Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

ADVANCED SUBSIDIARY GCE

G622

APPLIED SCIENCE

Monitoring the Activity of the Human Body

FRIDAY 20 MAY 2011: Morning
DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (RW/SW) 11MEP06417 48546/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Answer ALL the questions.**

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.**

Answer ALL the questions.

1 Drugs have been used in sports for many years. Some sportsmen and women make headline news when they take performance-enhancing drugs.

(a) Name one RECREATIONAL drug and one PERFORMANCE-ENHANCING drug that can be detected using blood tests.

recreational drug _____

performance-enhancing drug _____ **[2]**

(b) Name two techniques used to detect drugs in a blood sample.

1. _____

2. _____ **[2]**

(c) State the PRINCIPLES of how blood tests are used to confirm that a drug is found in a blood sample taken from an athlete.

_____

_____

_____

_____

_____

_____ **[3]**

(d) Blood doping differs from the use of performance-enhancing drugs. During blood doping, red blood cells are injected into the blood of the athlete a few days before the sporting event.

(i) Explain how blood doping gives the athlete an unfair advantage.

_____

_____

_____

_____ **[2]**

(ii) A blood sample is taken from an athlete who is suspected of blood doping.

How is the sample analysed?

_____

_____

_____

_____

_____

_____ **[3]**

[Total: 12]

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2 A dietician is working in a local hospital. He provides a monitoring and guidance service for patients with diabetes. Some patients have TYPE 1 diabetes and others have TYPE 2 diabetes.

(a) High blood-glucose levels, increased thirst, frequent production of urine, tiredness and fatigue can be common symptoms of both types of diabetes.

Describe TWO other features or symptoms for EACH of type 1 and type 2 diabetes.

type 1 diabetes _____

_____

_____

_____

type 2 diabetes _____

_____

_____

_____ **[4]**

(b) Explain the link between 'early onset' diabetes and obesity in children and young adults.

_____

_____

_____

_____ **[2]**

(c) The dietician monitors the blood-glucose levels of his patients with TYPE 1 diabetes on a regular basis.

(i) The dietician uses a biosensor to monitor blood-glucose levels.

Describe how a biosensor works and how the results are used by a person with diabetes.

how a biosensor works _____

_____

_____

_____ **[2]**

use of results by a person with diabetes _____

_____

_____ **[1]**

(ii) The dietician finds that one of his patients with TYPE 1 diabetes has a very high blood-glucose level.

Suggest two pieces of advice that the dietician should give to his patient.

1. _____

_____

2. _____

_____ **[2]**

(d) The dietician is concerned about a patient with TYPE 2 diabetes who is struggling to regulate her diabetes. The dietician decides to carry out a GLUCOSE TOLERANCE TEST on this patient and then compare the results with normal responses to the test.

The results of the two-hour glucose tolerance test are shown in Fig. 2.1.

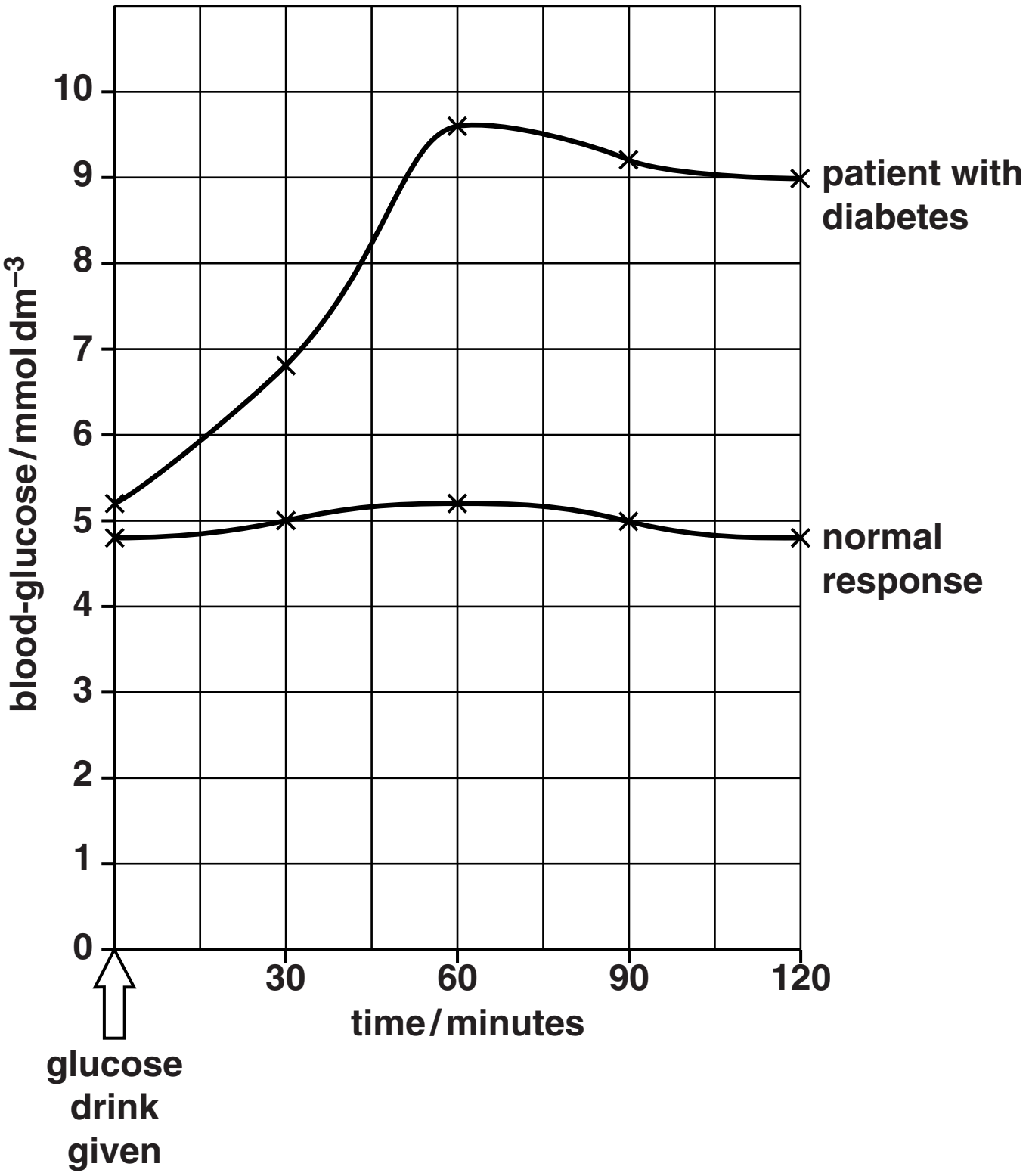
10
9
8
7
6
5
4
3
2
1
0
blood-glucose/mmol dm^{-3}
30
60
90
120
time/minutes
patient with diabetes
normal response
glucose drink given

Fig. 2.1

(i) Calculate the percentage increase in the blood-glucose level of the patient with diabetes in relation to the normal response at 60 minutes.
Show your working.

diabetic reading _____ normal reading _____

percentage increase = _____ % [3]

(ii) Suggest two reasons why there is a drop in the blood-glucose levels for the patient with diabetes during the final 60 minutes of the test period.

1. _____

_____

2. _____

_____ **[2]**

(e) The dietician must be fully aware of the risks involved when taking a patient's blood.

Complete the risk assessment, Table 2.1, used to safeguard a patient during such blood tests.

Table 2.1

BLOOD TEST HAZARD	RISK	RELATED PROCEDURE TO MINIMISE THE RISK
use of sharps	1.	1.
	2.	2.

[4]

[Total: 20]

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3 A group of students is investigating the structure and function of the respiratory system in humans. The students find a slide showing a section through the lung tissue of a person suffering from pulmonary emphysema, Fig. 3.1.

Pulmonary emphysema is a chronic lung condition. The reasons for the onset of this condition include smoking and exposure to air pollution and irritating fumes or dusts. Some of the lung tissue may be destroyed over time.

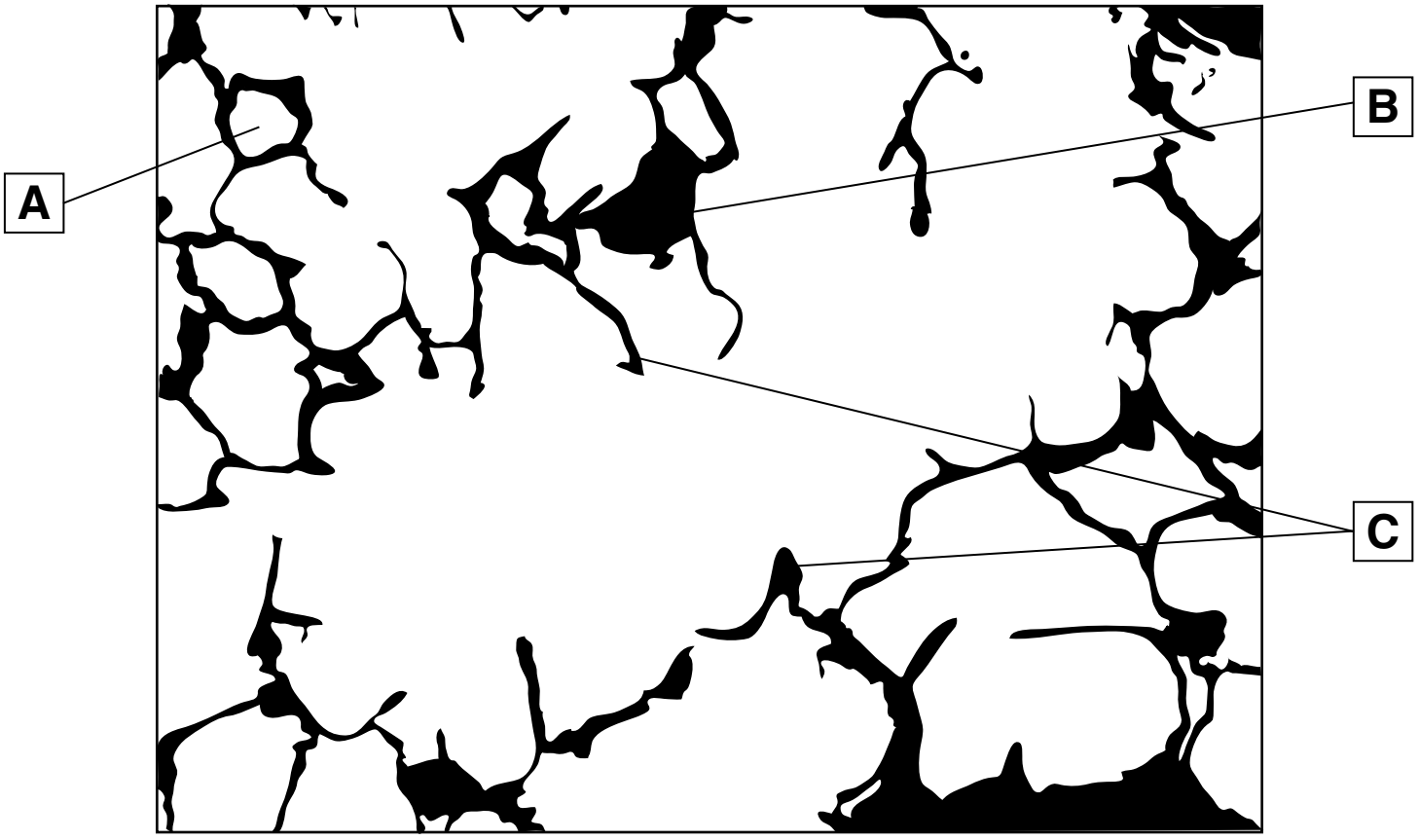

Fig. 3.1

(a) In Fig. 3.1, structure A is an alveolus or air sac.

(i) State two features of the alveolus that promote the process of gaseous exchange.

1. _____

_____

2. _____

_____ **[2]**

(ii) Describe what happens during gaseous exchange in the lungs.

_____

_____

_____

_____

_____

_____ **[3]**

(b) Name the structure labelled B in Fig. 3.1.

_____ **[1]**

(c) Diseases such as pulmonary emphysema cause some damage in the lungs as shown at the points labelled C in Fig. 3.1. This slows down the rate of gaseous exchange.

Explain this decrease in rate.

_____

_____

_____

_____

_____

_____ **[3]**

(d) The peak flow of expired air from a person with pulmonary emphysema is likely to be different from that of a healthy person.

Explain how to measure peak expiratory flow rate using a peak flow meter.

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[4]**

(e) The students also study the process of VENTILATION of the lungs.

Describe how breathing movements cause air to LEAVE the lungs.

In your answer, use ideas about the following:

DIAPHRAGM
INTERCOSTAL MUSCLES
RIBS
STERNUM

_____

_____

_____

_____

_____

_____

_____ **[3]**

(f) An MRI scanner can be used to examine the lungs.

(i) State why an MRI SCAN is effective for this type of examination.

_____

_____

_____ **[1]**

(ii) Complete Table 3.1 to describe TWO hazards of using an MRI scanner FOR THE PATIENT and identify the precautions to be taken for each.

Table 3.1

HAZARD FOR THE PATIENT	PRECAUTION
1.	1.
2.	2.

[4]

[Total: 21]

4 An athlete is following a 10-week training programme to increase her running speed.

Her trainer tells her that she must be capable of releasing as much energy as possible in her muscles for rapid and powerful contractions.

(a) Complete the word equations below for aerobic and anaerobic respiration.

(i) aerobic respiration

glucose + _____ → _____ +

_____ + _____ [2]

(ii) anaerobic respiration

glucose → _____ + _____ [1]

(b) Give the NAME of the molecule produced in both aerobic and anaerobic respiration that provides the immediate source of energy for muscle contraction.

_____ [1]

(c) State the TYPE of respiration that releases more energy for each molecule of glucose oxidised and give TWO reasons to explain this.

type of respiration _____

reasons _____

_____

_____

_____ **[3]**

(d) Explain why ANAEROBIC respiration is a 'useful' process in the muscle cells of an athlete.

_____

_____

_____

_____ **[2]**

(e) Name the SITE of anaerobic respiration in muscle cells.

_____ **[1]**

(f) The trainer cannot easily test for energy levels in the muscles of the athlete and so he takes the athlete to a clinic to estimate her fitness levels.

The athlete's pulse rate is measured before, during and after exercise, Table 4.1.

Table 4.1

WEEK OF TRAINING PROGRAMME	ATHLETE'S PULSE RATE READINGS / BEATS min^{-1}		
	immediately BEFORE exercise	DURING exercise	3 minutes AFTER exercise
1	76	120	85
10	65	110	67

(i) Describe and explain TWO effects of the 10-week training programme on the athlete's pulse rate readings.

Refer to the DATA in your answer.

EFFECT	SUPPORTING DATA	EXPLANATION
1.		
2.		

[6]

(ii) Explain the link between pulse rate readings and energy levels in muscles.

_____

_____

_____

_____ **[2]**

(g) The athlete's LACTIC ACID levels are also recorded at the start and end of the training programme at the fitness clinic.

She has blood samples taken when running at different speeds, Table 4.2.

Table 4.2

WEEK OF TRAINING PROGRAMME	ATHLETE'S RUNNING SPEED / km h^{-1}				
	10	11	12	13	14
	BLOOD LACTIC ACID LEVELS / mmol dm^{-3} AT EACH RUNNING SPEED				
1	2.4	2.6	3.0	3.5	4.0
10	1.6	1.9	2.5	3.4	3.6

(i) State the effect of running speed on the levels of lactic acid in the athlete's blood at the start of the training programme.

_____

_____ **[1]**

(ii) State and explain ONE effect that the training programme has on the athlete's blood lactic acid levels when running at different speeds.

effect _____

explanation _____

_____

_____ **[2]**

(iii) Give TWO reasons why high levels of blood lactic acid cause problems for athletes.

_____

_____

_____

_____ **[2]**

(iv) There is little difference between lactic acid levels recorded at 13 km hr^{-1} from week 1 to week 10.

Suggest how you could improve this test to make the results more reliable.

_____

_____ **[1]**

[Total: 24]

5 Matthew was born with a heart defect.

(a) Matthew's doctors monitor his heart using an ultrasound scanner.

(i) A gel is put on the surface of Matthew's skin when the probe is used.

Why is the gel needed?

_____

_____ **[1]**

(ii) Why do Matthew's doctors need to avoid his ribs when using the ultrasound probe?

_____

_____ **[1]**

(iii) Explain the PRINCIPLES of ultrasound scanning.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[5]**

(b) Matthew's heart defect is a hole between the two ventricles in his heart. This is called a ventricular septal defect (VSD), see Fig. 5.1.

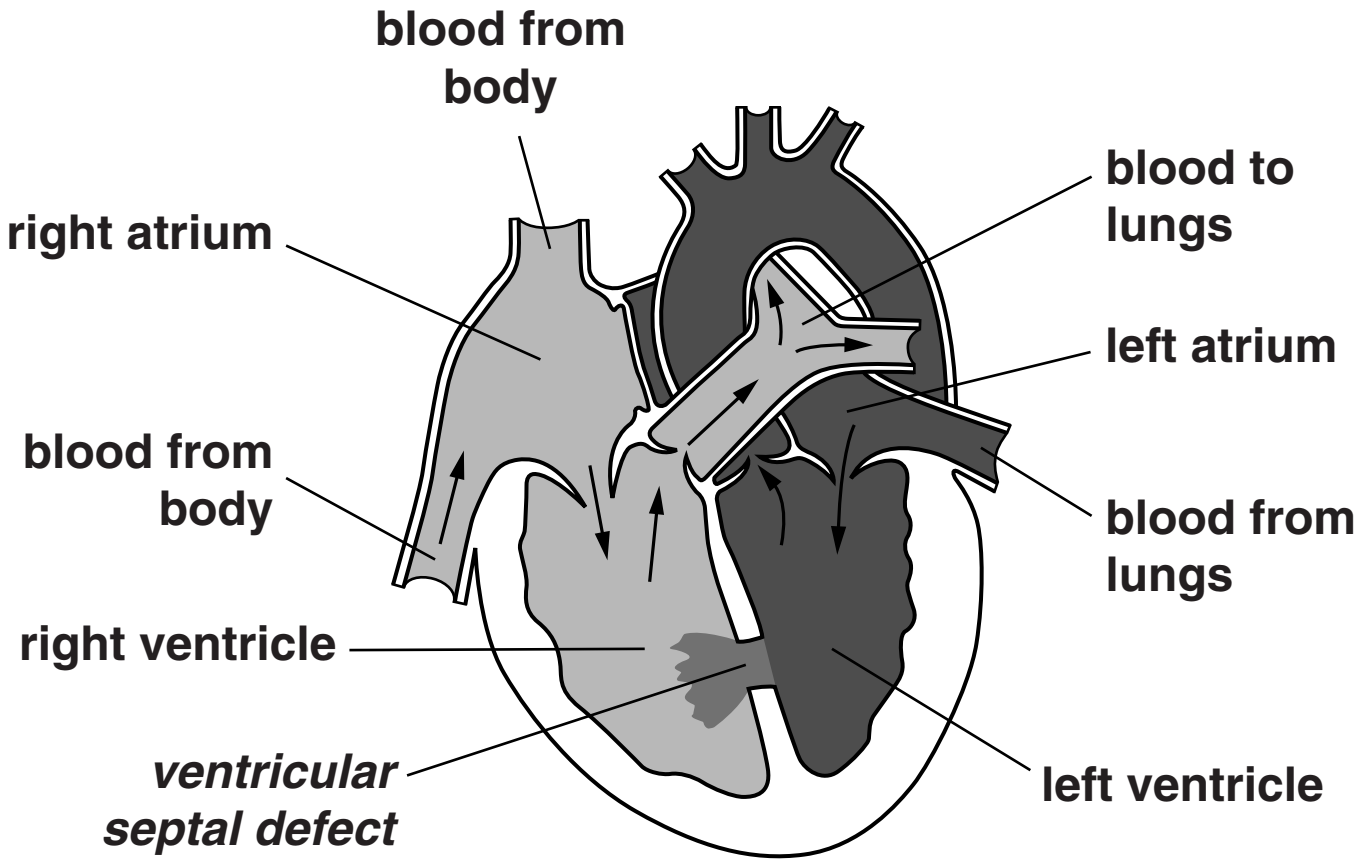

Fig. 5.1

Describe TWO problems that are likely to be caused in Matthew's circulatory system by the VSD.

_____

_____

_____

_____ **[2]**

(c) Describe TWO advantages of using an ultrasound scan to diagnose a VSD.

_____

_____

_____

_____ **[2]**

(d) State two further medical uses of ultrasound scans, other than recording blood flow in the heart.

1. _____

_____

2. _____

_____ **[2]**

[Total: 13]

END OF QUESTION PAPER

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