

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
AS GCE**

**G622/01**

**APPLIED SCIENCE**

**Monitoring the Activity of the  
Human Body**

**WEDNESDAY 17 MAY 2017: Afternoon**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**Electronic calculator**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**



## **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. 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.**

## **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.**

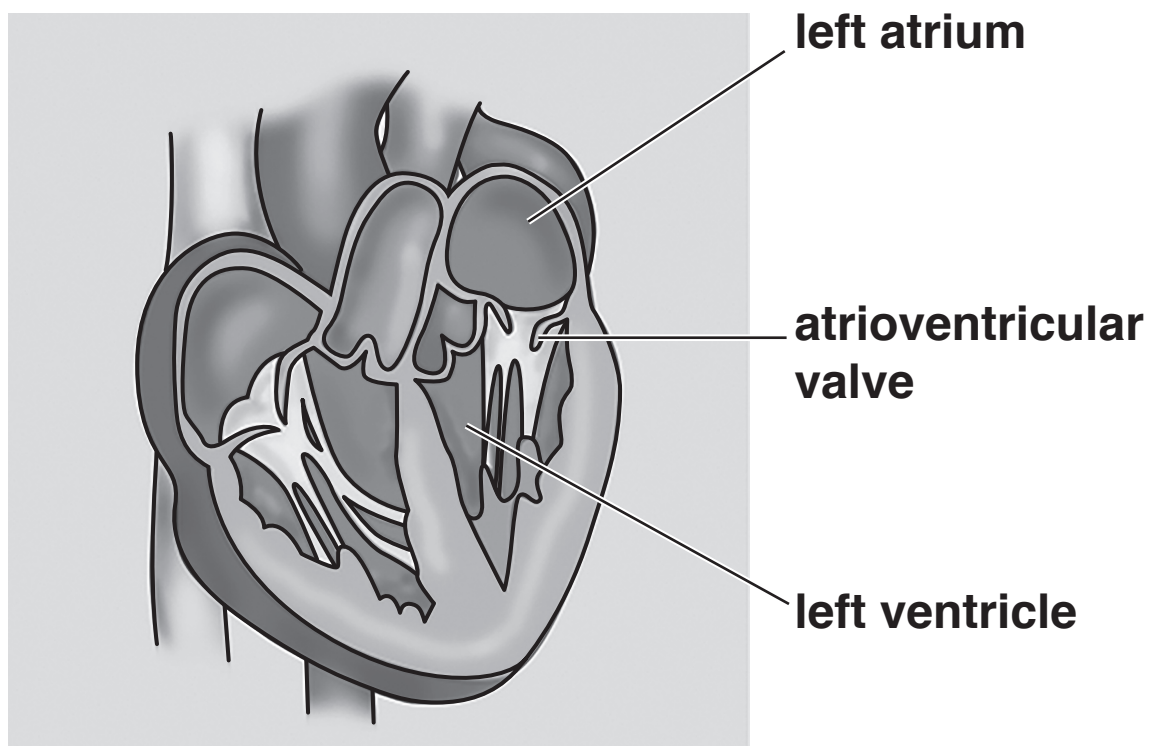
**You may use an electronic calculator.**

**Answer ALL the questions.**

- 1 Fred is 75 years old and was born with a heart defect.**

**There is a problem with the atrioventricular valve between his left atrium and ventricle (FIG. 1.1).**

**FIG. 1.1**



- (a) The atrioventricular valve can open but fails to close fully.**

- (i) Suggest how this affects the flow of blood between the left atrium and left ventricle.**

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**[2]**

- (ii) Some of Fred's blood vessels are directly affected by this heart defect.

As a result, one of the vessels carries blood out of the heart under lower pressure than normal.

Identify this blood vessel. Put a tick (✓) in the correct box.

coronary artery	<input type="checkbox"/>	
vena cava	<input type="checkbox"/>	
pulmonary vein	<input type="checkbox"/>	
aorta	<input type="checkbox"/>	
pulmonary artery	<input type="checkbox"/>	[1]

- (b) The doctor must observe the action of Fred's atrioventricular valves.

- (i) Give a reason why a CT scanner would NOT be used for this procedure.

\_\_\_\_\_

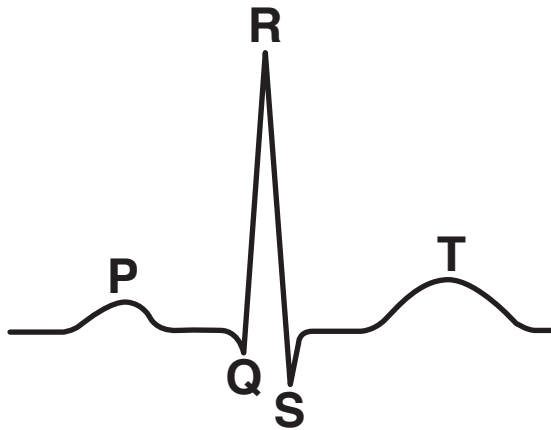
\_\_\_\_\_ [1]

- (ii) Suggest the most effective type of scanner to use to observe the action of Fred's heart valves.

\_\_\_\_\_ [1]

- (c) A typical electrocardiograph, or ECG trace, for one heart beat of a healthy person is shown in FIG. 1.2.

**FIG. 1.2**



The doctor suspects that the condition of Fred's heart has worsened.

The cardiac muscle forming the wall of the left ventricle has weakened.

This problem was detected when the doctor looked at a recent ECG trace for Fred.

- (i) Using the ECG trace, FIG. 1.2, identify the region which would be most affected by Fred's weak left ventricle wall.

Put a tick (✓) in the box next to the correct region.

**P** ☐

**QRS** ☐

**T** ☐ [1]

- (ii) The doctor finds that Fred's heart beat rate is normal.

State the typical range for the heart beat rate.

\_\_\_\_\_ to \_\_\_\_\_ beats per minute [2]

- (iii) The heart beat rate can be checked further by recording the **PULSE RATE**.

Suggest **TWO** procedures to follow to make sure that a pulse rate reading is as meaningful as possible.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

[2]

- (d) The doctor considers that Fred may eventually need a heart transplant.

- (i) Suggest **TWO** potential medical problems of carrying out a heart transplant for Fred.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

[2]



**(ii) Suggest TWO ethical reasons why Fred should not undergo a heart transplant.**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

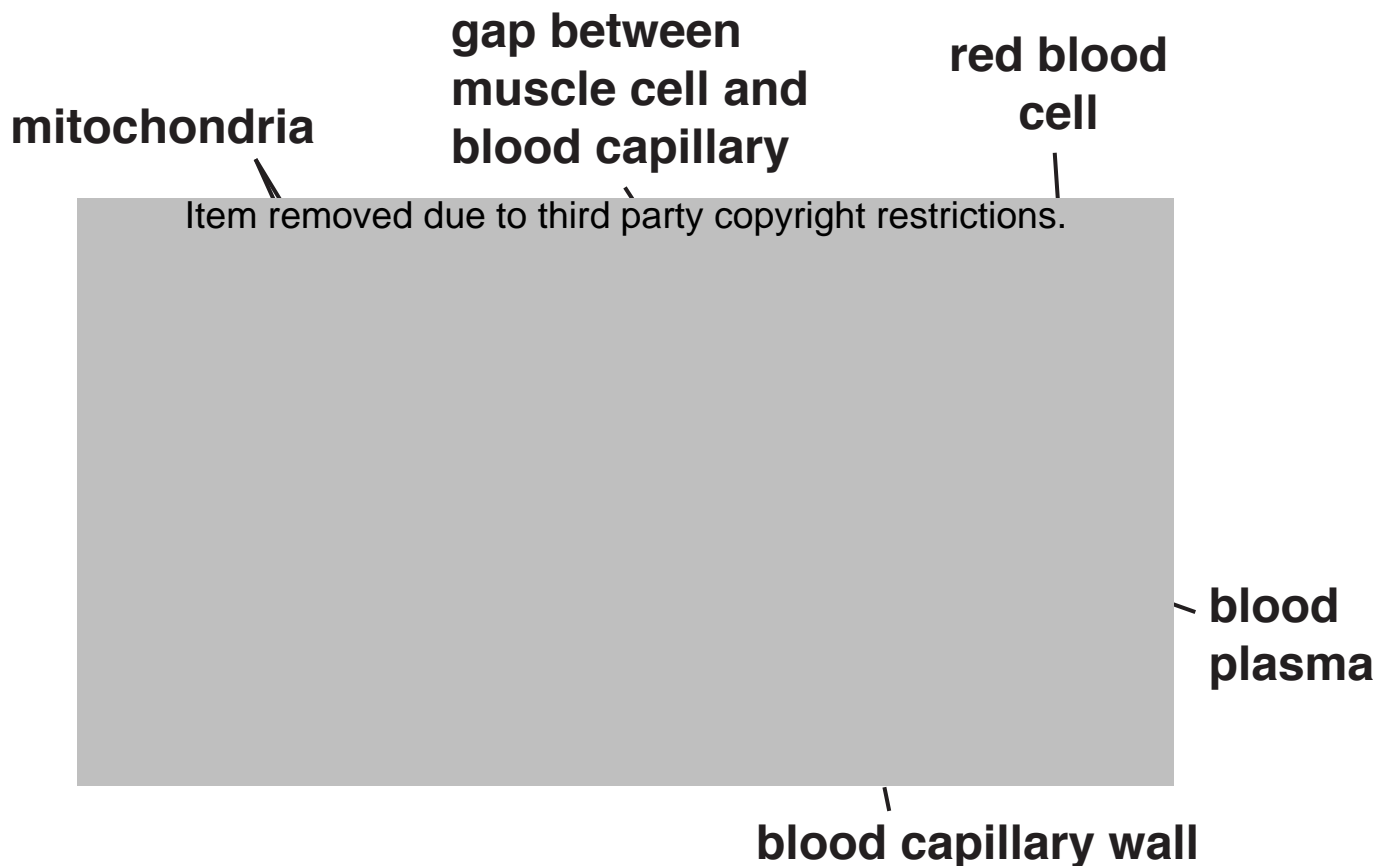
**[2]**

**[TOTAL: 14]**

**2 Harriet is studying the function of skeletal muscle tissue and the process of cellular respiration.**

**(a) She finds a highly-magnified photograph of some muscle cells (FIG. 2.1).**

**FIG. 2.1**



**Harriet can see that mitochondria are located inside the muscle cells. She also observes that the blood capillary contains a red blood cell and is surrounded by a capillary wall.**

**(i) Complete the following sentences.**

**Mitochondria are the site of \_\_\_\_\_  
respiration.**

**This means that the process can only take  
place in the presence of \_\_\_\_\_**

**The muscle cells contain many mitochondria.**

**As a result, the muscle cells can provide more  
\_\_\_\_\_ for contraction.**

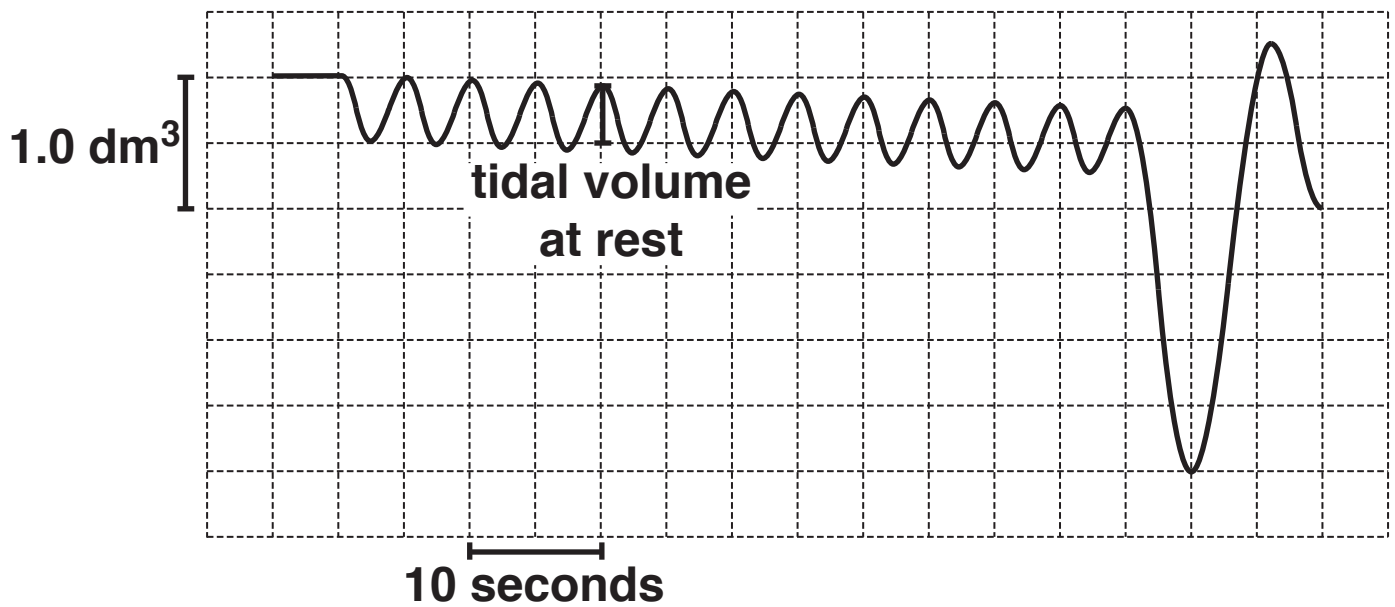
**The blood plasma delivers \_\_\_\_\_  
to the muscle cells for the process of cellular  
respiration. [4]**

[illegible]

- (b) Harriet knows that the efficiency of muscle contraction is closely linked to breathing.

She examines a spirometer trace (FIG. 2.2) to calculate various aspects of breathing.

FIG. 2.2



- (i) Use the spirometer trace, FIG. 2.2, to calculate the vital capacity.

Show your working.

\_\_\_\_\_  $\text{dm}^3$  [2]

- (ii) Using your knowledge of normal vital capacity values, suggest why this vital capacity value is more likely to be that of a typical female than that of a male.

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[3]

- (iii) Use the spirometer trace, FIG. 2.2, to calculate the breathing rate at rest.

Show your working.

breathing rate = \_\_\_\_\_ (value) \_\_\_\_\_ (units) [2]

- (iv) What will happen to the breathing rate during exercise?

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[1]

- (v) Describe AND explain how the change in breathing rate during exercise affects gaseous exchange at the lungs AND muscle contraction. [4]

**Gaseous exchange at the lungs:**

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**Muscle contraction:**

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**[TOTAL: 22]**

**3 Joan is visiting her local health centre for her annual medical check.**

**She looks well but has recently been feeling tired and tells the nurse about her concerns.**

**(a) The nurse takes a finger prick of blood and tells Joan that she is going to use a simple biosensor to test for diabetes.**

**(i) Suggest why the nurse should wear surgical gloves when performing this procedure.**

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**[2]**



- (ii) List the steps to follow when using a biosensor to monitor blood glucose levels.

Complete the table.

The first step has been done for you. [2]

Step	Procedure
1	Clean and prick the skin
2	
3	

- (iii) Some biosensors are disposable.

State how this type of biosensor should be disposed of after the procedure is completed.

\_\_\_\_\_ [1]

**(b) The finger prick test indicates that Joan may have type 2 diabetes.**

**(i) State THREE features to distinguish type 1 from type 2 diabetes.**

**Complete the table [3]**

<b>Feature</b>	<b>Type 1 diabetes</b>	<b>Type 2 diabetes</b>
<b>1</b>		
<b>2</b>		
<b>3</b>		

**(ii) Suggest why the nurse asks Joan to keep a record of her diet during the next two weeks before attending a diabetes clinic.**

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**[2]**

- (c) Joan visits the diabetes clinic and is instructed to fast for an 8 to 12 hour period before taking part in a glucose tolerance test.**

**State the reason for fasting before the glucose tolerance test.**

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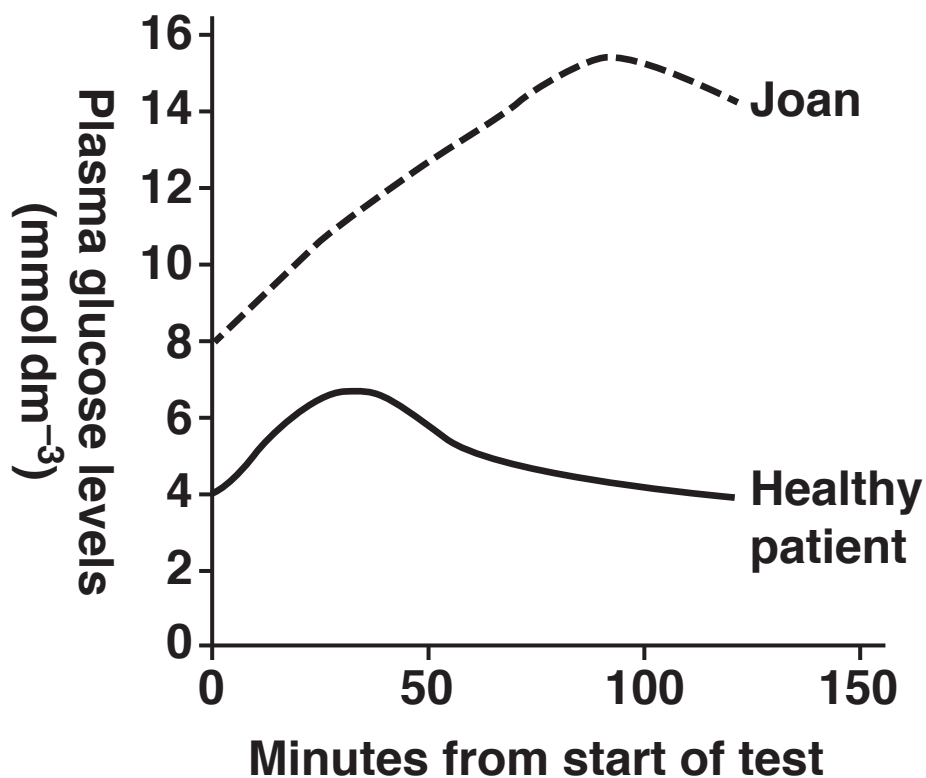
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**[2]**

- (d) Joan is given a glucose drink at the start of the test period and her plasma glucose levels are monitored during the following 120 minutes.

Joan's results are plotted on a graph in addition to the results obtained from a typical, healthy patient (FIG. 3.1).

FIG. 3.1





**(A detailed explanation of hormone action is NOT required in your answer).**

[illegible]

[6]

**[TOTAL: 18]**

**4 Tomek has had a car accident.**

**He is taken to the accident and emergency unit at the nearest hospital.**

**The medical team can see that Tomek has damaged his hand but they are also concerned about internal injuries.**

**(a) Tomek has an X-ray taken of his hand and then has a whole-body MRI scan.**

**(i) State THREE differences between an X-ray scanner and an MRI scanner. [6]**

<b>Difference</b>	<b>X-ray scanner</b>	<b>MRI scanner</b>
<b>1</b>		
<b>2</b>		
<b>3</b>		

- (ii) State the benefits of using BOTH an X-ray scanner and an MRI scanner for the diagnosis of Tomek's injuries.

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[2]

- (iii) The radiographer in the imaging suite is aware that, although both procedures are non-invasive, they carry some risks.

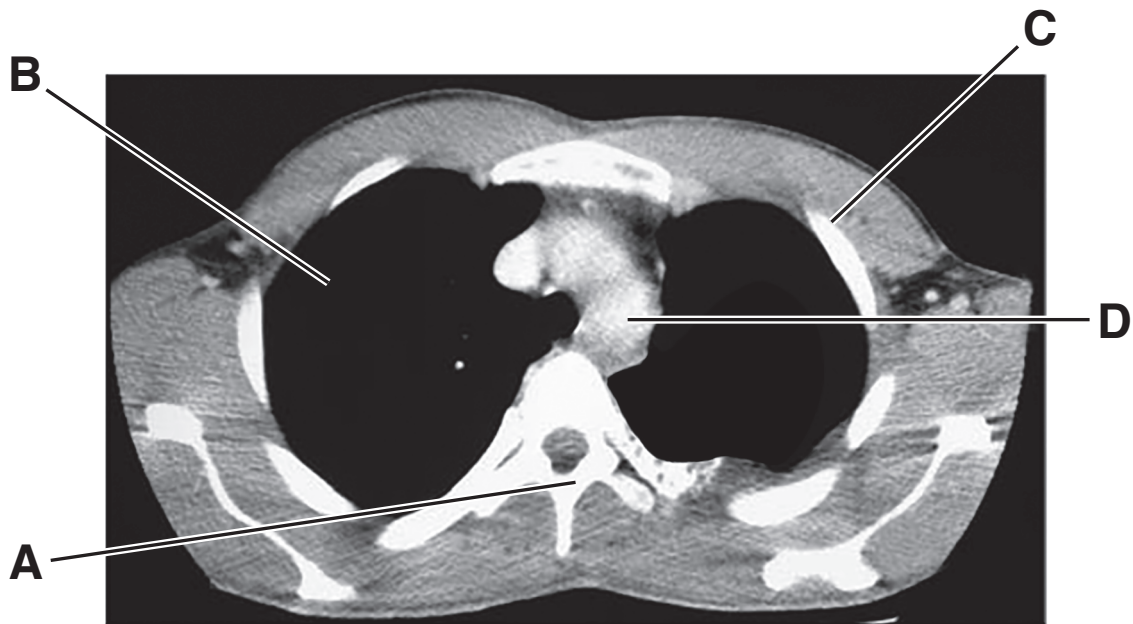
Complete the table to identify the risks to BOTH Tomek and to the radiographer and suggest ways to minimize the impact of these risks. [4]

Procedure	Risk	Way of minimising the risk
<b>X-ray</b>	<b>For Tomek</b>	
	<b>For the radiographer</b>	
<b>MRI</b>	<b>For Tomek</b>	
	<b>For the radiographer</b>	



**(b) The MRI image shows that Tomek does not have any internal injuries (FIG. 4.1).**

**FIG. 4.1**



**The image shows a cross-section through Tomek's chest cavity.**

- (i) The chest cavity contains a number of organs associated with the circulatory and respiratory systems, supported by the skeleton.

Use your knowledge of these two systems to identify the organs shown in Tomek's MRI scan.

Draw **STRAIGHT LINES** to link the labels on the left shown in FIG. 4.1 to the correct organs on the right. [4]

<b>LABEL</b>	<b>ORGAN</b>
<b>A</b>	rib
<b>B</b>	heart
<b>C</b>	right lung
<b>D</b>	vertebral column

- (ii) State TWO pieces of evidence, shown in FIG. 4.1, to confirm that Tomek was lying on his back during the MRI scanning procedure.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

[2]

[TOTAL: 18]

**5 Ben is a member of a men's athletics team.**

**The team members are all 18-year-olds and they have been invited to take part in a fitness assessment programme.**

**Ben and his team members visit the sports physiology department of a local university.**

**(a) The programme starts with some basic physiological measurements.**

**(i) Complete the table to show the average results expected for the athletics team when at rest.**

**[4]**

<b>Physiological indicator</b>	<b>Typical value or range</b>	<b>Unit of measurement</b>
<b>blood pressure</b>	<b>120/80</b>	
<b>temperature</b>	<b>_____ to _____</b>	<b>°C</b>
<b>peak flow</b>	<b>400 to 600</b>	

**(ii) Describe what is shown by a peak flow value.**

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**[2]**

**(b) Ben has his blood pressure and temperature recorded when he is exercising on a training cycle in the physiology department.**

**(i) State TWO precautions to be taken by the physiologists to make sure that Ben's blood pressure readings are valid while he is using the training cycle during the exercise period.**

**The physiologists are using an electronic digital sphygmomanometer.**

**1** \_\_\_\_\_

**2** \_\_\_\_\_

**[2]**

**(ii) Describe AND explain the likely changes to Ben's blood pressure during the period of exercise.**

\_\_\_\_\_

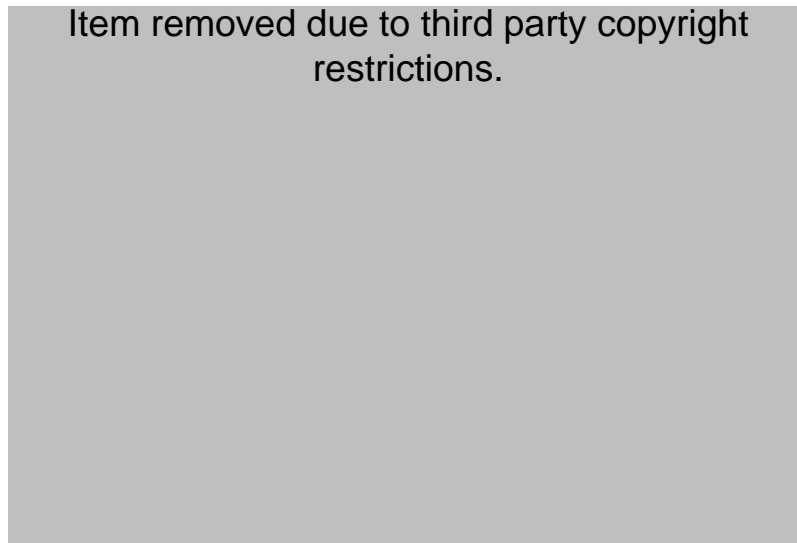
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[3]**

- (iii) A strip-type thermometer is used to take Ben's temperature (FIG. 5.1).

**FIG. 5.1**



**Suggest why the use of a strip-type thermometer shown in FIG. 5.1 may NOT be the most appropriate type of thermometer under these conditions.**

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**[2]**

**(c) The athletes have blood samples taken as part of the fitness assessment programme.**

**(i) The physiologists are testing for the presence of performance-enhancing drugs.**

**Suggest why three blood samples are often taken for this type of blood test.**

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**[2]**

**(ii) The physiologists take an additional blood sample from one of the athletes.**

**The athlete is showing symptoms of hepatitis.**

**State the name of a technique used to test for this disease.**

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**[1]**

- (iii) Suggest why it is important to test for performance-enhancing drugs and for diseases such as hepatitis.**

**Consider the impact on the athletes involved.**

**1. Performance-enhancing drugs**

\_\_\_\_\_ [1]  
\_\_\_\_\_

**2. Diseases such as hepatitis**

\_\_\_\_\_ [1]  
\_\_\_\_\_

**[TOTAL: 18]**

**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).**

[illegible]











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