



**GCE AS/A level**

**1661/01**

**APPLIED SCIENCE**

**UNIT 1**

**A.M. THURSDAY, 15 May 2014**

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

**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** 2 \_\_\_\_\_

<b>For Examiner's use only</b>		
<b>Question</b>	<b>Maximum Mark</b>	<b>Mark Awarded</b>
<b>Section A</b> <b>1. – 11.</b>	<b>32</b>	
<b>Section B</b> <b>12.</b>	<b>9</b>	
<b>13.</b>	<b>13</b>	
<b>14.</b>	<b>5</b>	
<b>15.</b>	<b>9</b>	
<b>16.</b>	<b>12</b>	
<b>Total</b>	<b>80</b>	

## **ADDITIONAL MATERIALS**

In addition to this examination paper, you will need a calculator and ruler.

## **INSTRUCTIONS TO CANDIDATES**

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces on the front cover.

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

## **INFORMATION FOR CANDIDATES**

Section A is based on the pre-release article (included).

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answers.

A DATA SHEET is included on pages 51-52.

**1 ORGAN DONATION: OPT-OUT BILL TO BE  
PUBLISHED IN WALES**

**5 WELSH GOVERNMENT PROPOSALS WOULD  
AUTOMATICALLY ADD PEOPLE TO THE ORGAN  
DONOR REGISTER.**

Legislation to change the organ donation system in Wales will be published soon. The Welsh government wants an opt-out scheme, which means everyone is assumed to have consented to becoming a donor when they die, and only those who object will be taken off the register.

Health Minister Lesley Griffiths has said she cannot imagine organs being removed if a family objects. Supporters say change will mean more organs being available for transplants. But church leaders have opposed the changes and the Law Society has called for more clarity on what role will be left for families when a relative dies. The reforms would make Wales the first country in the UK to adopt a system of presumed consent.

## **OPT-OUT LAW**

Despite a record 83 people donating organs in 2010, the Welsh government said a shortage of organs continues to cause deaths and the system will improve donations. Opponents have said changing the law may not make a difference and could be counter-productive. With 300 people on the transplant waiting list, the Welsh government wants to improve the rate of organ donation. But the Church in Wales, the Roman Catholic Church in Wales and the Wales Orthodox Mission have called for a re-think, with other critics saying there is no evidence that changing the law will work.

## **'TALK TO FAMILIES'**

A consultant in intensive care at Cardiff's University Hospital of Wales, said: "As doctors we are not going to do anything against family wishes. The role of the family is crucial and essential and will not change under this legislation. It is a terrible time to talk to families. It helps if you know what a patient's wishes are. If patients haven't opted out we would hope to talk to families about what organ donation is and the fact that a member of their family has expressed to be an organ donor and, hopefully, that could be followed through."

He said organ donation has increased by 50% in Wales over the last four years, and key to that has been the appointment of a specialist organ donation nurse at every hospital. But he said it was hoped  
50 those figures could improve further over time because the biggest “obstacle” is lack of family support after their relative dies which he hoped the new legislation would help to resolve.

The above article is adapted from a report published  
55 on the BBC website on 18 June 2012.

## **WHAT IS ORGAN DONATION?**

Organ donation is where a person offers their organs for transplant. Their organs are given to someone who has damaged organs that need to be replaced.  
60 An organ transplant may save a person’s life, or it may significantly improve their health and quality of life.

## THE NEED FOR DONORS

**65** In 2009, 3,700 organ transplants were carried out in the UK. However, there are always significantly more people waiting to have an organ transplant than there are suitable donors.

For example, at the end of March 2010, 8,000 people were waiting for an organ transplant.

**70** There is a particular need for more people of African, African-Caribbean and south Asian ethnicities to join the Organ Donor Register. This is because donation rates among these ethnic groups are low. Black people are three times more likely to develop kidney failure than the general population, and the need for **75** donated organs in Asian communities is three to four times higher than it is in the general population.

Most people who are waiting for a donated organ need to have a kidney, heart, lung or liver transplant.

**80** One donor can help several people. This is because a single donor is able to donate a number of organs – called multi-organ donation. The following table shows the number of organs donated in selected UK hospitals in 2010.

**TABLE 1**

<b>Donating Hospital</b>	<b>Kidney</b>	<b>Heart</b>	<b>Lung</b>	<b>Liver</b>	<b>Pancreas</b>
<b>A</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>2</b>
<b>B</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>C</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>
<b>D</b>	<b>8</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>E</b>	<b>12</b>	<b>2</b>	<b>2</b>	<b>6</b>	<b>4</b>
<b>F</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>G</b>	<b>4</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>H</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1</b>



**85 TABLE 1 Number of organs donated in selected UK hospitals in 2010**

**HOW TO DONATE**

**90 The NHS Organ Donor Register is a national, confidential database that holds the details of more than 17 million people who want to donate their organs after their death. The register can be accessed by healthcare professionals to find out whether an individual has registered to be an organ donor.**

**95 Even though there are a significant number of people on the register, most people will not die in circumstances that will allow them to donate their organs. It is, therefore, important that as many people as possible join the register.**

**CHECKING FOR A MATCH**

**100 When an organ becomes available for donation, it is checked to make sure that it is healthy. The blood and tissue type of both donor and recipient are also checked to ensure that they are compatible. The better the match, the greater the chance of a**  
**105 successful outcome.**

110 People from the same ethnic group are more likely to be a close match. Those with rare tissue types may only be able to accept an organ from someone of the same ethnic origin. This is why it is so important that people from all ethnic backgrounds register to donate their organs.

## TYPES OF DONATION

There are three different ways of donating an organ. These are known as:

- 115 • donation after brain stem death
- donation after cardiac death
- live organ donation.

## DONATION AFTER BRAIN STEM DEATH

120 Most organ donations are from brain stem dead donors. This is where the donor has been diagnosed with brain stem death following a severe brain injury, and the circulation continues to be supported by artificial ventilation until the donated organs have been removed.

125 Heartbeating donations have a high success rate because the organs are supported by oxygenated blood until they are removed from the body of the donor.

## **DONATION AFTER CARDIAC DEATH**

**130** Organs and tissue can also be donated from non-heartbeating donors. In the UK, almost all donors of this type are people who have died in intensive care from severe brain injuries, but who are not quite brain stem dead.

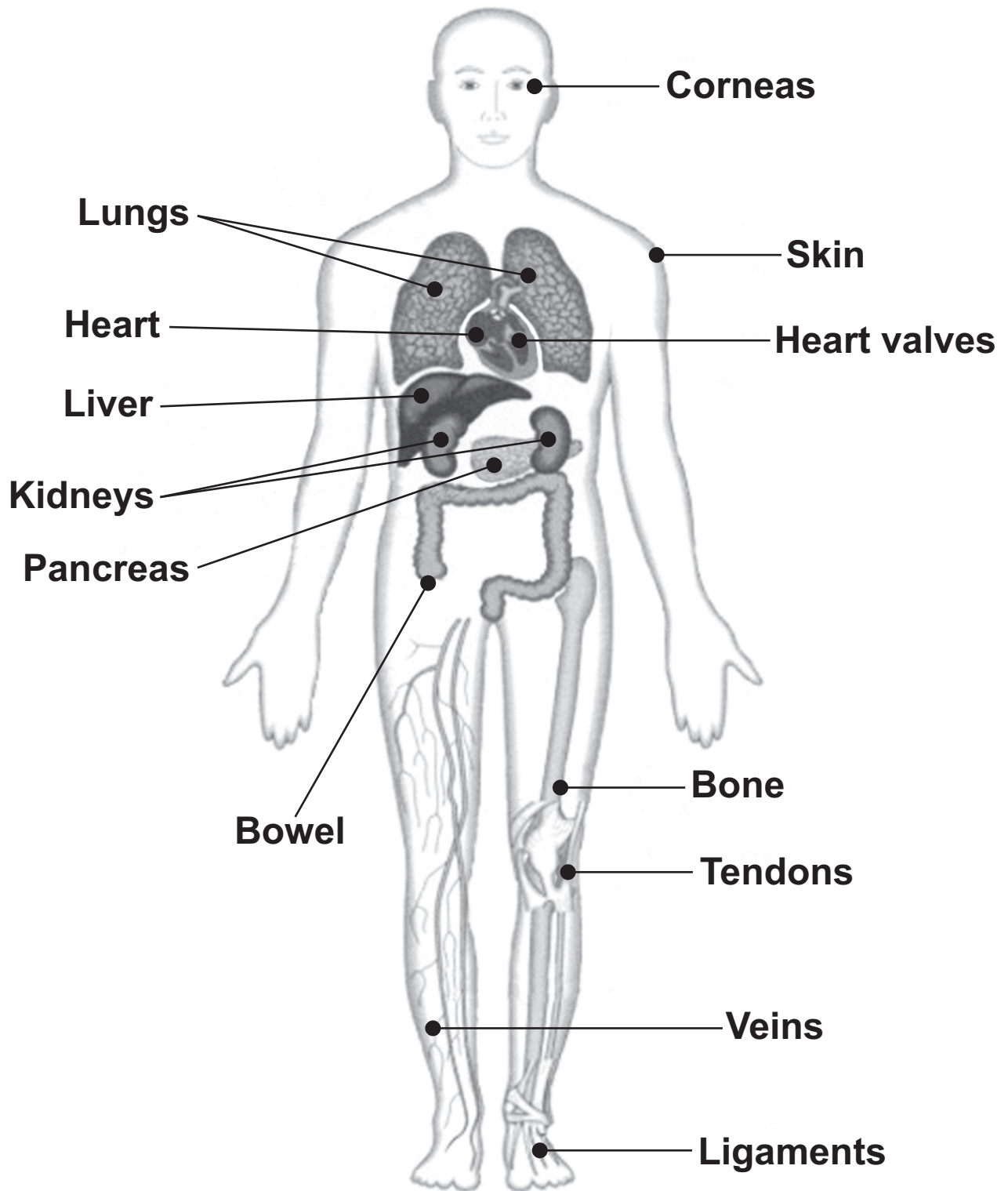
**135** In such cases, the donation must occur within a few minutes of the heart stopping because, otherwise, the organs will be damaged by the lack of oxygenated blood and it will not be possible for them to be transplanted.

## **140 LIVE ORGAN DONATION**

A live organ donation usually involves one family member donating an organ to another family member. The relative is usually blood-related, most commonly a parent, although it could be a partner.

**145** Following changes in the law, it is now possible to be an altruistic donor. Altruistic donors are unrelated to the patient but become donors as an act of personal generosity. Kidney donations are often made from living donors as a healthy person can lead a normal  
**150** life with only one working kidney.

**FIGURE 1 DIAGRAM SHOWING THE ORGANS/  
TISSUES THAT CAN BE TRANSPLANTED**



## **WHEN ORGAN DONATION IS USED**

The organs that can be donated are shown on the diagram opposite.

### **KIDNEYS**

**155 A kidney can provide a better quality of life to someone who has end stage renal failure. Renal failure is where the kidneys stop working properly.**

**160 Kidney transplants give better long-term survival rates and quality of life than dialysis (where some of the kidney's functions are artificially replaced). Kidneys that are used for transplant can come from a living person or from someone who has died.**

### **LIVER**

**165 A liver transplant is often considered for people with end stage liver disease. In around 85% of cases, transplanted livers still function well a year after surgery.**

### **HEART**

**170 Most heart transplants are carried out on people with severe heart failure, which is caused by coronary heart disease or cardiomyopathy (diseased heart muscles), who can no longer be helped by medication or other types of surgery. The survival rate after one year of having a heart transplant is approximately 85%.**

**175 LUNGS**

Lungs can be damaged by illnesses, such as cystic fibrosis (where the lungs become clogged with thick, sticky mucus), or respiratory conditions, such as chronic obstructive pulmonary disease (COPD),  
180 which are often the result of smoking.

Patients are considered for lung transplantation when their lung function cannot be significantly improved by medical therapy or surgery. Lung and heart-lung transplants have a 70% success rate one  
185 year after surgery.

**SMALL BOWEL**

A small bowel transplant is usually recommended if there is not enough bowel left to absorb nutrition (short bowel syndrome), and when the patient is  
190 having difficulty with total parenteral nutrition (TPN). TPN is where nutrition is given intravenously (through a vein).

Small bowel transplants are often performed at the same time as a liver and pancreas transplant. This is  
195 called a multi-visceral transplant.

## **PANCREAS**

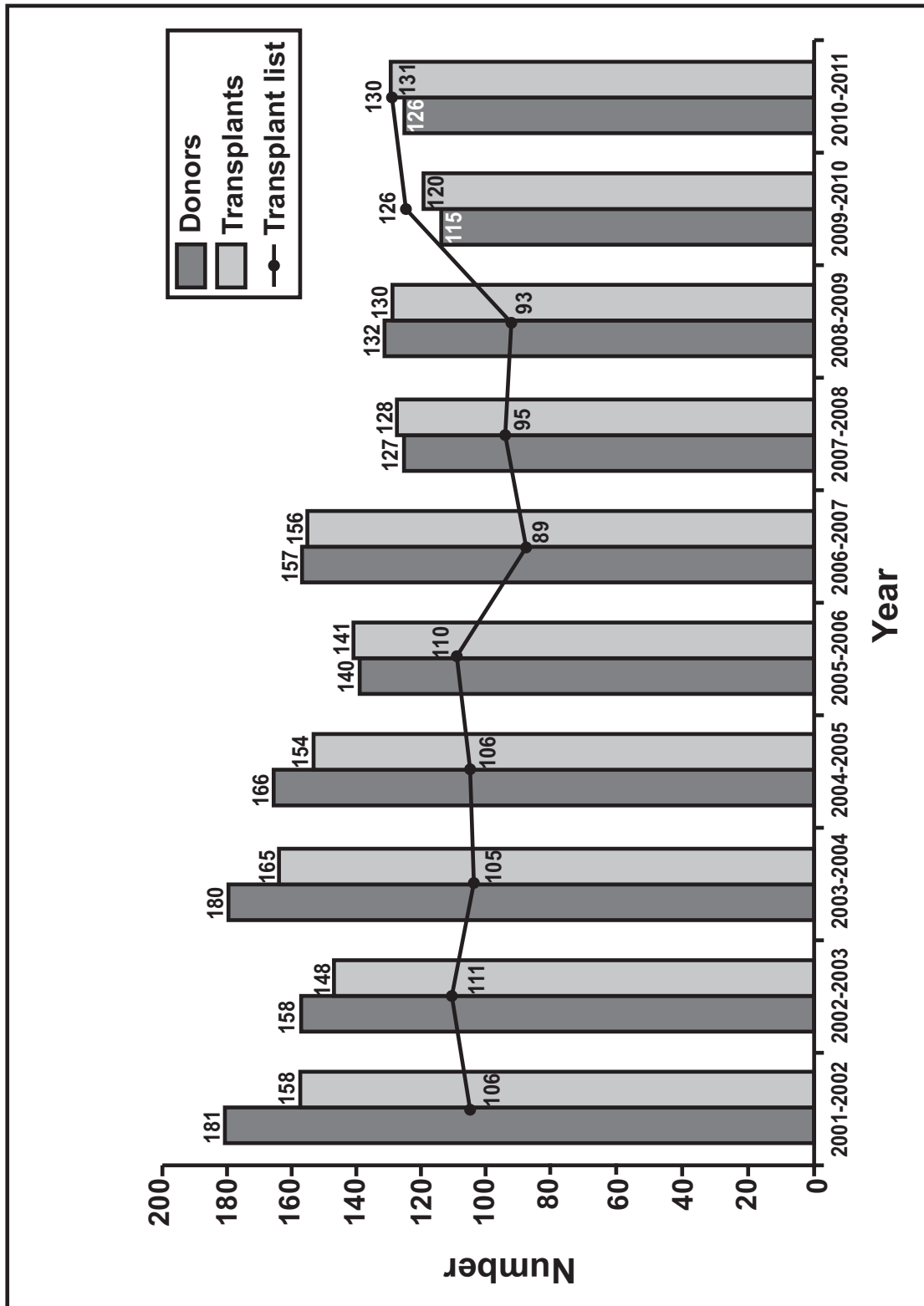
**A successful pancreas transplant is the only treatment that can restore complete insulin independence and blood sugar levels in patients with 200 type 1 diabetes.**

**Data illustrating the numbers of donors, transplants and patients for the most commonly donated organs is shown in charts 1 to 4 on pages 15-18.**

**Chart 1 Deceased donor heart programme in the UK, 1 April 2001 – 31 March 2011**

**Number of donors, transplants and patients on the active transplant list at 31 March**

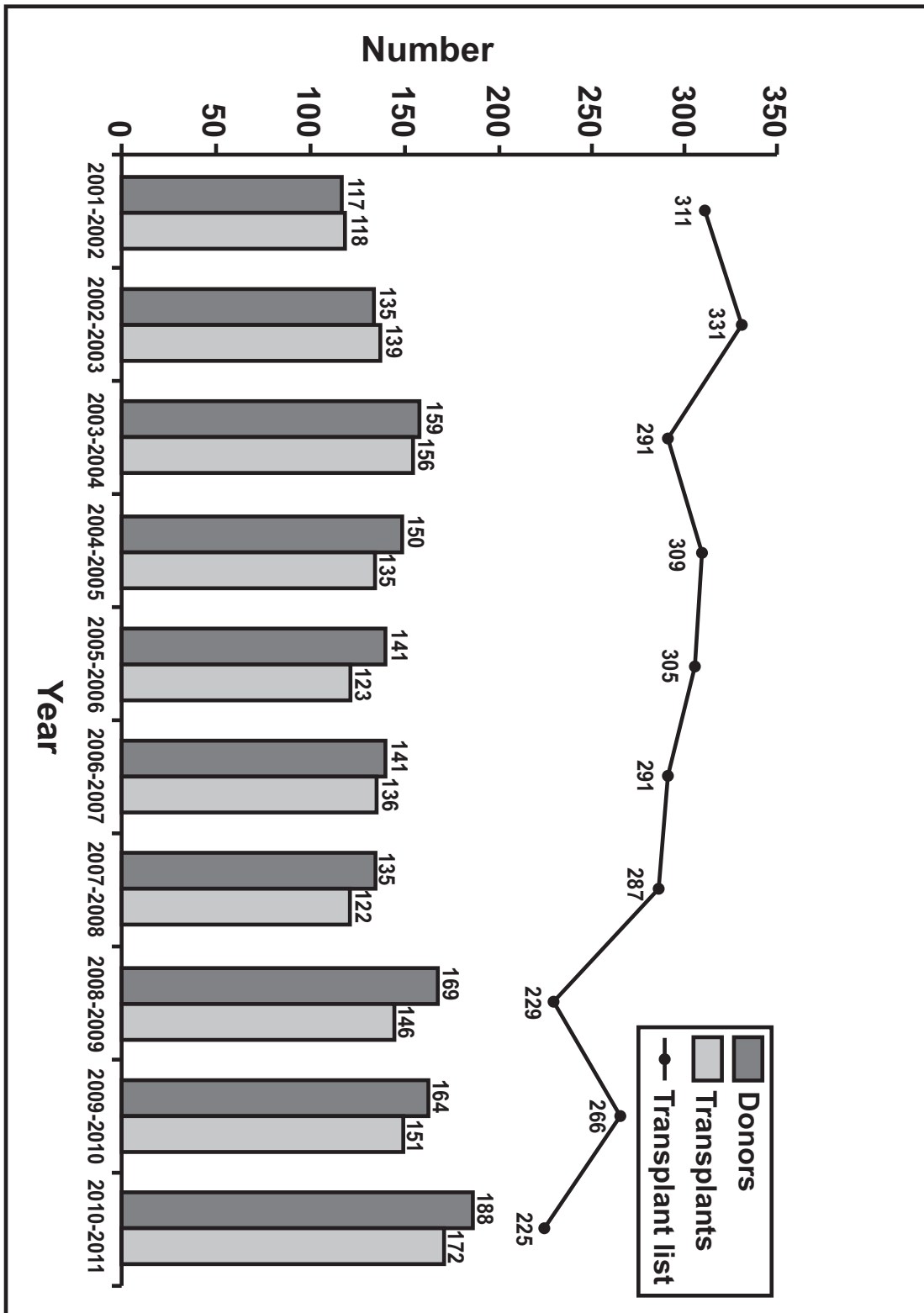
**Chart 1**





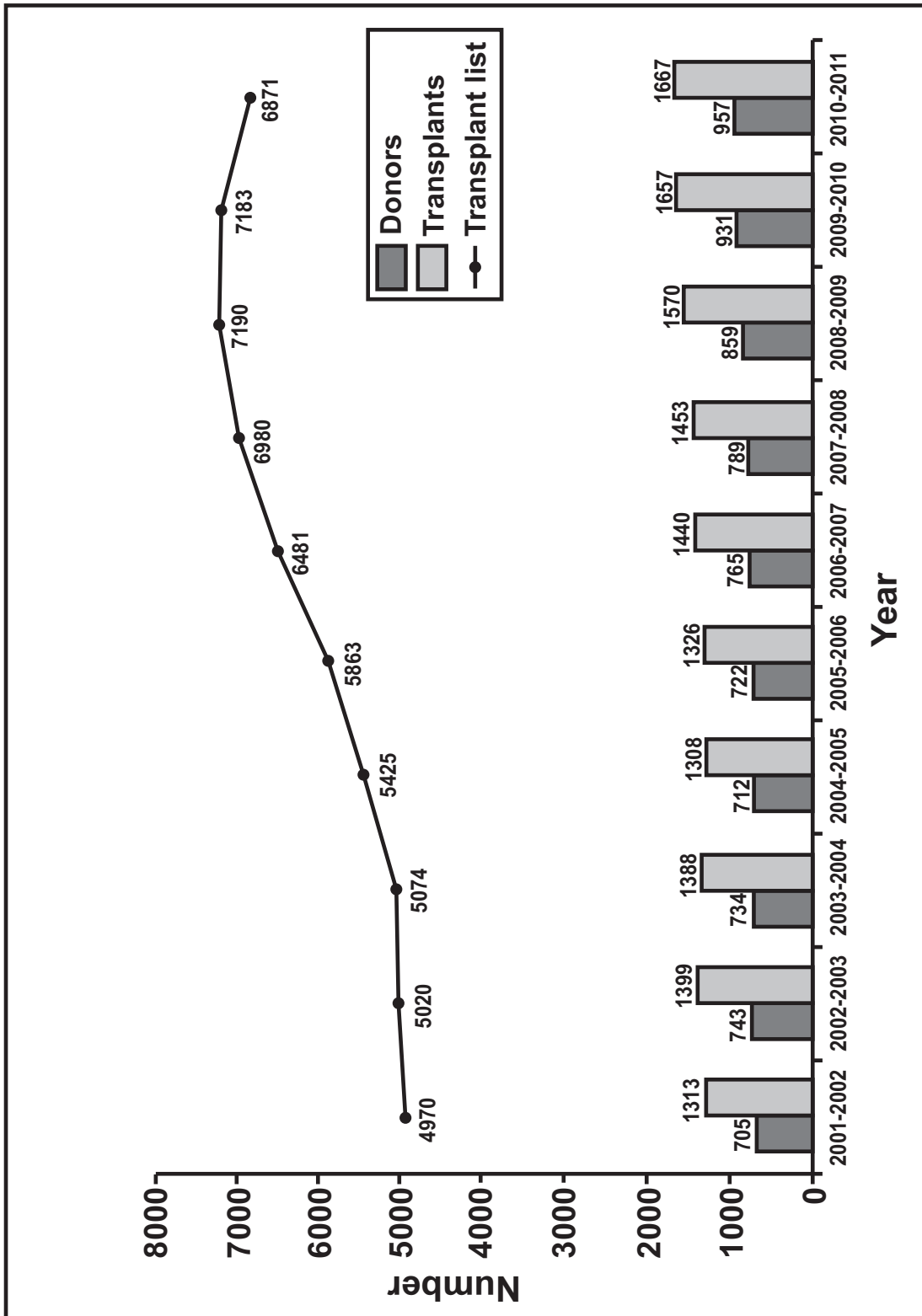
**Chart 2 Deceased donor lung and heart/lung programme in the UK, 1 April 2001 – 31 March 2011**  
**Number of donors, transplants and patients on the active transplant list at 31 March**

**Chart 2**



**Chart 3 Deceased donor kidney programme in the UK,  
1 April 2001 – 31 March 2011**  
Number of donors, transplants and patients on the  
active transplant list at 31 March

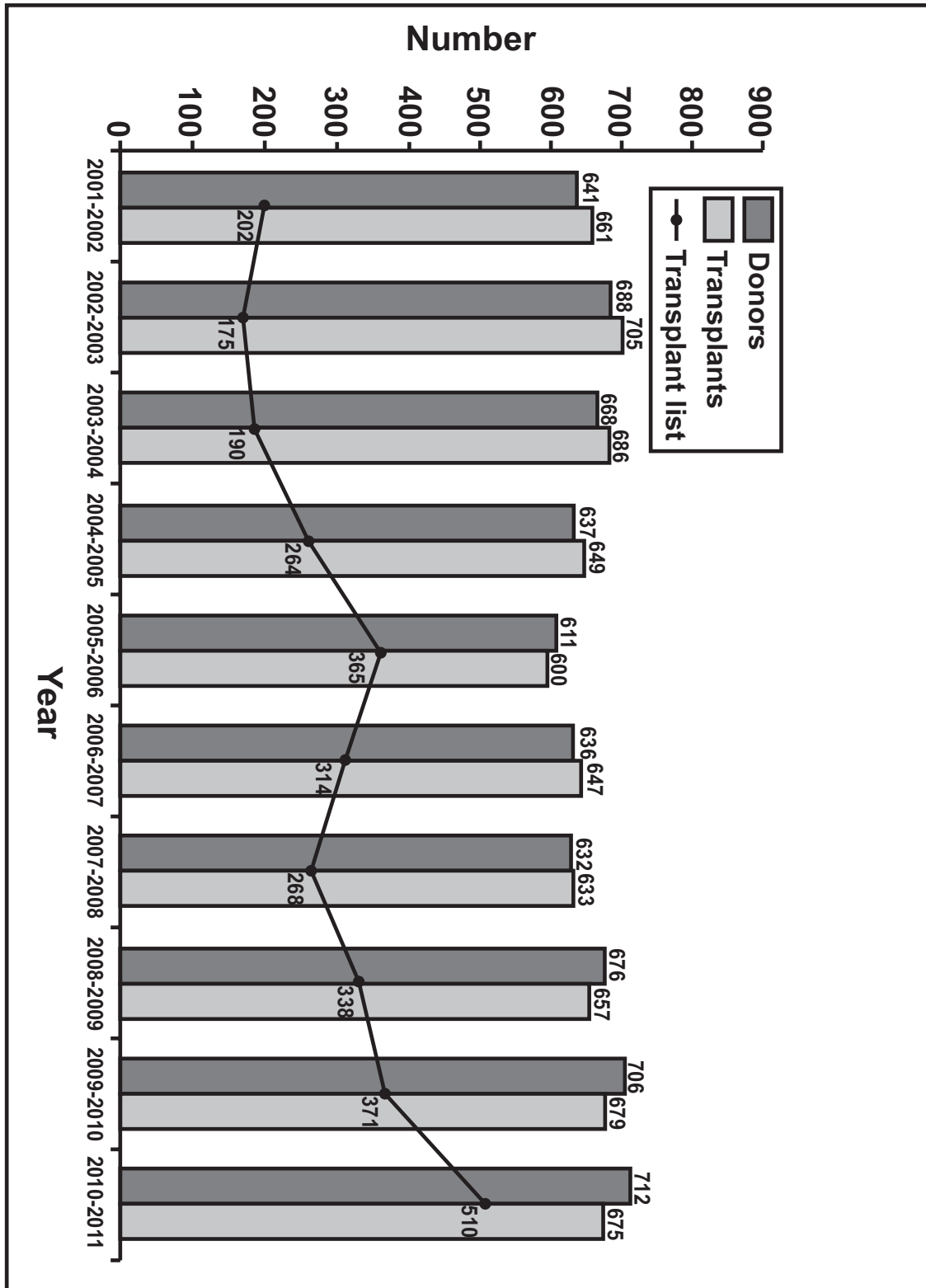
**Chart 3**



**Chart 4 Deceased donor liver programme in the UK, 1 April 2001 – 31 March 2011**

**Number of donors, transplants and patients on the active transplant list at 31 March**

**Chart 4**



## LIVING ORGAN DONATIONS

- 205** Kidneys are the most common organ to be donated by a living person. This is because it is possible for a healthy person to lead a completely normal life with only one working kidney. Nearly one in three of all kidney donations are from living donors.
- 210** It is also possible for part of a liver to be transplanted, and in some circumstances it may also be possible to donate a segment of lung. In a very small number of cases, part of the small bowel has also been transplanted.
- 215** The advantage of a living donor kidney transplant is that kidneys from a living donor last longer than those that are donated from someone who has died. Survival rates are also increased for people who receive kidneys from live donors as opposed to
- 220** donors who have died.

## **SUCCESS RATES**

**Research has shown that in people who receive a kidney from someone who has died:**

- **77% of kidneys will still be working at 5 years**
- 225** • **58% of kidneys will still be working at 10 years.**

**However, in kidney transplants where the kidney is donated from a living donor:**

- **84% of kidneys will still be working at 5 years**
- **66% of kidneys will still be working at 10 years.**

## **230 SURVIVAL RATES**

**The survival rates of patients who receive kidney transplants from live donors are as follows:**

- **94% will still be alive 5 years after the transplant**
- **85% will still be alive 10 years after the**
- 235**     **transplant.**

**For those who receive kidney transplants from donors who have died:**

- **85% will still be alive five years after the transplant**
- 240** • **61% will still be alive 10 years after the transplant.**

## **REGULATIONS AND ASSESSMENT**

**245 The Human Tissue Act 2004 and the Human Tissue (Scotland) Act 2006 provide the legal background for living donation in the UK. It is regulated by the Human Tissue Authority (HTA).**

**250 The HTA consists of 12 members, including 11 members from medical and scientific backgrounds, who are appointed by the Secretary of State for Health. The HTA's role in living donation is to ensure that:**

- donors are not put under pressure to donate an organ**
- no payment is made for the donation (paying for 255 donated organs is illegal in the UK).**

**260 After the organ donor and the recipient of the donation have been assessed by the transplant team, an independent assessor from the HTA will assess the donor. They will make sure that all the legal requirements for the donation have been met.**

## THE DONATION PROCESS

If appropriate, brain stem death testing is carried out by hospital staff to confirm that the patient is dead. Alternatively, a joint decision may be made by  
265 medical staff, nursing staff and the patient's relatives that, although brain stem death has not occurred, the prospect of survival is so low that it is not helpful to continue with artificial ventilation.

The organ donor register will be checked and if  
270 the patient is found to be on the register, the local specialist nurse for organ donation is contacted. If the patient is on the donor register, the specialist nurse will speak to the family about the patient's wishes.

275 If the family agrees to organ donation, the specialist nurse must ensure that medical tests are carried out, such as blood group and tissue type matching. They also look at the donor's medical history and may ask the family some questions about them. This will help  
280 to confirm whether or not the organ donation can take place.

## CONDITIONS THAT RULE OUT ORGAN DONATION

There are only two medical conditions that always prevent someone from donating an organ. These are:

- 285 • HIV, which is a virus that attacks the immune system (the body's natural defence against illness and infection) and is spread through the exchange of infected bodily fluids, such as blood.
- Creutzfeldt-Jakob Disease (CJD), which is a  
290 rare condition that affects the nervous system, causing brain damage. Patients who are suspected of having CJD are also prevented from donating organs.

All patients who are waiting for transplants are  
295 registered on the National Transplant Database at NHS Blood and Transplant. This is a database that holds records of every person in the UK who is waiting to receive an organ transplant. When organs from a donor become available, a computer search is  
300 carried out to find the most suitable recipients.

A team of specialist surgeons is called to the donor's hospital to carry out the surgery to remove and preserve the organs for transport to the transplant unit. Timing is crucial because certain organs need  
305 to be transplanted within four to six hours.



During the operation, the surgeon will make a final decision about whether the organs are healthy and suitable to be transplanted. If all is well, the organ is received at the transplant unit and transplanted immediately. After the transplant has been completed, the recovery process and a new life for the transplant recipient can begin.

## **RISKS ASSOCIATED WITH ORGAN DONATION**

There are some risks associated with organ donation. These are outlined below.

### **VIRUS TRANSMISSION**

To reduce the risk of diseases and viruses being transmitted from an organ donor to a recipient, all potential organ donors have a sample of their blood taken. The blood is tested for:

- HIV (see page 23)
- HEPATITIS, which is a virus that causes inflammation (swelling) of the liver. Hepatitis can be passed on through bodily fluids, such as semen, blood and saliva.

## **IMMUNOSUPPRESSANT MEDICATION**

**Most people do not experience any physical problems after receiving a transplanted organ. However, after the operation the recipient will have**  
**330 to take immunosuppressant medication to prevent the body rejecting the new organ. Without this medication, the body will try to reject the donated organ.**

**Immunosuppressants work by suppressing**  
**335 (controlling) the immune system, which allows the body to accept the donated organ. However, the recipient will need to take immunosuppressants for the rest of his or her life. Immunosuppressants have side effects, including:**

- 340**
- an increased risk of developing some types of cancer**
  - an increased risk of developing infections.**

**Following an organ donation, the side effects that are experienced will depend on the type of**  
**345 immunosuppressant medication and the dosage that is required. The potential side effects of immunosuppressants should be discussed with the surgeon or transplant team.**

## **OTHER RISKS**

- 350** The donor may also experience prolonged wound pain after the donation operation. Depression and anxiety are also common. There is a risk of a number of long-term complications relating to specific donated organs.
- 355** There are ethical questions regarding live organ donation. If more people donated organs after their death it would not be necessary to use live donors. There are also concerns about the possibility of pressure being put on people to donate to a family
- 360** member.

**SECTION A**

**Answer ALL questions.**

- 1. State THREE different ways of donating an organ. [1]**

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- 2. Suggest ONE benefit and ONE problem with changing the law on organ donation in Wales to an opt-out system. [2]**

**Benefit** \_\_\_\_\_

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**Problem** \_\_\_\_\_

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**3(a) Explain why organ donation is necessary. [1]**

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**(b) State TWO disadvantages of organ donation to the person RECEIVING the organ. [2]**

1. \_\_\_\_\_

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2. \_\_\_\_\_

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**4(a) State TWO reasons why living donor kidney transplants are preferable to donations from someone who has died. [2]**

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

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

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**(b) Suggest ONE reason why payment for donated organs is illegal in the UK. [1]**

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**5. Please refer to the charts on PAGES 15-18 to answer this question.**

**(a) State the name of ONE organ for which the number of donors appears to meet demand for organs. [1]**

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**(b) Suggest ONE reason why there are still patients on the transplant list although the supply of donated organs meets the demand. [1]**

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**6. Please refer to TABLE 1 opposite page 8 to answer this question.**

**(a)(i) Name the least donated organ in the hospitals in TABLE 1. [1]**

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**(ii) Suggest ONE reason why this is the case. [1]**

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**(b) Suggest TWO reasons why kidneys are the most donated organs. [2]**

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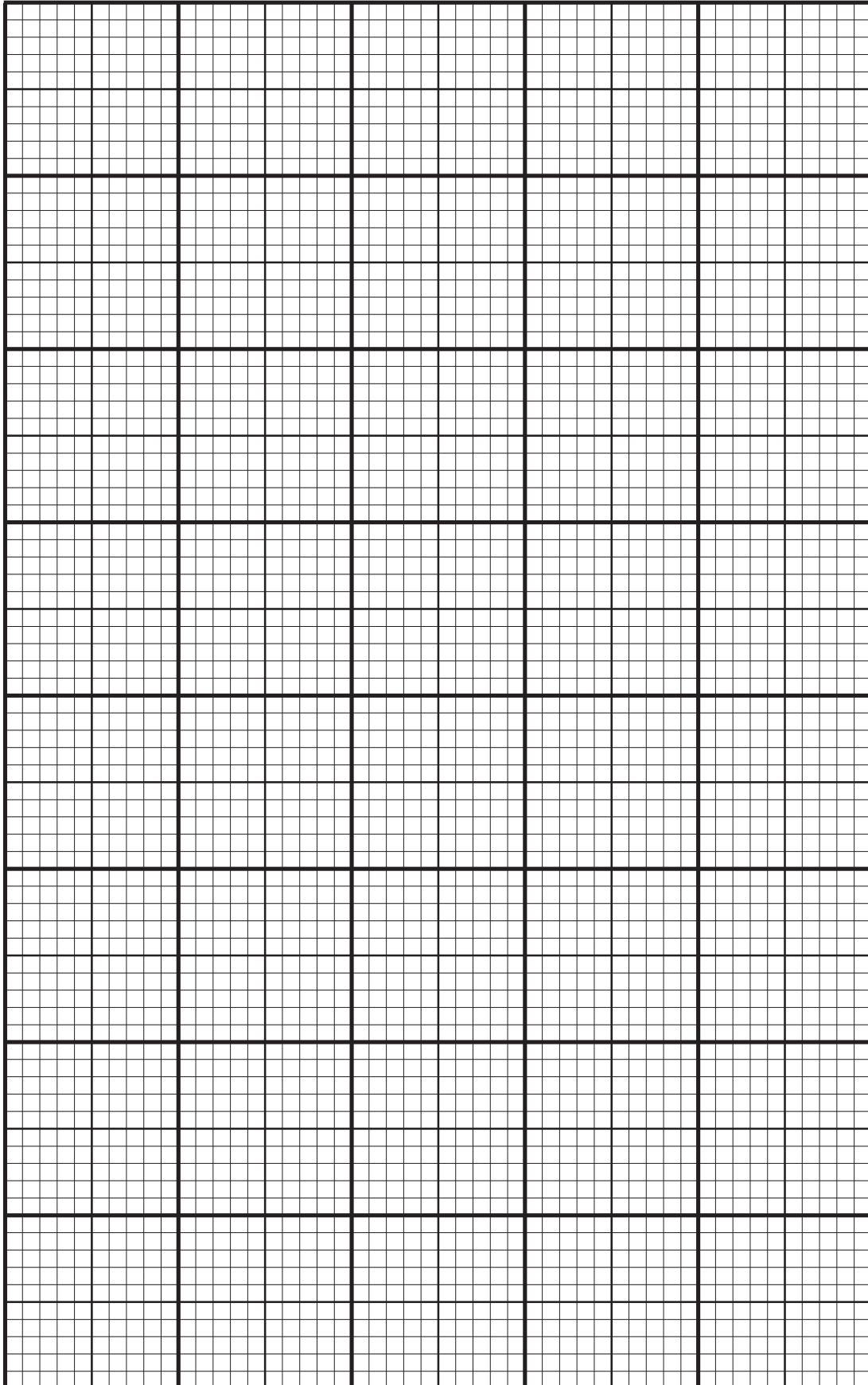
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7. **“Survival rates are also increased for people who receive kidneys from live donors as opposed to donors who have died.” (PAGE 19, LINES 218 TO 220).**
- (i) **Use relevant data from PAGES 19-21 to construct a table to show the SURVIVAL rates of patients who receive kidney transplants. [2]**

- (ii) Use your table to construct a suitable chart showing the SURVIVAL rates of people who have kidney transplants. [3]



**8. Explain why the tissue and blood type of the donor and recipient are checked before a transplant is carried out. [1]**

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**9. “Heartbeating donations have a high success rate because the organs are supported by oxygenated blood until they are removed from the body of the donor” (PAGE 9, LINES 125-128)**

**(a) Describe how the blood in the capillaries around the alveoli is oxygenated. [3]**

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**9(b) State the role of the following structures in the cardiac cycle: [3]**

**(i) Vena cava: \_\_\_\_\_**

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**(ii) Tricuspid Valve: \_\_\_\_\_**

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**(iii) Bundle of His: \_\_\_\_\_**

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**10. “Most heart transplants are carried out on people with severe heart failure, which is caused by coronary heart disease or cardiomyopathy” (PAGE 12, LINES 169 TO 171)**

**(a) State what is meant by the term CORONARY HEART DISEASE. [2]**

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**(b) Suggest TWO possible causes of coronary heart disease. [2]**

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**11. State TWO medical conditions that prevent donation of organs. [1]**

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<b>Physiological Measurement</b>	<b>At Rest</b>	<b>Immediately after Strenuous Exercise</b>
<b>Breathing rate (breaths min<sup>-1</sup>)</b>	12	_____
<b>Cardiac output (dm<sup>3</sup>min<sup>-1</sup>)</b>	5	25
<b>Heart rate (beats min<sup>-1</sup>)</b>	70	190
<b>Stroke volume (cm<sup>3</sup>)</b>	71	132
<b>Oxygen consumption (cm<sup>3</sup> min<sup>-1</sup>)</b>	250	2 500
<b>Systolic pressure (mmHg)</b>	_____	180

**SECTION B**

**Answer ALL questions.**

- 12. The table opposite shows some physiological measurements made on a 20 year old athlete at rest and at the end of a period of strenuous exercise.**
- (a) Using the data sheet on PAGES 51-52 as a reference, complete the table by estimating the following measurements:**
- (i) breathing rate at the end of strenuous exercise. [1]**
- (ii) systolic blood pressure at rest. [1]**
- (b) Calculate the percentage increase in stroke volume after strenuous exercise. [2]**

**12(c) Explain why the changes shown in the table opposite page 37 occur during exercise. [4]**

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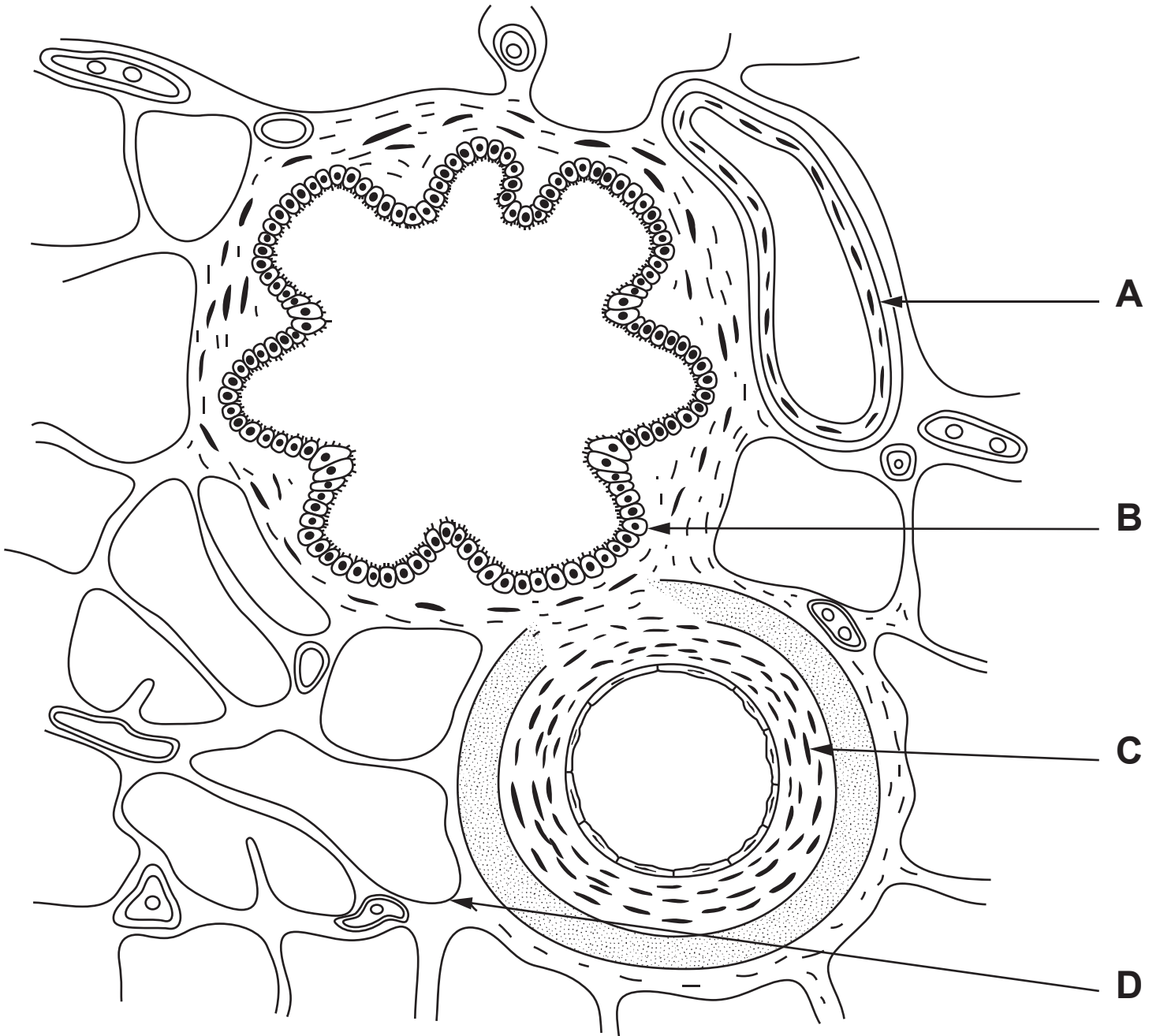
**(d) Suggest why regular exercise is beneficial for a person's heart. [1]**

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13. The diagram opposite shows a cross section of the lung tissue.

(a) State the names of structures A, B and C. [3]

D is named for you.

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D alveolus

(b) Describe TWO adaptations of the alveolus that make it suitable for its function. [2]

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**13(c) State the name of the cells lining structure C and describe their function. [2]**

**Name** \_\_\_\_\_

\_\_\_\_\_

**Function** \_\_\_\_\_

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**13(d)(i) Describe how the structure of the alveoli would differ in a person suffering from emphysema. [2]**

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**(ii) What effect would these changes have on gas exchange? [1]**

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**13(e) The peak flow of a person suffering from emphysema is likely to be different to that of a healthy person.**

**(i) Describe how a peak flow meter is used to measure peak flow rate. [2]**

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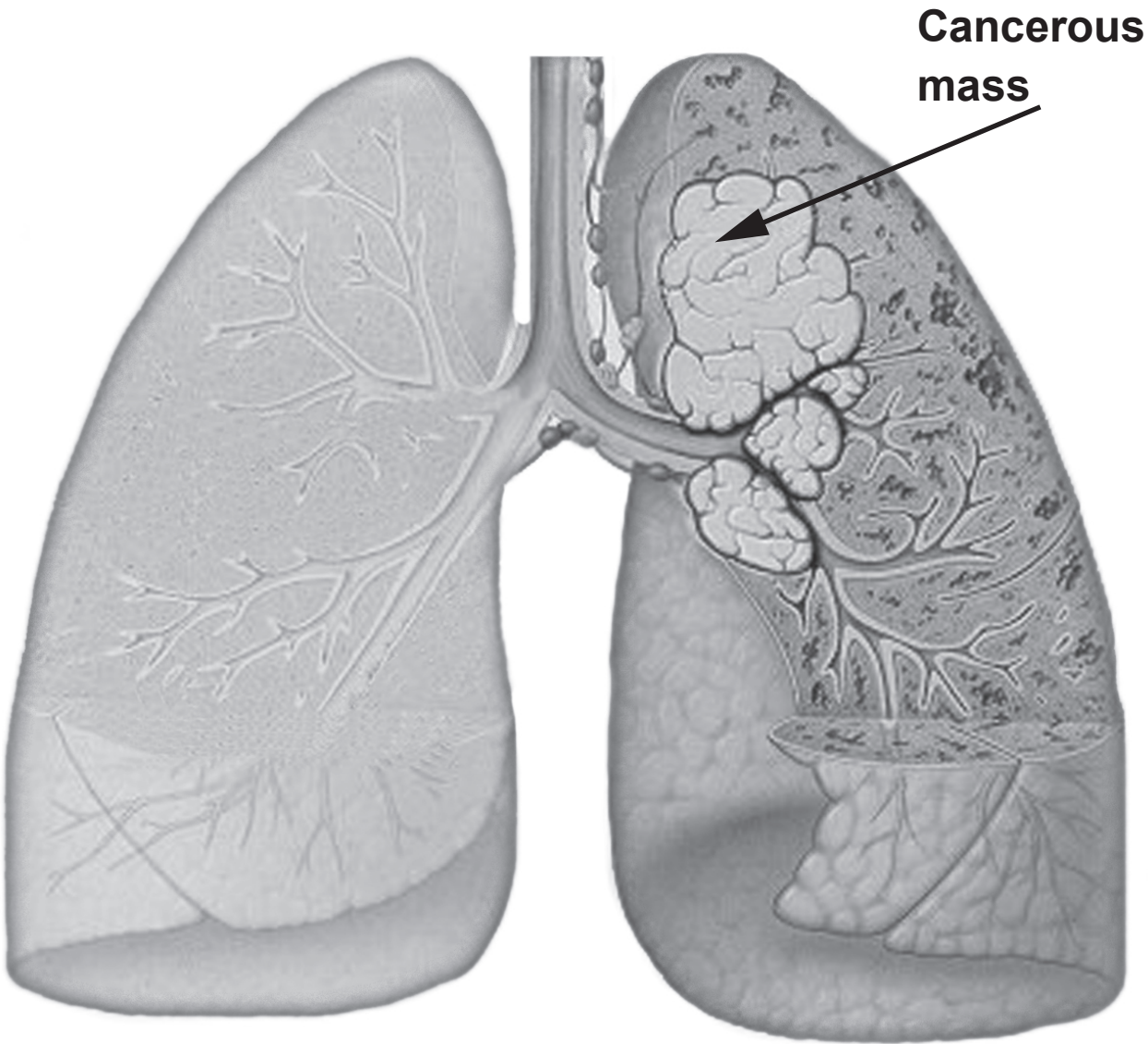
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**(ii) State the expected effect of emphysema on peak flow rate. [1]**

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**Cancerous  
mass**

**14. The image opposite shows lungs that are affected by cancer.**

**(a) The cancerous mass reduces the lung space available for gas exchange. SUGGEST TWO symptoms of lung cancer. [2]**

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**(b) Endobronchial ultrasound is a new technique for diagnosing lung cancer. MRI is rarely used to image lung cancer.**

**(i) Name TWO other medical imaging techniques that could be used to discover and locate tumours in the lungs. [2]**

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**14(b)(ii) Give ONE advantage of using ultrasound over the techniques named in part (i) to detect lung cancer. [1]**

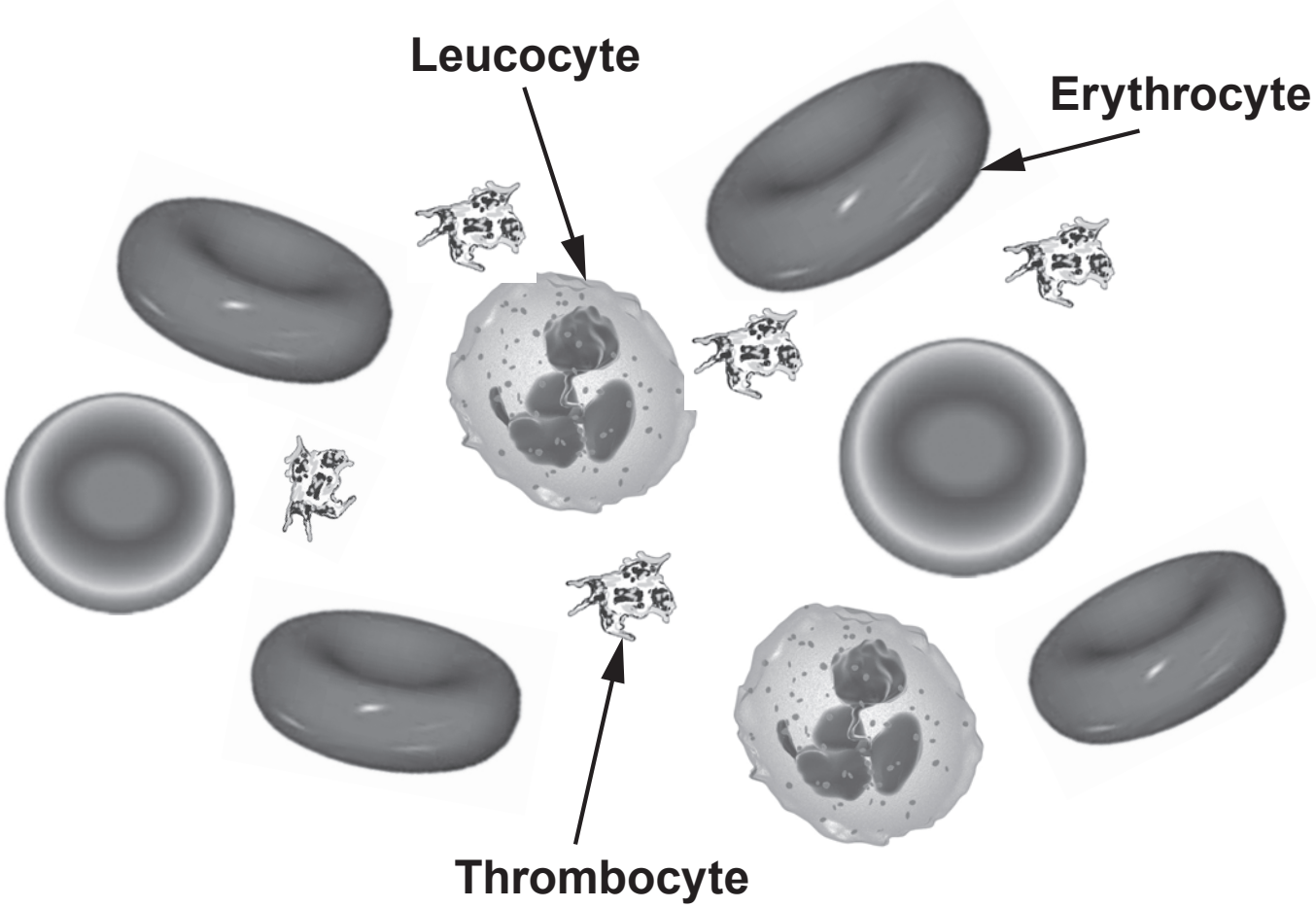
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**15. A Phlebotomist was studying the composition of a patient's blood.**

**(a) Describe how erythrocytes are adapted for their function. [2]**

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**(b) The diagram opposite shows the presence of many thrombocytes. State the function of the thrombocytes. [1]**

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**15(c) What component of the blood is not labelled in the diagram? State TWO functions of this component. [3]**

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**15(d)(i) What piece of equipment would measure the number of blood cells in a blood sample? [1]**

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**(ii) Outline a rule for counting blood cells using this equipment. [2]**

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**16. Catrin was studying the electrical activity of the heart as part of her Applied Science course. She learnt that the heart muscle was myogenic and that the electrical excitation spread in a particular route, to ensure that the chambers contract in the correct sequence.**

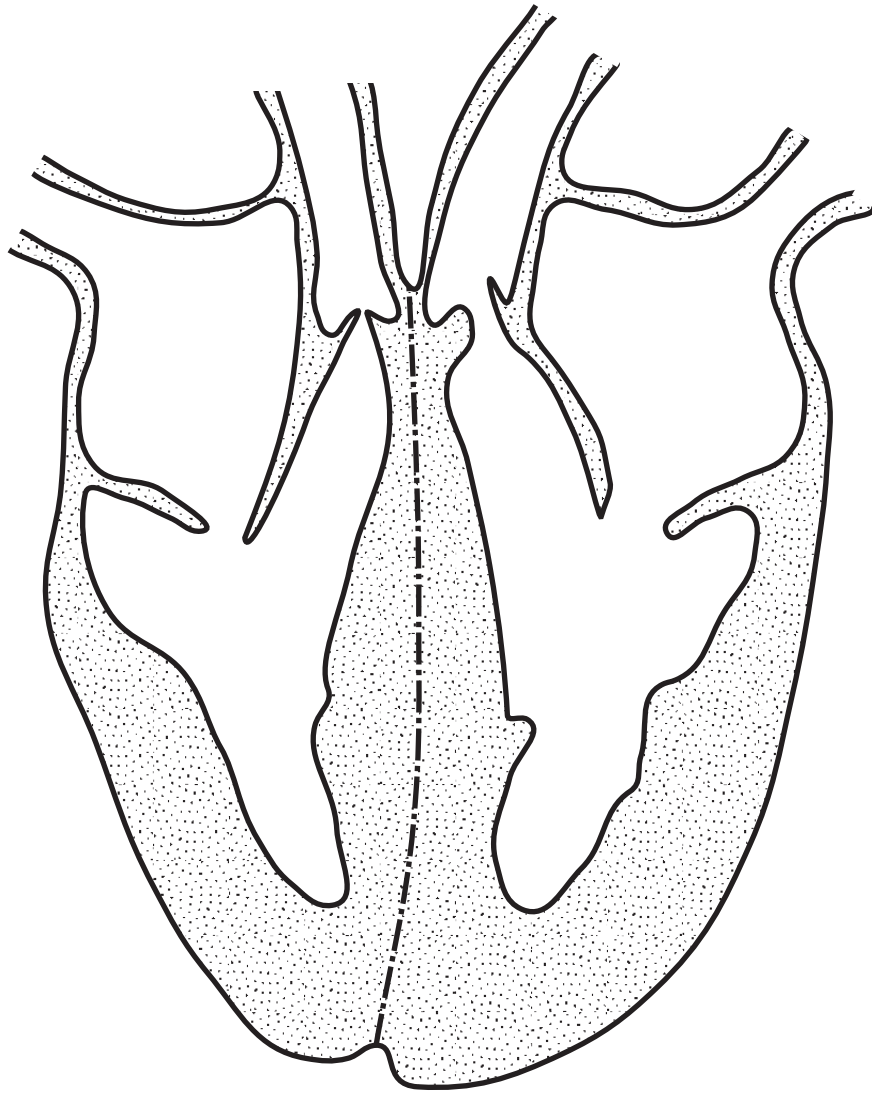
**(a) State what is meant by the term MYOGENIC. [1]**

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**(b)(i) Catrin studied the role of the Atrio-Ventricular Node, Purkinje (Purkyne) tissue and Sino-Atrial Node. On the diagram opposite, show the position of these THREE structures. [3]**

**(ii) On the diagram opposite, use arrows to show the path of the electrical impulse across the heart. [3]**



**16(c) The atrio-ventricular septum is a thin layer of tissue between the outer walls of the atria and ventricles. Explain the role of the atrio-ventricular septum. [2]**

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**(d) Name the equipment used to determine the electrical activity of the heart. [1]**

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- (e) In Britain, about 10 000 people a year are fitted with an artificial pacemaker to treat an abnormally slow heartbeat.



**AN ARTIFICIAL PACEMAKER**

- (i) What is the medical term given to a heart beat of less than 60 beats per minute? [1]

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- (ii) What region mentioned in part (b) is mimicked by an artificial pacemaker? [1]

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## DATA SHEET

**TABLE 1** Normal values for some physiological indicators

<b>INDICATOR</b>	<b>ADULT MALE</b>	<b>ADULT FEMALE</b>
<b>Pulse Rate</b>	<b>60 – 80 beats per minute</b>	<b>60 – 80 beats per minute</b>
<b>BREATHING</b>		
<b>Rate</b>	<b>12 – 15 breaths per minute</b>	<b>12 – 15 breaths per minute</b>
<b>Tidal volume</b>	<b>400 – 500 cm<sup>3</sup></b>	<b>400 – 500 cm<sup>3</sup></b>
<b>Vital Capacity</b>	<b>4.8 dm<sup>3</sup></b>	<b>3.1 dm<sup>3</sup></b>
<b>Peak Flow</b>	<b>400 – 600 dm<sup>3</sup> min<sup>-1</sup></b>	<b>400 – 600 dm<sup>3</sup> min<sup>-1</sup></b>
<b>BLOOD PRESSURE</b>		
<b>20 years old</b>	<b>125/80 mmHg</b>	<b>123/80 mmHg</b>
<b>40 years old</b>	<b>135/85 mmHg</b>	<b>133/85 mmHg</b>

TABLE 2 Reference ranges for some common blood tests

TEST	ADULT MALE	ADULT FEMALE
Glucose (Fasting)	4.5 – 6.1 mmol dm <sup>-3</sup>	4.5 – 6.1 mmol dm <sup>-3</sup>
Sodium ions	133 – 147 mmol dm <sup>-3</sup>	133 – 147 mmol dm <sup>-3</sup>
Potassium ions	3.5 – 5.0 mmol dm <sup>-3</sup>	3.5 – 5.0 mmol dm <sup>-3</sup>
Calcium ions	1.15 – 1.29 mmol dm <sup>-3</sup>	1.15 – 1.29 mmol dm <sup>-3</sup>
Zinc ions	10 – 17 μmol dm <sup>-3</sup>	10 – 17 μmol dm <sup>-3</sup>
<b>RED BLOOD CELLS</b>		
Haemoglobin	140 – 180 g dm <sup>-3</sup>	115 – 160 g dm <sup>-3</sup>
Red Cell count	4.5 – 6.5 × 10 <sup>12</sup> dm <sup>-3</sup>	3.8 – 5.8 × 10 <sup>12</sup> dm <sup>-3</sup>
<b>WHITE BLOOD CELL COUNT</b>	4 – 11 × 10 <sup>9</sup> dm <sup>-3</sup>	4 – 11 × 10 <sup>9</sup> dm <sup>-3</sup>
<b>PLATELET COUNT</b>	150 – 400 × 10 <sup>9</sup> dm <sup>-3</sup>	150 – 400 × 10 <sup>9</sup> dm <sup>-3</sup>