
A	Seal the edge of the petri dish and lid with sticky tape.
B	Pour melted agar jelly into a sterile petri dish and allow the agar to cool.
C	Culture the petri dishes in an incubator at 30 °C for 48 hours and observe the colonies of microbes growing on the surface of the agar.
D	Dip a sterile bacteria-spreader into the blood sample.
E	Spread the sample of blood on the bacteria-spreader across the surface of the agar.

Table 3.2

Complete Table 3.3 below by putting the steps in the correct order.

One has been done for you.

				C
--	--	--	--	----------

Table 3.3

- (ii) Anatazja must follow standard laboratory regulations when taking blood and carrying out the analyses described on the previous page.

Complete a risk assessment, Table 3.4, for these investigations.

State **three** different hazards and explain how to minimise the associated risks to Anatazja.

Hazard	How to minimise the risk of this hazard
1	1
2	2
3	3

Table 3.4

[3]

- (iii) A second laboratory technician handles the ‘used’ petri dishes when Anatazja has completed the microbial analysis.

Describe the procedures for the treatment of the ‘used’ petri dishes and microbiological materials after completion of this analysis. Explain why the procedures are necessary.

.....

.....

.....

..... [3]

[Total: 15]

4 Alice is 18 years old.

She has severe headaches and a pain in her neck after falling off her bicycle.

Alice is taken to her local hospital so that the cause of her symptoms can be identified and treated if necessary.

(a) Alice is seen by a member of the medical team in the accident and emergency unit.

A scan of her head and neck is taken using an MRI scanner.

An MRI image of this region of the body is shown in Fig. 4.1.

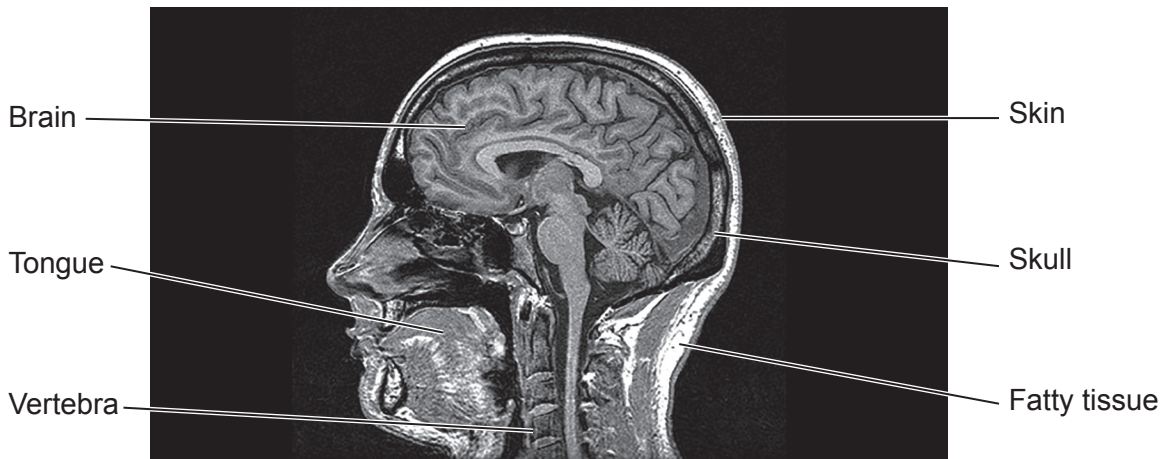


Fig. 4.1

(i) Explain why the MRI technician removed Alice’s earrings before using the MRI scanner.

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

(ii) Describe **three** differences between an MRI scanner and a CAT scanner.

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

- (iii) Some of the structures labelled in Fig. 4.1 will **not** be clearly visible when an X-ray image is taken of Alice's head and neck.

Complete Table 4.1 by putting a tick (✓) next to the structures which will **not** be clearly visible in the X-ray image.

Brain	
Tongue	
Vertebra	
Skin	
Skull	
Fatty tissue	

Table 4.1

[3]

(ii) The ultrasound images confirm that a vein is damaged, rather than an artery.

There are a number of structural differences between arteries and veins.

Complete Table 4.2.

One difference has been identified for you.

State **two** other structural differences.

	Feature	Artery	Vein
1	Thickness of vessel wall	Relatively thick	Relatively thin
2			
3			

Table 4.2

[4]

(iii) Suggest why more blood may have been lost if an **artery** had been damaged.

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

(c) A 96 year old man also arrives at the accident and emergency unit.

The man has had a heart attack and is very weak.

Identify **two** factors for the medical team to consider for the treatment of this elderly patient.

1
.....
2
.....

[2]

[Total: 22]

- 5 The number of people suffering from **type 2** diabetes is increasing in the community in many developed countries.

One medical association has issued the following press release in relation to **type 2** diabetes.

“Two of the country’s leading voices in healthcare will launch a major effort aimed at reducing the incidence of one of the nation’s most debilitating chronic diseases.”



Suggest how the incidence of **type 2** diabetes could be reduced in the community and consider the importance of monitoring blood-sugar levels for patients with diabetes.

..... [6]

[Total: 6]

6 Andy is a student paramedic. He must be sufficiently fit and healthy to take care of patients both inside and outside of an ambulance.

Andy must achieve the Higher Educational Occupational Physicians Standards (HEOPS) of Medical Fitness to train as a paramedic.

- Andy attends a health screening programme.
- He visits his local health centre to be assessed by a physiologist.

(a) Andy is tested for immunity and infection.

He will be immunised against hepatitis B if, at some time in the past, he was exposed to 'unfixed human blood and tissues'.

(i) Give the name of **one** blood test used to screen for hepatitis B **and** describe the positive result required to confirm the presence of the hepatitis B virus in a blood sample.

Name of blood test

Positive result.....

[2]

(ii) Explain why Andy's blood samples must be stored in labelled and sealed containers such as those shown in Fig. 6.1.



Fig. 6.1

Labelled

Sealed

.....

[2]

(iii) Suggest **two** key facts to be written on the blood sample label.

- 1
- 2

[1]

(b) The physiologist also carries out a physical examination of Andy and completes some functional assessments.

(i) The physiologist uses different types of equipment for the functional assessments.

Draw a clear, single line between each item of equipment and the correct, normal functional assessment values it gives.

Equipment	Normal functional assessment values
Digital sphygmomanometer	0.4 – 0.5 dm ³
Peak flow meter	litres min ⁻¹
Electronic spirometer	120/80 mmHg

[2]

(ii) Andy has his pulse rate taken manually before and after a few minutes of exercise.

Complete Table 6.1 by outlining **three** steps for the physiologist to follow when taking Andy's pulse rate readings manually.

Step	Action
1	
2	
3	

Table 6.1

[3]

[Total: 10]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing. It consists of a vertical solid line on the left side, creating a margin. To the right of this line, there are 25 horizontal dotted lines spaced evenly down the page, providing a guide for writing.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.