

**Wednesday 18 May 2016 – Afternoon**

**AS GCE APPLIED SCIENCE**

**G622/01** Monitoring the Activity of the Human Body

Candidates answer on the Question Paper.

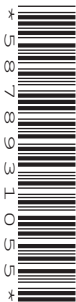
**OCR supplied materials:**

None

**Other materials required:**

- Electronic calculator
- Ruler (cm/mm)

**Duration:** 1 hour 30 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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 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 Jessica visits her local hospital before having an operation.

Some tests are carried out by a clinical physiologist.

(a) The physiologist takes a sample of Jessica’s blood.

Table 1.1 shows two hazards of this procedure.

Complete Table 1.1 to include the risks and the precautions to be followed to protect the **physiologist**.

Hazard	Risk	Precaution to protect the physiologist
Handling the patient’s blood		
Using a hypodermic needle		

[4]

**Table 1.1**

(b) It is also important for the physiologist to check the function of Jessica’s heart.

Jessica’s heartbeat trace is recorded.

(i) State the name of the trace obtained for Jessica’s heartbeat.

..... [1]

(ii) Jessica's heartbeat trace is shown in Fig. 1.1.

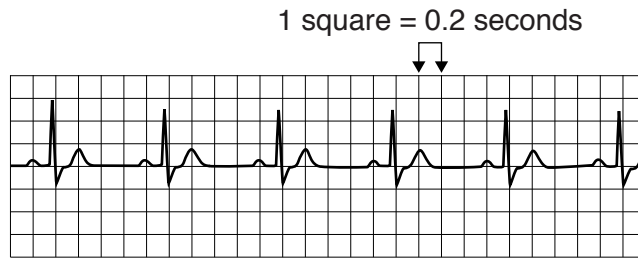


Fig. 1.1

Use the trace in Fig. 1.1 to calculate Jessica's pulse rate.

Show your calculations.

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

(iii) Suggest what a heartbeat trace, such as that shown in Fig. 1.1, can indicate about the **physiological status** of a patient.

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..... [3]

(c) The physiologist uses a manual sphygmomanometer to record Jessica’s blood pressure while she is seated.

(i) State two **similarities** and two **differences** between the use of a **manual** and a **digital** sphygmomanometer.

Similarities

1 .....

2 .....

Differences

1 .....

2 .....

[4]

(ii) What is the normal blood pressure for a 40-year-old **female**?

Include the correct units in your answer.

normal blood pressure = ...../..... (values) ..... (units) [2]

(iii) Jessica walks home from the hospital.

Suggest **how** and explain **why** Jessica’s blood pressure will change as her level of activity increases.

.....

.....

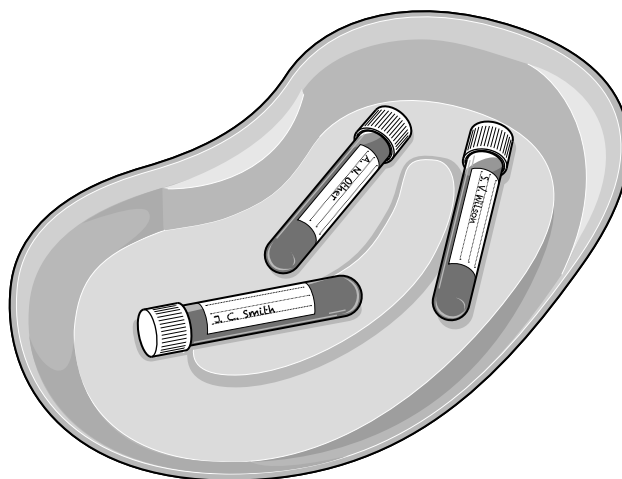
..... [3]

[Total: 19]

2 Andy works at a doctor's surgery.

He takes blood samples from patients and sends the samples to the pathology department of a hospital for various tests.

The blood samples collected by Andy are carefully labelled with the patient's name and the type of test to be carried out (Fig. 2.1).



**Fig. 2.1**

(a) In the pathology department, different techniques are used for different blood tests.

Select the correct technique to test for the presence of **alcohol** in the blood.

Insert a tick (✓) in the correct box.

Calorimetry	
Electrophoresis	
Gas chromatography	
Microscopy	

[1]

(b) Pathology technicians may carry out blood cell counts on samples of patients' blood.

A blood cell count can provide a **diagnosis** for various conditions and diseases.

How would the blood cell count of patients with the following conditions be different from the normal blood cell count?

a patient with **anaemia** .....

a patient with **leukaemia** .....

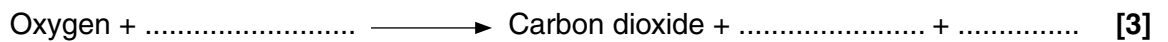
[2]

(c) Blood samples can be cultured in a laboratory to test for the presence of **bacteria**.

This is an important type of blood test, particularly if the patient has the life-threatening condition called sepsis.

Many bacteria found in the blood are aerobic, but they may tolerate anaerobic conditions.

(i) Complete the equation for **aerobic** respiration.



(ii) Give **two** reasons why parts of the human body may be **anaerobic** rather than aerobic.

1 .....

2 .....

[2]

- (d) Blood tests can be used to assess a patient's state of health, but they can also help to confirm the presence of a viral infection.

One type of test for viral hepatitis is the **ELISA** test.

- (i) State **three key features** of the ELISA test when used to confirm the presence of the virus causing hepatitis.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

- (ii) Suggest why blood **plasma**, and not a blood sample, is used to carry out the ELISA test.

.....

.....

..... [1]

[Total: 12]

3 Two patients are next to each other in treatment areas in a hospital ward.

They are both being treated for kidney failure and are connected to kidney dialysis machines.

- Karina is one of the patients. She is 20 years old and has had kidney problems since she was a child.
- The second patient is Wendy. She is 72 years old and has only recently been diagnosed with kidney failure.

During dialysis, blood passes continuously from a vein in the patient's arm and is pumped into the dialysis machine (Fig. 3.1).

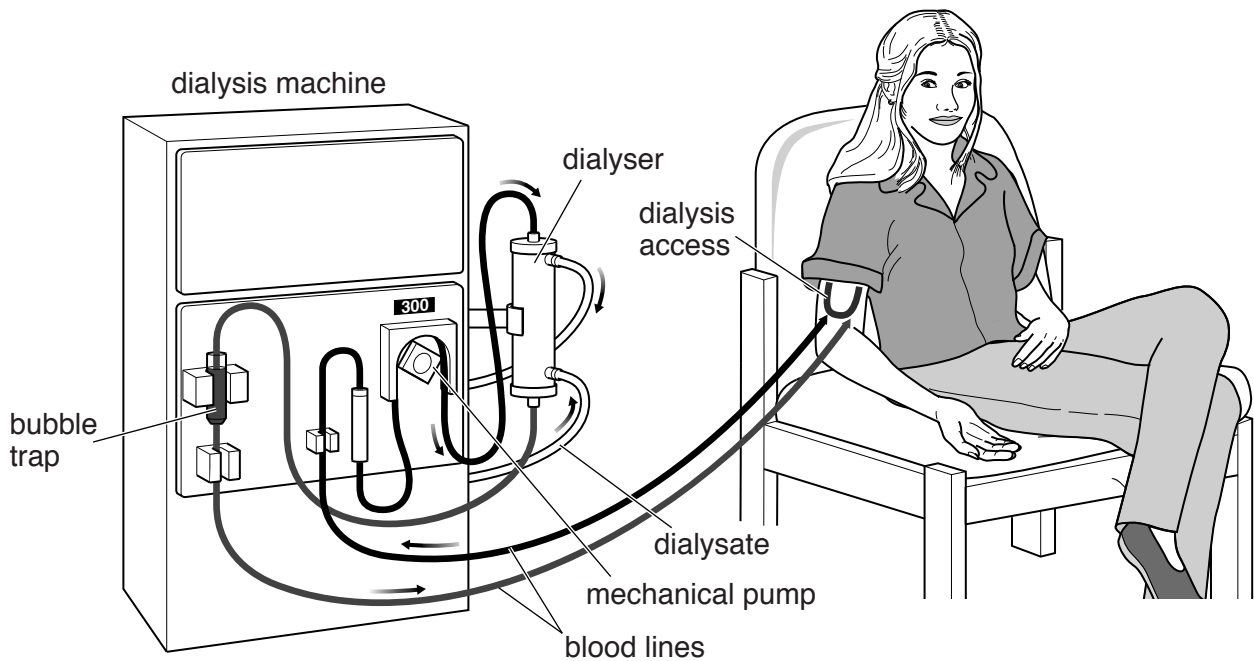


Fig. 3.1

(a) Using your knowledge of heart function and the features of blood vessels, suggest a reason why the **mechanical pump** is necessary.

.....

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..... [2]



(b) Both patients have had regular ultrasound scans of their kidneys.

Suggest **two** reasons why an ultrasound scanner is used, rather than an X-ray scanner, to determine the structure and function of the kidneys.

1 .....

.....

2 .....

.....

[2]

(c) Describe the basic principles of ultrasound scanning.

.....

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[3]

(d) The older patient, Wendy, has type 2 diabetes.

She does not fit into the typical or average range for the fasting glucose concentration of blood plasma.

(i) State the **typical range** for the fasting glucose concentration of blood plasma.

concentration = ..... to .....mmol dm<sup>-3</sup> [1]

**Question 3(d) continues on the next page**

- (ii) Glucose sometimes appears in the **urine** produced by Wendy's kidneys.

This happens when Wendy's blood plasma glucose concentration exceeds a specific level or critical value.

Give the **critical value** for the blood plasma glucose concentration above which glucose appears in the urine.

critical value = .....mmol dm<sup>-3</sup> [1]

- (iii) Suggest why it is useful for Wendy to know the typical or average range of blood plasma glucose concentration and to be aware of the critical value.

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

- (e) Having met Wendy and heard about her problems with diabetes, Karina wants to find out more about the link between type 2 diabetes and diet.

Outline the link between type 2 diabetes and diet.

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

(f) A kidney from a donor becomes available for transplantation.

The urologist treating Karina and Wendy discovers that they have equal chances of accepting the kidney without significant problems of tissue rejection.

Describe **two** possible medical issues and **two** ethical issues affecting the urologist's decision whether to choose Karina or Wendy for the kidney transplant.

<b>Medical issue</b>	1
	2
<b>Ethical issue</b>	1
	2

[4]

[Total: 17]

4 Some students are investigating the ability of humans to maintain a stable internal body temperature.

(a) (i) **Oral thermometers** are often used to measure body temperature.

Describe **three** steps to follow to make sure that an **accurate reading** is obtained when using an oral thermometer.

Step	Description
1	
2	
3	

[3]

(ii) Using an oral thermometer appears to be a straightforward procedure but, as for other non-invasive physiological measurements, a **risk assessment** must be completed.

Suggest **one** potential hazard of using an oral thermometer to measure body temperature and the precaution to be taken to minimise risk to the **patient**.

Potential hazard .....

.....

Precaution taken .....

.....

[1]

(iii) State **three** other types of clinical thermometer used to measure body temperature.

1 .....

2 .....

3 .....

[3]

(b) The students find out that vasoconstriction is used by the body to maintain a normal body temperature.

(i) **Describe** the mechanism of **vasoconstriction**.

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

(ii) **Explain** the effects of vasoconstriction on body temperature.

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

(c) The students used their understanding of how the body maintains a constant internal temperature to recognise the symptoms of hyperthermia and hypothermia.

Put ticks (✓) in the correct boxes in Table 4.1 for each of the symptoms listed.

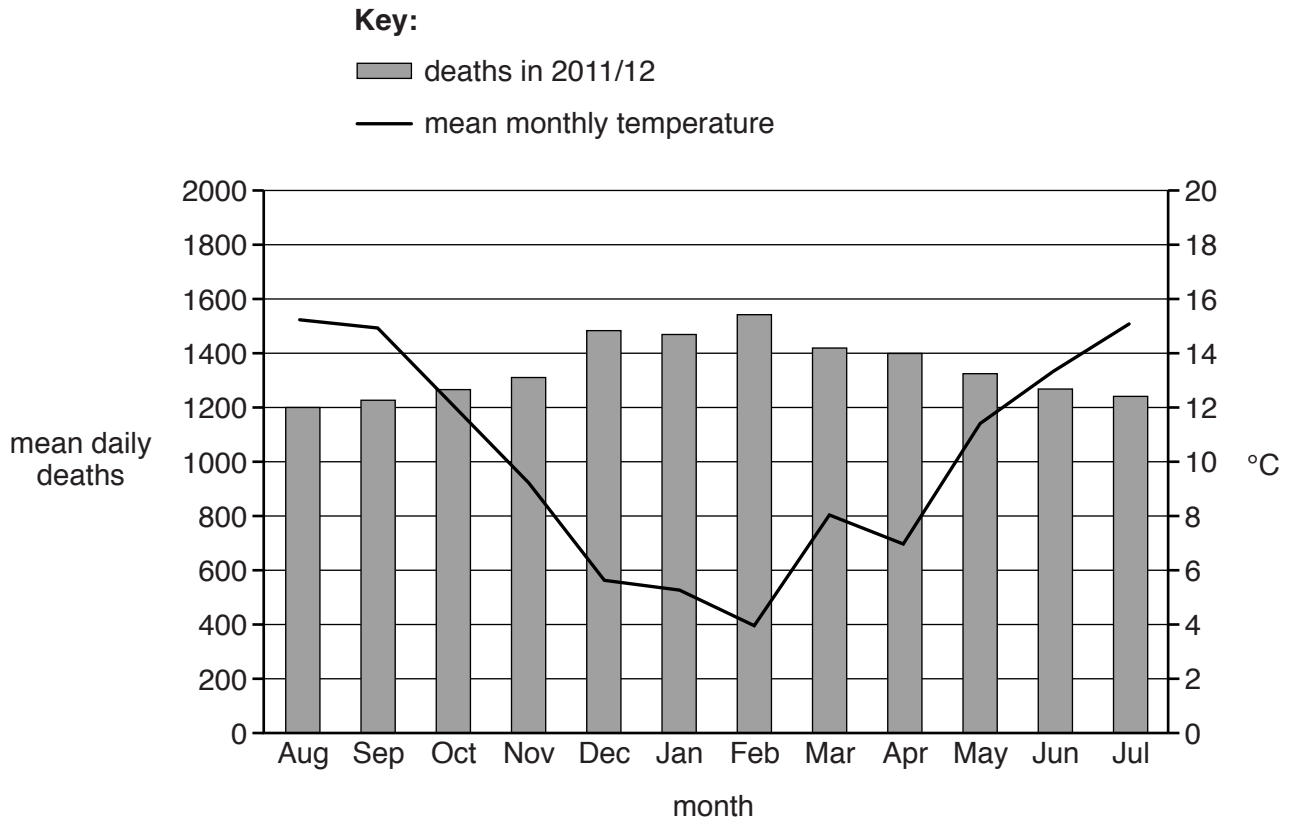
Symptom	Hyperthermia	Hypothermia
Excessive sweating		
Blue lips		
Constant shivering		
Dehydration		
Unconsciousness		

Table 4.1

[2]

(d) The students are shown a graph of deaths in 2011/12 for the human population in England and Wales (Fig. 4.1).

The graph also shows mean monthly external temperatures during the same year.



**Fig. 4.1**



Using Fig. 4.1 and your knowledge, **describe** the data presented in the graph and suggest an **explanation** for the link between deaths and the mean monthly temperature during 2011/12.

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[6]  
[Total: 19]

5 Milosz has a bacterial infection in his lungs.

He is currently taking antibiotics to treat his condition.

Milosz's doctor has obtained a microscopic image of a small sample of his lung tissue.

The image is shown in Fig. 5.1.

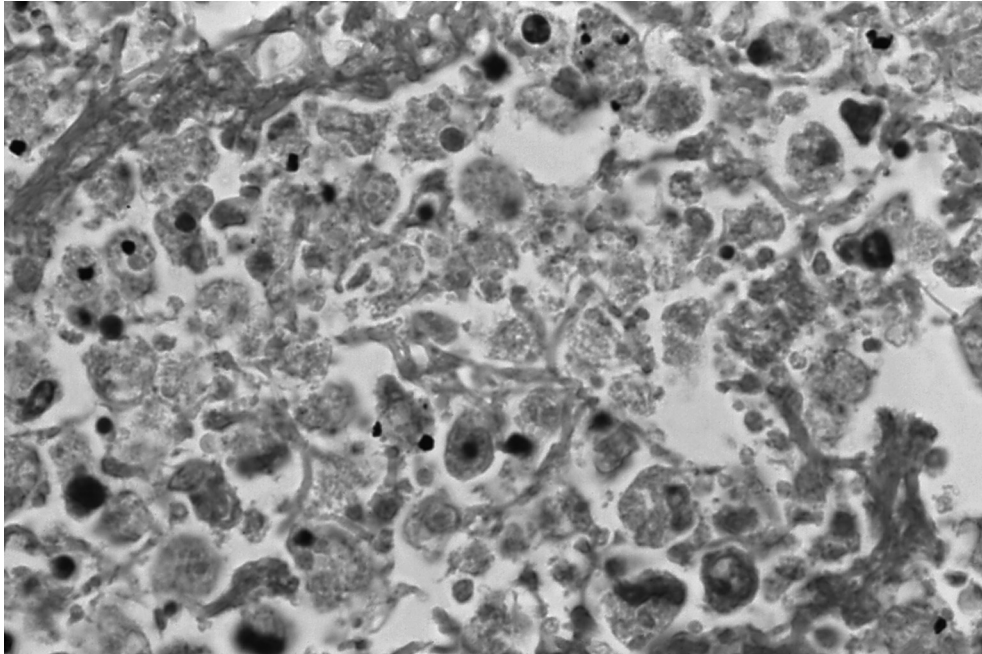


Fig. 5.1

(a) The alveoli and blood capillaries in Milosz's lungs have been damaged by the bacteria.

(i) Suggest how this damage will reduce the uptake of oxygen in Milosz's lungs.

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..... [3]

(ii) Explain how oxygen entering Milosz's lungs reaches the cells in his muscles.

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

(iii) In response to the infection, Milosz produces large amounts of mucus along the lining of his **trachea**.

Describe **two** ways in which the normal function of the trachea will be affected by this mucus.

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

(b) The doctor uses a peak flow meter to estimate the flow of air along Milosz's trachea.

Describe **three** ways to increase the **reliability** of the peak flow meter readings.

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



(c) Milosz's doctor does further investigations.

He decides to use a **spirometer** (Fig. 5.2) to measure the capacity of Milosz's lungs.

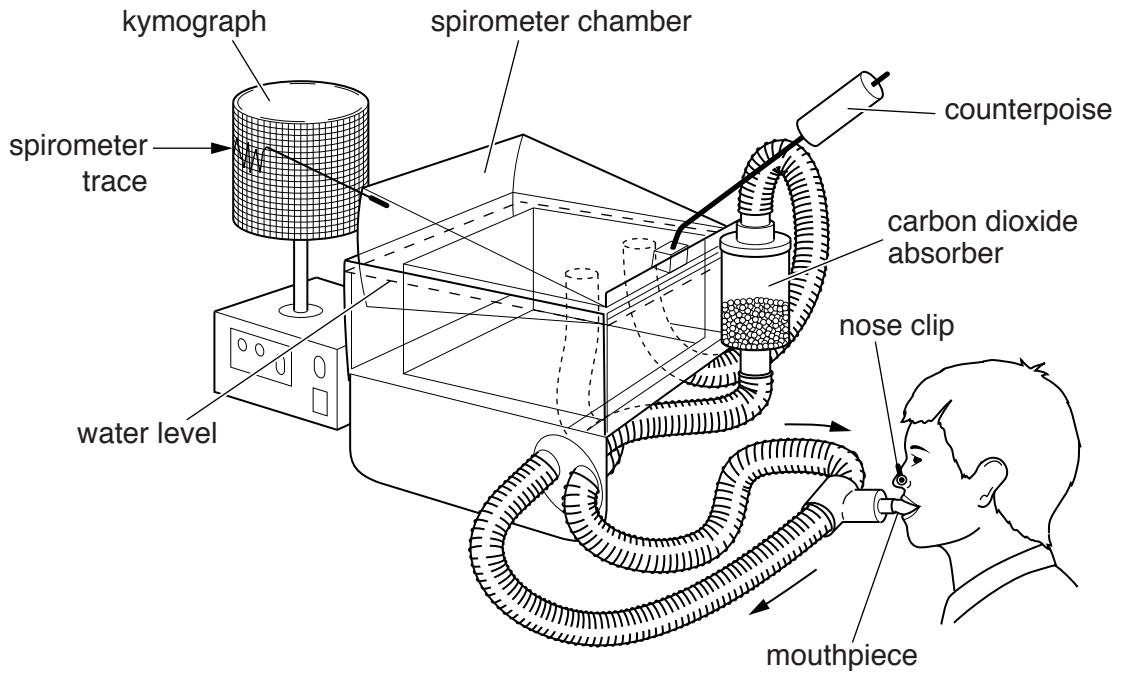


Fig. 5.2



Using Fig. 5.2 and your knowledge, describe how to use a spirometer **and** how to make sure that the patient is safe during this procedure.

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[6]

- (d) The doctor can use the spirometer trace to determine Milosz's tidal volume and breathing rate.

Describe how a spirometer trace can be used to measure

tidal volume .....

.....

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breathing rate .....

.....

.....

[2]

- (e) The doctor becomes increasingly concerned about Milosz's ability to breathe.

Breathing involves the use of muscles.

Describe how breathing in and out is brought about by the intercostal and diaphragm muscles.

breathing in .....

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breathing out .....

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[4]

[Total: 23]

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 features a vertical solid line on the left side, creating a margin. The rest of the page is filled with horizontal dotted lines, providing space for writing answers.

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.



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