

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

APPLIED SCIENCE

G622

Monitoring the activity of the human body

Tuesday

6 JUNE 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 | | | | | | | | | | | | |
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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 | 17 | |
| 2 | 10 | |
| 3 | 17 | |
| 4 | 15 | |
| 5 | 15 | |
| 6 | 16 | |
| TOTAL | 90 | |

This question paper consists of 16 printed pages.

Answer all the questions.

- 1 A group of student nurses were studying the heart during a dissection practical. They produced the diagram of the heart shown in Fig. 1.1.

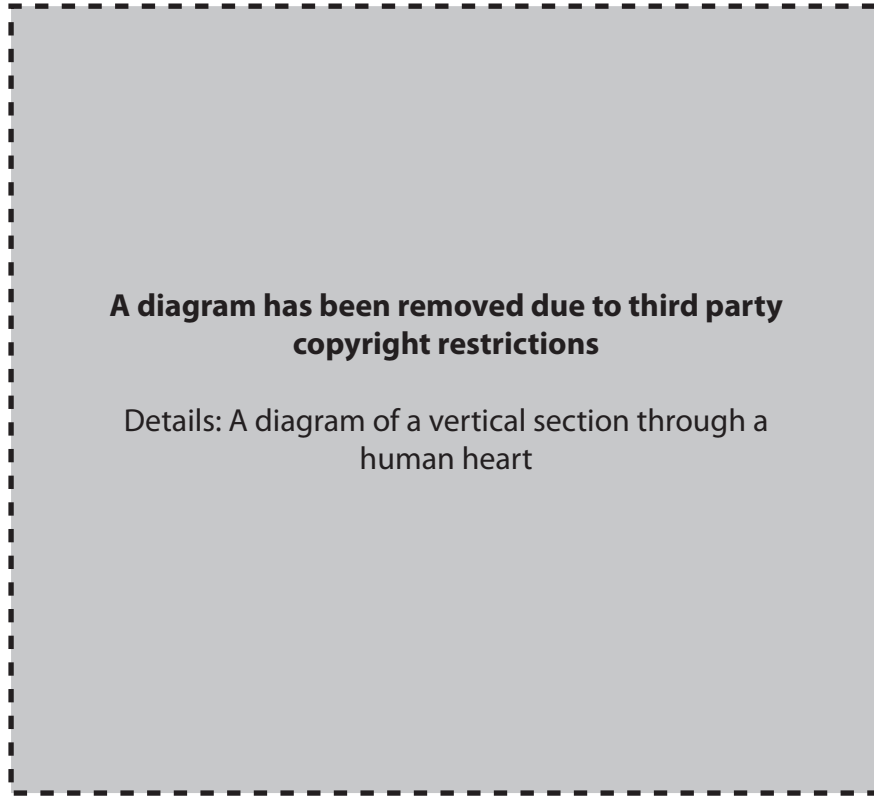


Fig. 1.1

- (a) Name the chamber labelled A. [1]
- (b) Complete the statement:
'Blood entering A comes from the' [1]

(g) Fig. 1.2 illustrates 'double circulation'.

Label **Y** and **Z** and draw arrows on the four lines to show the direction of blood flow.

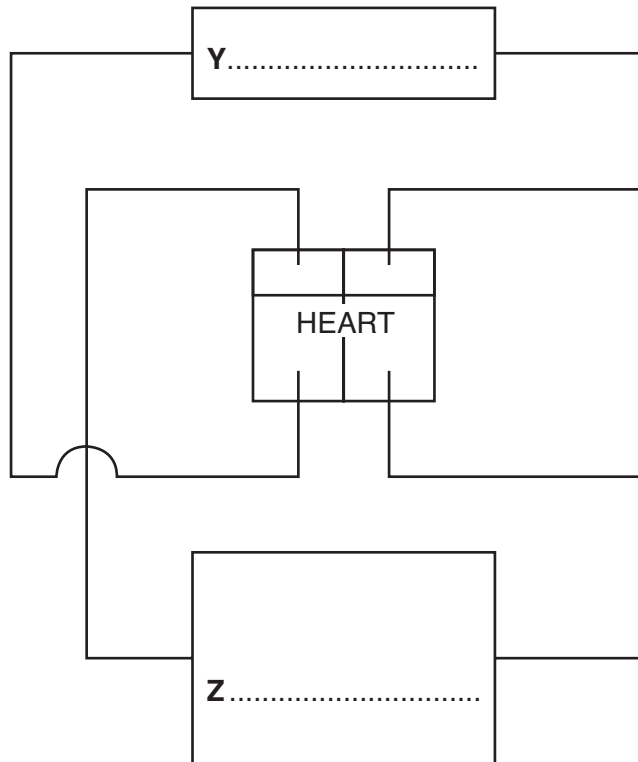


Fig. 1.2


[3]

[Total: 17]

- 2 Technicians working in medical laboratories are frequently exposed to materials that are contaminated with microbiological hazards.

Design and complete a risk assessment form in the space below that would be appropriate for such a situation. In your design, include the following:

material/procedure; hazard; what could go wrong; safety precautions;
in case of accident; risk explained; regulations for disposal of hazardous biological waste.



[10]

[Total: 10]

3 Staff in an asthma clinic were asked to monitor and record lung volumes.

(a) (i) Complete Table 3.1 to show 'typical' lung volumes.

| | gender | volume / dm ³ |
|----------------|--------|--------------------------|
| tidal volume | male | 0.4 – 0.5 |
| | female | |
| vital capacity | male | |
| | female | 4.25 |

Table 3.1 [2]

(ii) Name a piece of laboratory equipment that is commonly used to measure lung volumes.

..... [1]

(b) State the typical breathing rate for an adult male at rest.

..... breaths per minute [1]

(c) The volume of air being breathed (lung ventilation) by someone at rest can be found by multiplying the tidal volume (dm³) by the breathing rate (breaths per min).

(i) Complete Table 3.2.

| patient | tidal volume / dm ³ | breathing rate / breaths per minute | lung ventilation / dm ³ per minute |
|---------|--------------------------------|-------------------------------------|---|
| Richard | 0.5 | 12 | |
| James | 0.2 | | 6.0 |

Table 3.2 [2]

(ii) How does James' tidal volume compare to the typical value-range for males?

..... [1]

(d) Gas exchange takes place in the alveoli. Some of the air breathed into the lungs does not get into the alveoli.

Approximately 0.15 dm³ of air fills the tubes leading to the alveoli. This part of tidal volume is called 'dead space'.

(i) Name the **three** types of tubes leading to the alveoli.

A B C [3]

The amount of air reaching the alveoli each breath, to take part in gas exchange, can be estimated using the following equation:

$$\text{air to alveoli} = \text{tidal volume} - \text{dead space}$$

Alveolar ventilation can be calculated using the following equation:

$$\text{alveolar ventilation} = \text{air to the alveoli} \times \text{breathing rate}$$

Richard and James both had the same 'dead space' volume, 0.15 dm³.

Richard had an alveolar ventilation of 4.2 dm³ per minute.

(ii) Calculate James' alveolar ventilation.
Show your working.

..... dm³ per minute [3]

(iii) Use your answer to (d)(ii) to compare and explain Richard and James' probable ability to take part in physical exercise.

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.....
.....
.....
.....
.....
.....
..... [4]

[Total: 17]

4 A dietician was investigating the physiological effects of different diets on glucose levels in the blood.

The amount of glucose in the blood depends on the interaction of several hormones but two antagonistic hormones in particular are involved.

(a) Name the **two** antagonistic hormones that control blood glucose concentration and explain what they do.

1. name of hormone [1]

function in blood glucose control

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

2. name of hormone [1]

function in blood glucose control

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

(b) Diabetics need to monitor their blood sugar (glucose) levels in order to manage their diabetes.

The test for blood glucose involves two enzymes and a dye.

Explain:

(i) how diabetics test their blood glucose level;

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

(ii) how the blood glucose test works.

.....

.....

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..... [4]

(c) The dietician recorded two blood glucose concentration values that are important in diagnosis.

These are summarised in Table 4.1.

(i) Complete Table 4.1.

| | blood glucose concentration mmol / dm ³ |
|--------------------------|---|
| when fasting | 3.7 |
| glucose appears in urine | |

Table 4.1 [1]

(ii) Why are these values important?

.....

.....

..... [2]

[Total: 15]

(b) The elderly lady will be placed in the CAT scanner.

Describe what she will experience during the scan.

.....

.....

.....

.....

..... [3]

(c) Explain why the doctor would have asked for a CAT scanner to be used, rather than a conventional X-ray machine.

.....

.....

.....

..... [2]

(d) State **three** ways the elderly lady may be at risk during the CAT scan.

.....

.....

.....

.....

..... [3]

[Total: 15]

- 6 Sports scientists in Britain were investigating the effect of acclimatisation on athletic performance. Acclimatisation is the way in which the body gets used to different, often extreme, environmental conditions.

They produced physiological data for an athlete in training to perform in a warmer foreign country.

The data is summarised in Tables 6.1 and 6.2.

- (a) Table 6.1 records body temperature measurements at different time intervals during a 90-minute exercise, before and after acclimatisation.

| exercise time / min | athlete's body temperature / °C | |
|------------------------|---------------------------------|--------------------------|
| | before acclimatisation | after acclimatisation |
| 0 | 37.8 | 37.5 |
| 5 | 37.9 | 37.6 |
| 30 | 38.5 | 38.3 |
| 45 | 39.0 | 38.6 |
| 60 | 39.5 | 38.8 |
| 75 | 39.3 | 38.9 |
| 90 | 39.8 | 39.0 |

Table 6.1

- (i) Calculate the increase in body temperature, caused by the 90-minute exercise, **before** the athlete was acclimatised.

increase in body temperature unit [2]

- (ii) Describe **two** trends shown by the data on the effect of exercise on body temperature before and after acclimatisation.
Use data values in your answer.

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..... [4]

- (iii) The scientists decided that, compared to the rest of the results, **one** of the body temperature recordings was not as expected.
Identify the anomalous result.

.....

..... [1]

(b) Table 6.2 records heart rate measurements at different time intervals during a 90-minute exercise, before and after acclimatisation.

| exercise time / min | heart rate / beats min ⁻¹ | |
|---------------------|--------------------------------------|-----------------------|
| | before acclimatisation | after acclimatisation |
| 0 | 120 | 118 |
| 5 | 128 | 122 |
| 15 | 133 | 125 |
| 30 | 142 | 128 |
| 45 | 150 | 130 |
| 60 | 160 | 132 |
| 75 | 168 | 135 |
| 90 | 175 | 138 |

Table 6.2

Compare the two sets of heart rate data.

Use data from Table 6.2 to support your comparisons.

.....

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.....

.....

..... [4]

(c) The scientists also considered the effect of altitude on performance.

Some of the facts they discovered are listed below:

- | |
|---|
| <p>1 The amount of oxygen in each litre of air decreases as altitude increases.</p> <p>2 In 1964 the Olympic Games were held in Tokyo (sea-level) and in 1968 in Mexico City (2300 m above sea-level).</p> <p>3 Performances in 'Short Races' (100 m to 800 m) were as good or better in 1968 than they were in 1964 for men and women.</p> <p>4 Performances in 'Long Races' (1500 m to Marathon) in 1968 were up to 6% slower than in 1964.</p> |
|---|

Use the information listed above and what you know about muscle cellular respiration to answer (i) and (ii).

(i) How does the air breathed in, in Mexico City, differ from the air in Tokyo?

..... [1]

(ii) Suggest an explanation for the differences highlighted in statements 3 and 4 above.

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..... [4]

[Total: 16]

END OF QUESTION PAPER

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