Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1661/01

APPLIED SCIENCE
UNIT 1

P.M. FRIDAY, 18 May 2012

1½ hours

For Examiner's use only			
	Question	**Max. Mark**	**Mark Awarded**
Section A	**1-7**	**34**	
Section B	**8**	**7**	
	9	**8**	
	10	**11**	
	11	**8**	
	12	**12**	
Total		**80**	

1661
010001

ADDITIONAL MATERIALS

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

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

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 page 26.

Pre-release article

Gareth's story

"I really thought I might not make it…"

It took 33 units of blood and skilled medical care to save Gareth Jones's life. Now he's raring to get back on a bike.

Motorsport fanatic, Gareth Jones, 34, will never forget the summer of 2006. On his way to work on his much loved Kawasaki ZX–7R motorbike, he collided with a car. The accident was devastating. "The impact of the crash trapped my leg between my bike and the car," says Gareth. "My body was slumped over and I knew my leg was in a bad way, but I didn't feel any pain."

An ambulance and paramedics soon arrived and they spent over 45 minutes trying to stabilise Gareth before he could be taken to hospital. The crash had almost destroyed Gareth's leg – all the skin and muscle had been torn from it, the bones were shattered, and his femoral artery was badly damaged.

"As soon as I arrived at A&E, blood was pumped into each arm and another bag was attached to my neck. The bags of blood were all being squeezed into me as I was losing blood faster than it could be transfused. I was still conscious but the doctors could not find a pulse and my chances of survival were becoming very slim."

Gareth was quickly taken to theatre where surgeons tried their hardest to save his leg by putting in a plate and stitching everything back together. During the operation the entire volume of his blood had to be replaced four times.

Two days later the doctors took a look at his leg. It was not good news. "I was told that my leg would need to be amputated above the knee," says Gareth. "I already knew that it would not survive – there was simply nothing they could do. Even though I had already told myself my leg would be amputated, hearing the actual words was still heart–wrenching."

After months of operations, involving a total of 33 units of blood products, Gareth is looking positively to the future and has far from lost his passion for motorsport and hopes to ride again.

He says, "I'm still working hard with my physio and hope to get in a position where I can be fitted with a flexible knee limb.

Before something like this happens it is easy to go through life blinkered, but now I'm glad to be alive and appreciate each and every day. And, without blood donors I definitely would not be here."

Blood Donation

Blood Service organisations collect, test, process and distribute blood. They rely entirely on voluntary donors to maintain supplies to Welsh hospitals.
The Welsh Blood Service needs to collect over 400 donations of blood everyday and demand has risen steadily over the last 10 years as medical techniques become more sophisticated.

Blood Groups

What is a blood group?

Red blood cells have certain proteins on their surface, called antigens. There are various types of red blood cell antigens - the ABO and rhesus types are the most important. Your genetic make-up which you inherit from your parents determines which antigens occur on your red blood cells. Your blood group is said to be:

- A+ (A positive) if you have A and rhesus antigens.
- A– (A negative) if you have A antigens, but not rhesus antigens.
- B+ (B positive) if you have B and rhesus antigens.
- B– (B negative) if you have B antigens, but not rhesus antigens.
- AB+ (AB positive) if you have A, B and rhesus antigens.
- AB– (AB negative) if you have A and B antigens, but not rhesus antigens.
- O+ (O positive) if you have neither A nor B antigens, but you have rhesus antigens.
- O– (O negative) if you do not have A, B or rhesus antigens.

The following chart shows blood group compatibility:

Donor

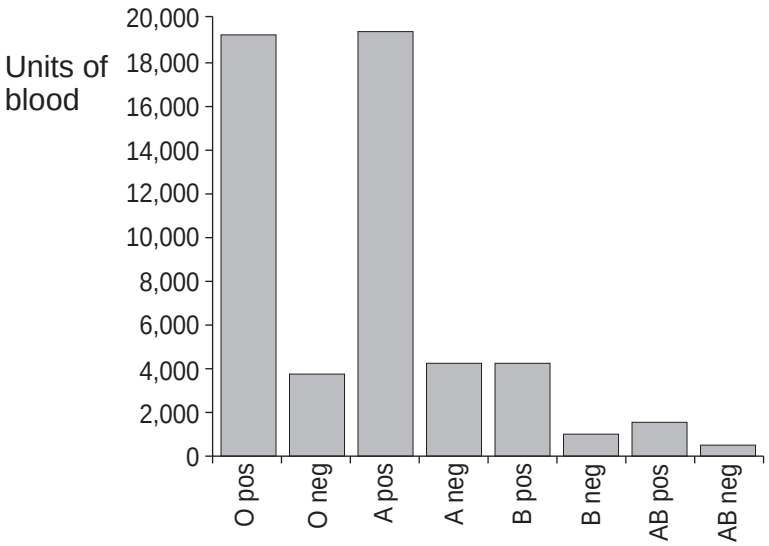
Recipient: Type	O–	O+	B–	B+	A–	A+	AB–	AB+
AB+	●	●	●	●	●	●	●	●
AB–	●		●		●		●	
A+	●	●			●	●		
A–	●				●			
B+	●	●	●	●				
B–	●		●					
O+	●	●						
O–	●							

Key
● = Compatible

Blood Stock Levels

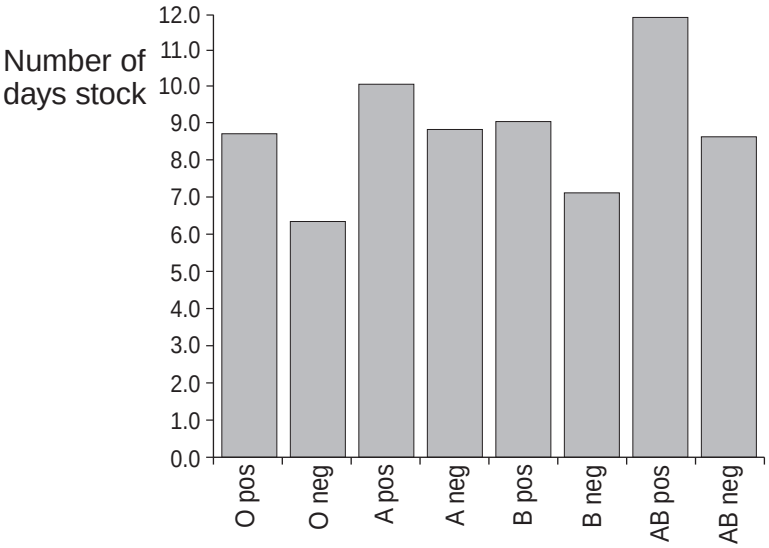
Blood stock levels are updated daily and the data published on the web. The charts below give the stock levels on the 14 May 2011.

Stock Level on 14 May 2011



Group	Stock Level (units)
O+	19,234
O-	3,850
A+	19,244
A-	4,052
B+	4,098
B-	850
AB+	1,579
AB-	381
Total	53,288

Days Stock on 14 May 2011



Group	Days Stock
O+	8.73
O-	6.24
A+	10.16
A-	8.87
B+	9.07
B-	7.02
AB+	12.34
AB-	8.66

About blood

Between 7 - 10% of a person's mass is blood.

Mass is a good guideline for blood volume in people of average build. This is why there is a minimum mass limit of 50 kg (7st 12lbs) for donating blood because if more than 13% of blood volume is taken there is more risk of the donor feeling faint after donating. People who are very overweight may not be allowed to give blood for their own safety.

Blood is a defence against infection and takes waste material to the kidneys. It carries oxygen and carbon dioxide to and from the tissues and the lungs.

It carries food to the tissues, regulates the chemicals in the body and regulates the temperature of the body.

Why are blood donations needed?

Throughout medical history it has been proved that blood and its by-products have played a vital role in saving lives. Most donors do not realise what their donations are used for. The blood collected is not just used for emergency operations or accident victims. So many patients could not survive without blood transfusions, such as anyone having a kidney, liver or an organ transplant; leukaemia and cancer patients; patients having cardiac operations and many premature babies.

Today the Welsh Blood Service is required to supply 400 donations a day to the hospitals in South, West and Mid Wales. A single donation can be broken down into its different components, so it can be used in various ways. These components all have differing life spans:

- Red cells can be stored for 35 days at 4°C.
- Platelets can be stored for only 5 days at 22°C. Platelets are collected from whole blood donations and through a special machine method of collection called plateletpheresis.
- Fresh Frozen Plasma can be stored for 1 year at –40°C. Clotting factors such as Factor VIII are also removed from plasma to treat patients with haemophilia and to make immunisations such as anti-tetanus.
- White cells need to be used within 24 hours of collection. They are used in rare circumstances to help treat severe infection that will not respond to antibiotics. All but these special donations have the majority of white cells filtered out – a process called leucodepletion.

How blood is used

Whole blood

This is rarely used these days, only really in instances of severe blood loss. It's usually separated into its individual components.

Red cells

Figure 1 Red cells

These are used in the treatment of all kinds of anaemia which can't be medically corrected, such as when rheumatoid arthritis or cancer is involved, when red cells break down in the newborn, and for sickle cell disease. They're also essential to replace lost red cells due to blood loss in childbirth, accidents, and after surgery.

Platelets (thrombocytes)

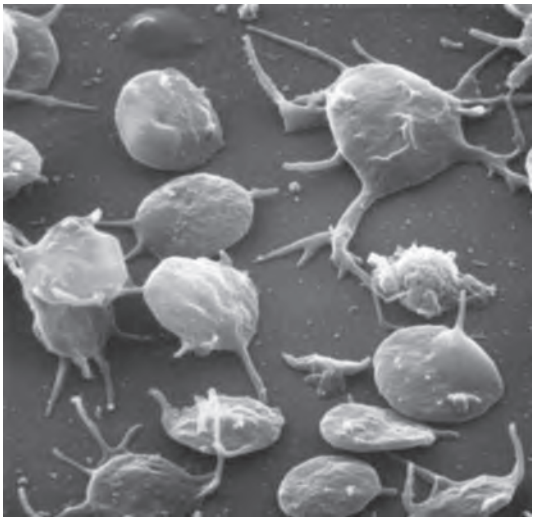


Figure 2 Platelets

Platelets, or **thrombocytes** are small, irregularly shaped clear cell fragments that circulate in the blood and are involved in formation of blood clots. Platelets can be used in bone marrow failure, post transplant and chemotherapy treatments, and leukaemia. Platelets can be of huge benefit to the recipient.

Plasma

Plasma is the yellow-coloured liquid component of blood, in which blood cells are suspended.

Fresh frozen plasma is used after obstetric loss of blood (which is usually childbirth), during cardiac surgery, and to reverse any anti-coagulant treatment. It's also used to replace clotting factors after massive transfusions or when they are not being sufficiently produced, such as liver disease.

There is also processed plasma, which has several important uses. For instance, it is used in the treatment of haemophilia including treating sufferers of Christmas disease, a life-threatening form of haemophilia. Processed plasma is also used to help produce stronger antibodies against diseases like tetanus, hepatitis, chickenpox and rabies. It also helps generate anti-D immunoglobulin, which is used for RhD negative pregnant women carrying RhD positive babies. It virtually eliminates the chances of the next foetus suffering from a dangerous condition called rhesus hemolytic disease.

Additionally there is a protein called albumin contained in plasma, which is extremely beneficial for burn victims.

Why blood is vital even for the dying

Everyone knows blood is literally a lifesaver for those who've been in an accident or need it to help survive treatments and operations. But for some, whose illness has no cure and that last battle they face just can't be won, a blood transfusion can help to improve their quality of life during their final months, weeks or even days.

Llinos Morgan, a Community Nurse who gives transfusions to the terminally ill in their own homes, says, "These vital transfusions give patients a better quality of life. It gives them the energy and ability to enjoy this precious, final time with their families."

But this time is often a gift that only blood can provide. In some serious accidents, its use can mean that a critically ill patient can stay alive long enough for their loved ones to reach the hospital to see them, one last time.

The top 10 users of blood

Users of blood	%
Anaemia (medical)	23
Orthopaedics	14
Haematology	15
Gastro intestinal bleeding	11
General Surgery	10
Cardio thoracic surgery	6
Obstetrics & Gynaecology	6
Vascular surgery	5
Urology	3
Trauma including road accidents	2

Who can give blood?

Most people are OK to give blood but checks are made each time a person donates just in case blood can't be taken. This is because they have to take good care of donors when they give blood and be sure of both the donors safety, and the safety of any patients who may receive the blood.

In order to become a blood donor you must be in:

1) good general health

2) be over 17 and under 66 (for the first donation)

3) weigh at least 50 kg (7 stone 12 lbs).

Although most people are potentially able to give blood, there are some who should not. There are two main reasons why donation may be refused.

1. If evidence suggests that donating blood could potentially harm the donor, then to protect their safety they are asked not to donate.

2. Likewise if there is evidence suggesting that the patient may be harmed by receiving it, then the blood donation should not be made. This would include the situation where a specific behaviour may have put the donor at a higher risk of an infection which could be transmitted to a patient by blood.

Standard procedure for blood donation

Preparation for Venepuncture

Figure 3 A blood pack

Blood must be drawn from a suitable vein in an area that is free of skin lesions. The veins can be made more prominent by using appropriate means of venous occlusion. Although it is not possible to guarantee sterility of the skin surface for venepuncture, a strict standardized and validated procedure for the preparation of the venepuncture site should be in operation to achieve surgical cleanliness and thus to provide maximum possible assurance of a sterile product. The antiseptic solution used must be allowed to dry completely after application to the donor's skin, or the skin wiped dry with sterile gauze before venepuncture. Thereafter, the prepared area must not be touched with fingers before the needle is inserted.

Preparation of the blood pack

The blood collection set must be in date and inspected for any defects. These are sometimes obscured by the label attached to the container, so careful inspection is required. The blood pack is positioned below the level of the donor's arm and the blood collection tube must be clamped off.

Performance of the venepuncture

Venepuncture should only be undertaken by authorized and trained personnel. If local anaesthetic is used, this should be a licensed medicinal product and injected in a manner which avoids any chance of donor-to-donor cross-infection (e.g. using individual disposable syringes and needles). A record of the batch number(s) should be made at each blood collection session and be capable of being related to individual donors.

Containers of local anaesthetic should be inspected for any leakage and if glass, inspected for cracks. Any suspect containers should be rejected.

Unused material must be discarded at the end of each donor session.

An aseptic technique must be used for drawing up the local anaesthetic into the syringe and the needle changed prior to the injection of the local anaesthetic.

Items used for venepuncture must be sterile, single use and disposable. If the dry outer wrapping of sterile packs becomes wet the contents must not be used. Prior to use, session staff must ensure that the materials used for venepuncture are sterile, in date and suitable for the procedure to be undertaken. The sterile donor needle should not be uncovered and its tamper-proof cover checked for integrity immediately prior to the venepuncture.

As soon as the venepuncture has been performed, the clamp on the bleed line must be released.

It is important that a clean skilful venepuncture is carried out to ensure the collection of a full, clot-free unit of blood suitable for the preparation of labile blood components.

SECTION A

Answer **all** *questions.*

1. Give **two** circumstances where the products of blood donations are used. [2]

.....

.....

2. *(a)* Explain why white blood cells are used to 'treat severe infection'. [2]

.....

.....

(b) State **two** differences between the features of red blood cells and white blood cells. [2]

1: .....

.....

2: .....

.....

3. *(a)* What are the two types of cell antigens mentioned in the article? [1]

.....

(b) Calculate the percentage of the total blood in stock that is made up of group AB+ on the 14 May 2011. [2]

.....

.....

(c) There was a relatively low amount of group AB+ blood in stock on the 14 May 2011. Suggest why this was enough to supply hospitals for a relatively long period of time. [1]

.....

.....

(d) State who can receive Group AB+ blood. [1]

.....

Examiner only

4. There is often a shortage of blood available to the Blood Services but despite this certain people cannot donate blood.

(a) State the minimum mass for a person to donate blood. [1]

.....

(b) Suggest **two** other **medical** reasons why a donor may be **postponed** from giving blood. [2]

.....

.....

(c) Suggest **one** reason why some people can **never** donate blood. [1]

.....

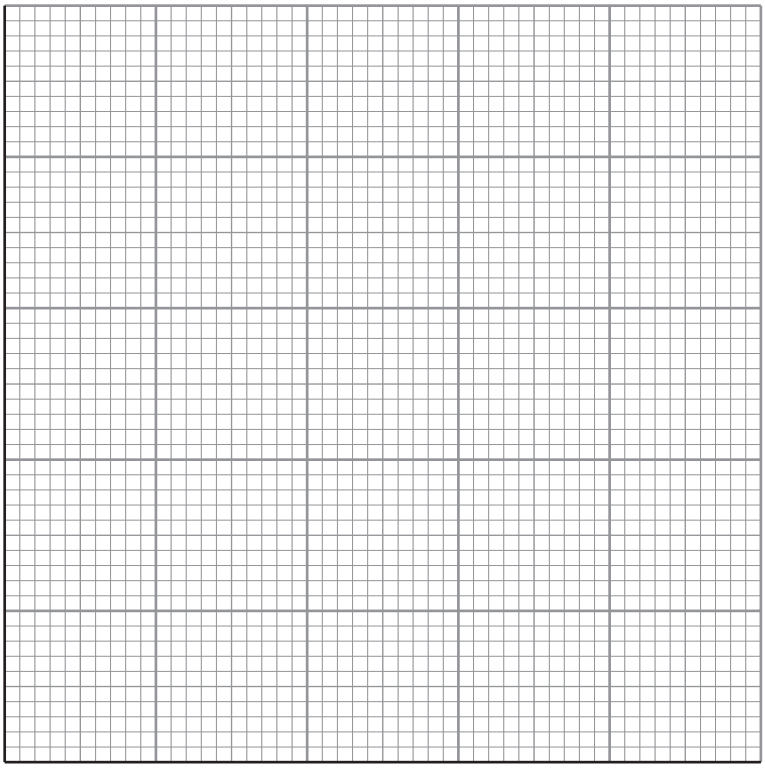
.....

5. *(a)* The users of donated blood do not add up to 100%. **Suggest one** reason for this. [1]

.....

(b) Plot a **bar chart** to show how blood donations are used based upon the data in the pre-release article (line 126).
The information from the pre-release article is reproduced below. [4]

Users of blood	**%**
Anaemia (medical)	23
Orthopaedics	14
Haematology	15
Gastro intestinal bleeding	11
General Surgery	10
Cardio thoracic surgery	6
Obstetrics & Gynaecology	6
Vascular surgery	5
Urology	3
Trauma including road accidents	2



Examiner only

6. *(a)* Give **one** reason why an antiseptic solution is used before venepuncture. [1]

.....

(b) A specially-trained person performs the venepuncture. Give **two** hazards and risks associated with the procedure. [4]

	Hazard	**Risk**
1	.....	.....
2	.....	.....

(c) Give **two** reasons why the blood sample is taken from a vein, rather than an artery. [2]

.....

.....

(d) "A record of the batch number(s) should be made at each blood collection session and be capable of being related to individual donors." (Lines 164-165)

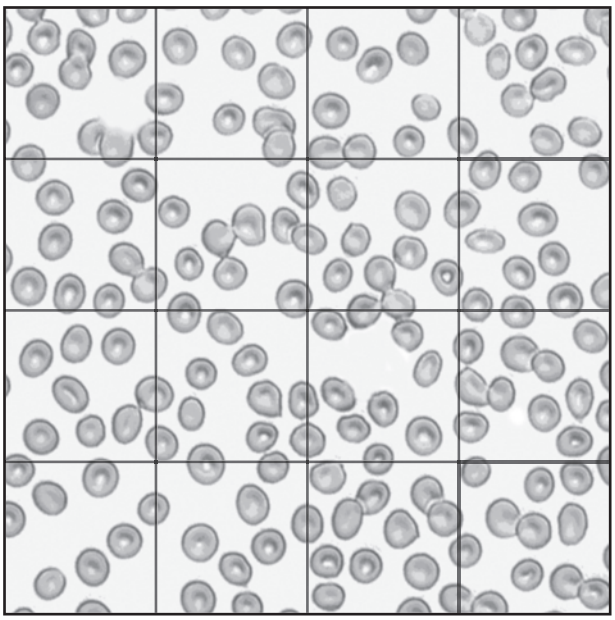
Give **two** reasons why this labelling procedure is carried out. [2]

.....

.....

Examiner only

7. After donation, blood is screened by a technician. One way of counting the number of cells in the blood is to use the apparatus below.



(a) Name the apparatus used in the diagram above. [1]

.....

(b) Outline the rule for counting cells using this apparatus. [1]

.....

.....

.....

(c) Explain why the technician would count each blood sample more than once. [2]

.....

.....

(d) A blood donor was found to have $2.9 \times 10^{12}/dm^3$ of red blood cells after screening. With reference to the data sheet on page 26, give **one** reason why this person may not be allowed to give blood. [1]

.....

.....

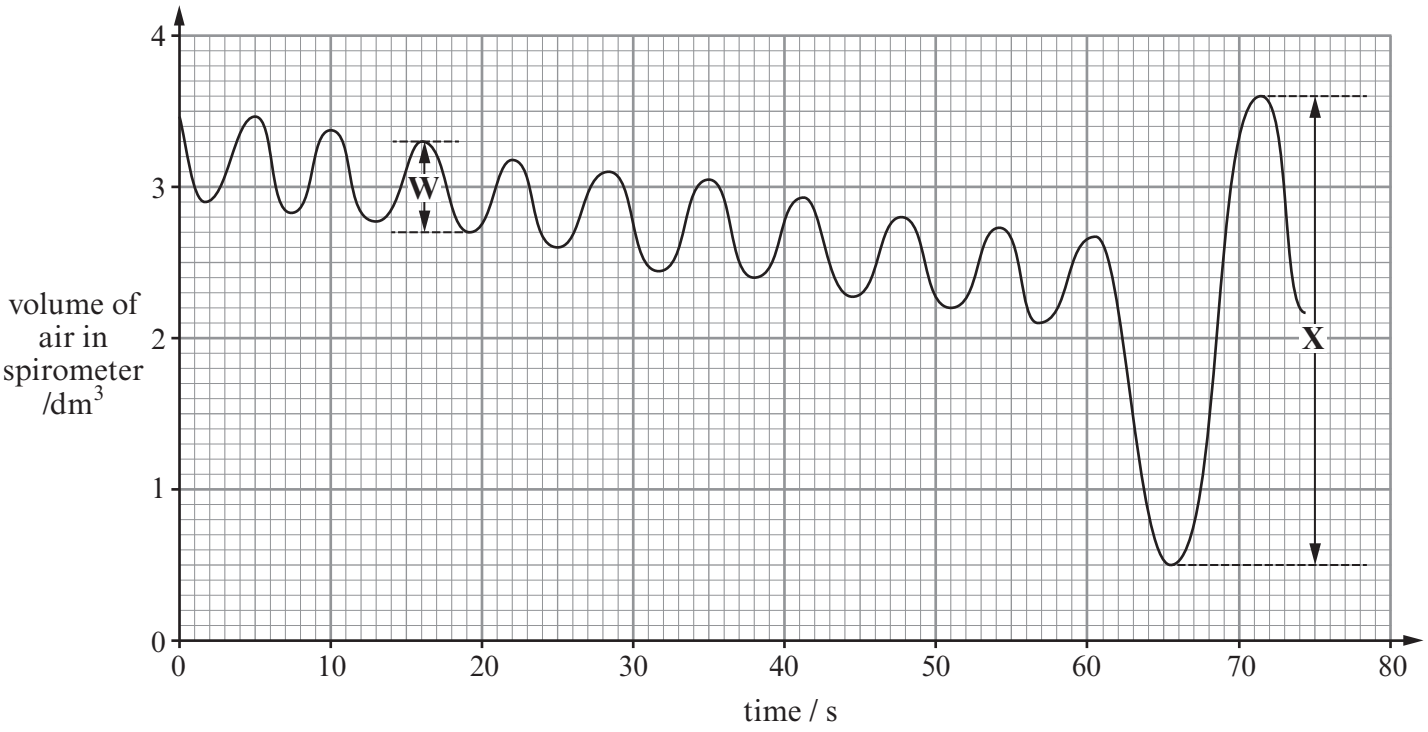
(Total Section A = 34 marks)

Examiner only

SECTION B

Answer **all** *questions.*

8. Nia was having a medical assessment as part of her job. One of the procedures involved in the assessment was breathing into a spirometer. The spirometer trace is shown below.



(a) State the **names** given to each of the measurements **W** and **X**. [2]

W .....

X .....

(b) Nia was asked to exercise for two minutes. Describe **two** ways in which you would expect the **trace** recorded during exercise to differ from that shown above. [2]

1: .....

2: .....

(c) Explain why the spirometer cannot be used to measure the total capacity of the lungs. [2]

.....

.....

(d) Suggest **one** way in which the spirometer **trace** would differ in a person with severe asthma. [1]

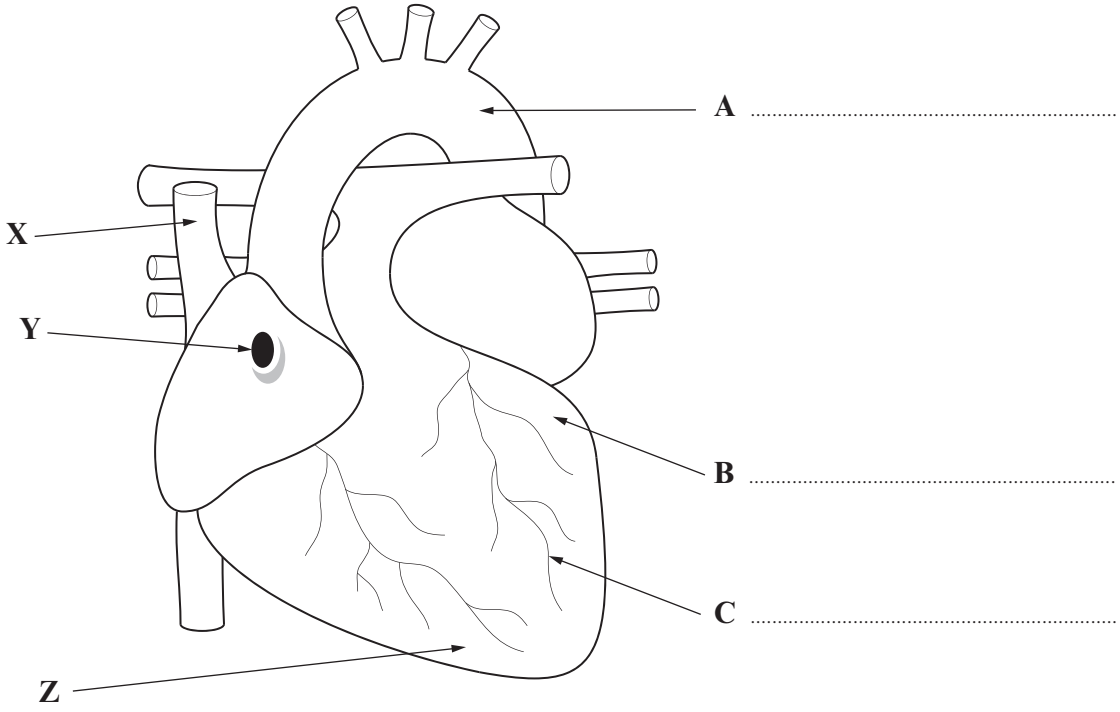
.....

.....

(Total 7 marks)

Examiner only

9. An applied science student was studying the external structure of the heart.



(a) On the diagram above, label the structures **A**, **B** and **C**. [3]

(b) (i) What is the function of structure **C**? [1]

.....

(ii) Give **two** reasons why, during periods of exercise, blood flow through **C** is increased. [2]

.....

.....

.....

(c) (i) Which of **X**, **Y** and **Z** shows where electrical activity of the heart is initiated? [1]

.....

(ii) **Name** this structure. [1]

.....

(Total 8 marks)

Examiner only

10. The following information is taken from the Office of National Statistics.

> The total number of imaging examinations or tests, covering the period April 1 2009 to 31 March 2010 was 37 742 000 compared to 35 944 000 in the period April 1 2008 to 31 March 2009. This is an increase of 5.0%.
>
> Of these imaging examinations or tests, 21 900 000 were X-Rays (radiographs), 3 700 000 were Computed Tomography (CT), 2 000 000 were Magnetic Resonance Imaging (MRI), 8 200 000 were Ultrasound, 600 000 were Radio isotopes and 1 300 000 were Fluoroscopy.

(a) Give **two** different medical investigations which require the use of ultrasound. [2]

1: .....

2: .....

(b) Describe how ultrasound images are produced. [4]

.....

.....

.....

.....

.....

.....

(c) Give **two** benefits and **one** disadvantage of ultrasound over other imaging techniques. [3]

Benefits .....

.....

.....

Disadvantage .....

.....

(d) In 2009-2010, there was a 5% increase in the number of ultrasound imaging examinations, compared to 2008-2009. Calculate the number of ultrasound examinations in **2008-2009**. [2]

.....

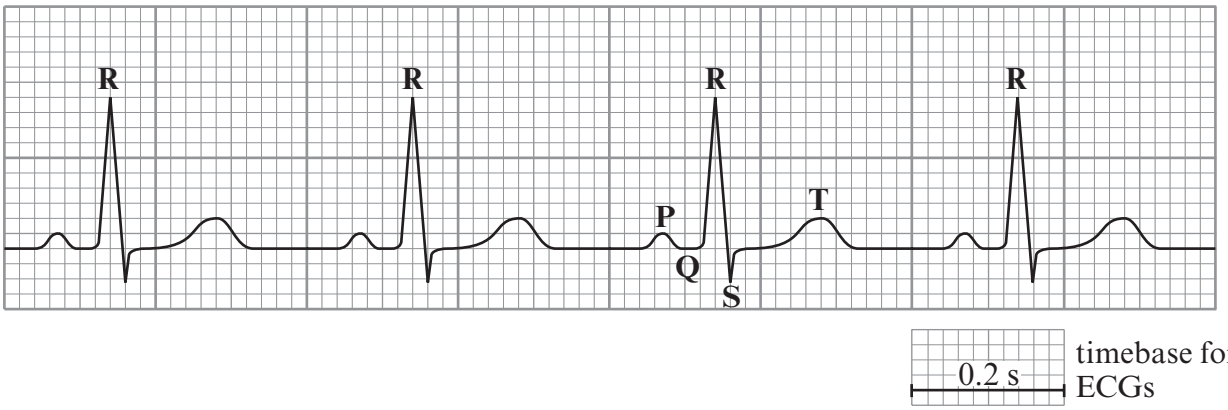
.....

.....

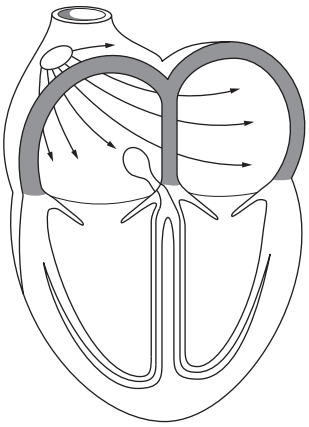
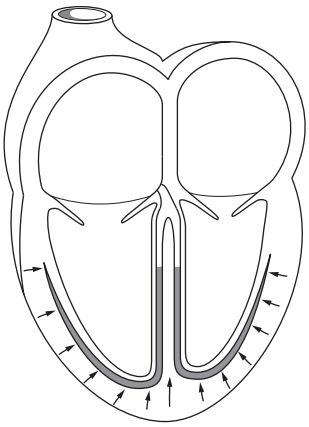
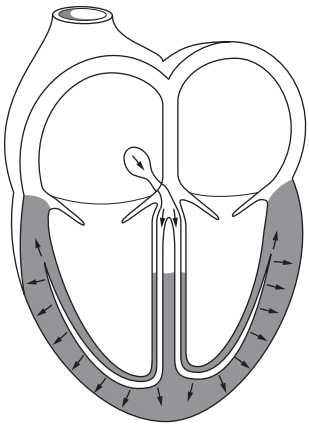
(Total 11 marks)

Turn over.

11. A patient in the Accident and Emergency department was found to have a normal ECG as shown below.



(a) Match the correct region(s) of the ECG with the corresponding diagram of the heart below. [3]

Cardiac Activity	 Activation of the atria	 Recovery wave	 Activation of the ventricles
Region of ECG	.....	.....	.....

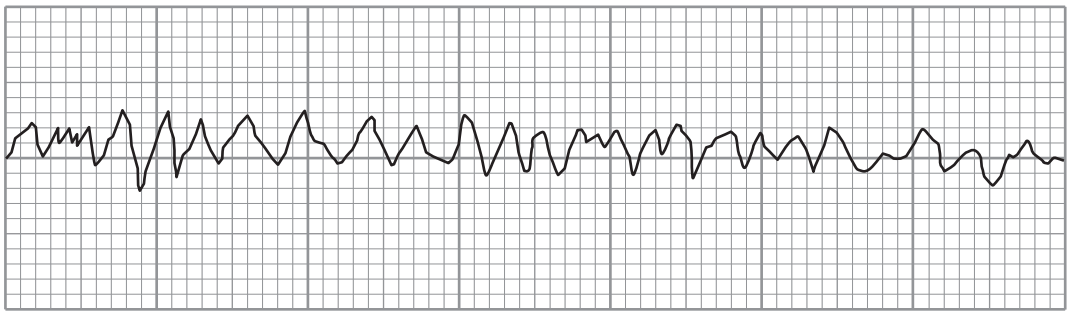
(b) Use the information on the trace to determine the time interval between the **R** waves. [1]

.....

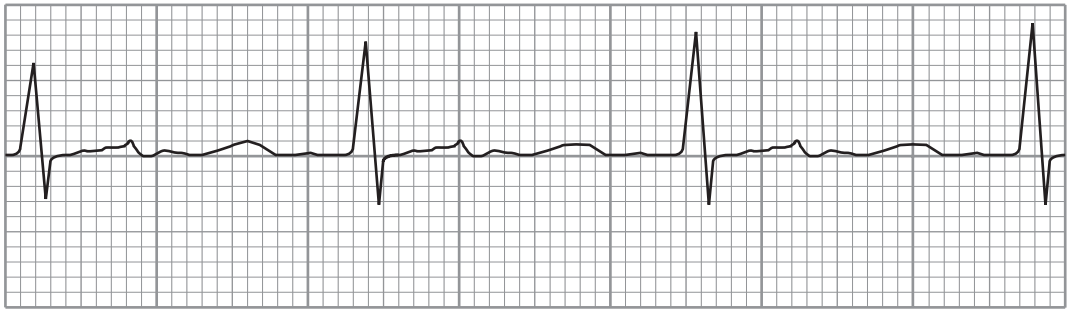
.....

(c) Three more patients were brought into the Accident and Emergency department and their ECGs are shown below.

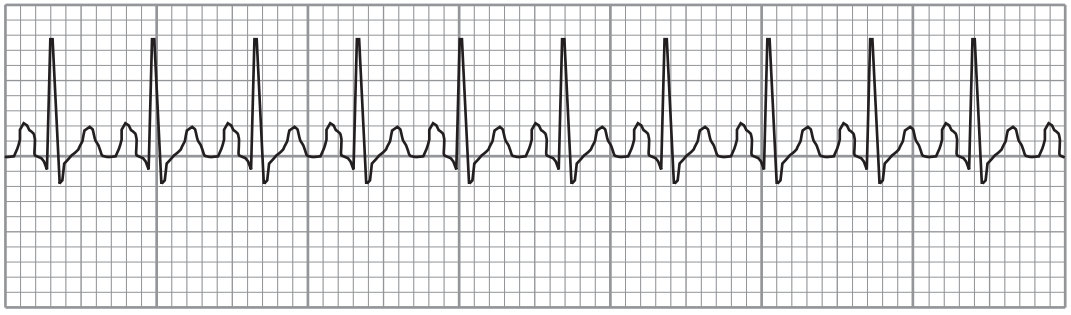
Patient A



Patient B



Patient C



State which of the patients (**A**, **B** or **C**) would benefit from being treated with a defibrillator? [1]

.....

Examiner only

(d) One of the patients, aged 85, admitted to the Accident and Emergency department underwent further tests and it was suggested that heart surgery was required. State a reason for and against this surgery. [2]

For: .....

.....

Against: .....

.....

(e) Before any surgical procedure patients have to sign a consent form. State the purpose of a consent form. [1]

.....

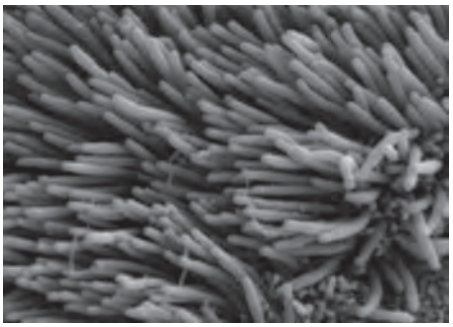
.....

(Total 8 marks)

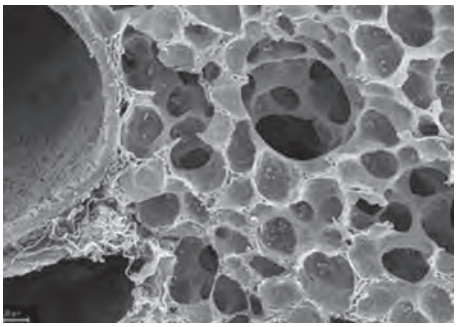
BLANK PAGE

Please turn over for the next question

12. Two parts of the human respiratory system are shown in the **electronmicrographs below**.

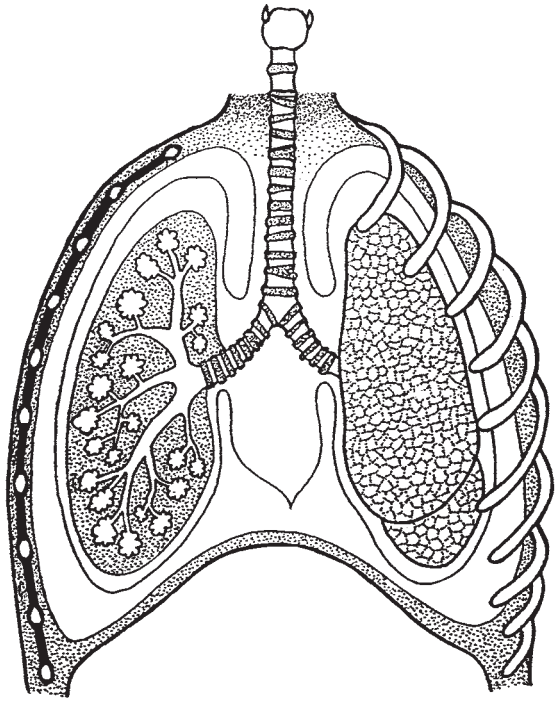


Electronmicrograph J



Electronmicrograph L

(a) On the following diagram of the lung, show the position of **J** and **L**. [2]



(b) State an adaptation of regions **J** and **L** shown in the above electronmicrographs, and describe a function of these adaptations. [4]

Region	Adaptation	Description
J	....	....
L	....	....

Examiner only

(c) Explain how respiratory gases are **exchanged** in the human respiratory system. [3]

.....

.....

.....

.....

.....

.....

(d) Region **L** is lined by a substance called surfactant. Explain the function of surfactant. [2]

.....

.....

(e) State who may be treated with surfactant to alleviate respiratory distress. [1]

.....

(Total 12 marks)

(Total section B: 46 marks)

Data Sheet

Table 1 Normal values for some physiological indicators

Indicator	Adult Male	Adult Female
Pulse Rate	60 – 80 beats per minute	60 – 80 beats per minute
BREATHING		
Rate	12 – 15 breaths per minute	12 – 15 breaths per minute
Tidal volume	400 – 500 cm^3	400 – 500 cm^3
Vital Capacity	4.8 dm^3	3.1 dm^3
Peak Flow	400 – 600 $dm^3\ min^{-1}$	400 – 600 $dm^3\ min^{-1}$
BLOOD PRESSURE		
20 years old	125/80 mmHg	123/80 mmHg
40 years old	135/85 mmHg	133/85 mmHg

Table 2 Reference ranges for some common blood tests

Test	Adult Male	Adult Female
Glucose (Fasting)	4.5 – 6.1 mmol dm^{-3}	4.5 – 6.1 mmol dm^{-3}
Sodium ions	133 – 147 mmol dm^{-3}	133 – 147 mmol dm^{-3}
Potassium ions	3.5 – 5.0 mmol dm^{-3}	3.5 – 5.0 mmol dm^{-3}
Calcium ions	1.15 – 1.29 mmol dm^{-3}	1.15 – 1.29 mmol dm^{-3}
Zinc ions	10 – 17 μmol dm^{-3}	10 – 17 μmol dm^{-3}
RED BLOOD CELLS		
Haemoglobin	140 – 180 g dm^{-3}	115 – 160 g dm^{-3}
Red Cell count	4.5 – 6.5 × 10^{12} dm^{-3}	3.8 – 5.8 × 10^{12} dm^{-3}
WHITE BLOOD CELL COUNT	4 – 11 × 10^9 dm^{-3}	4 – 11 × 10^9 dm^{-3}
PLATELET COUNT	150 – 400 × 10^9 dm^{-3}	150 – 400 × 10^9 dm^{-3}

GCE AS/A level

1661/01A

APPLIED SCIENCE
UNIT 1

Pre-release Article for Examination in May 2012

1661
01A001

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Information for Teachers

The pre-release article is intended as stimulus material in order to generate discussion. Questions will be set on the examination paper based on the information in the article and related aspects from the specification.

The article is based upon information found on the blood transfusion website and Welsh Blood Service website.

http://www.blood.co.uk

http://www.transfusionguidelines.org.uk/Index.aspx?Publication=RB&Section=25&pageid=555

No recall or terminology is required over and above that in the specification.

Students will be expected to have discussed and studied the article together with relevant specification content prior to the examination. However, they will not be expected to memorise any part of it as a copy will be provided in the examination paper.

Gareth's story

"I really thought I might not make it…"

It took 33 units of blood and skilled medical care to save Gareth Jones's life. Now he's raring to get back on a bike.

Motorsport fanatic, Gareth Jones, 34, will never forget the summer of 2006. On his way to work on his much loved Kawasaki ZX–7R motorbike, he collided with a car. The accident was devastating. "The impact of the crash trapped my leg between my bike and the car," says Gareth. "My body was slumped over and I knew my leg was in a bad way, but I didn't feel any pain."

An ambulance and paramedics soon arrived and they spent over 45 minutes trying to stabilise Gareth before he could be taken to hospital. The crash had almost destroyed Gareth's leg – all the skin and muscle had been torn from it, the bones were shattered, and his femoral artery was badly damaged.

"As soon as I arrived at A&E, blood was pumped into each arm and another bag was attached to my neck. The bags of blood were all being squeezed into me as I was losing blood faster than it could be transfused. I was still conscious but the doctors could not find a pulse and my chances of survival were becoming very slim."

Gareth was quickly taken to theatre where surgeons tried their hardest to save his leg by putting in a plate and stitching everything back together. During the operation the entire volume of his blood had to be replaced four times.

Two days later the doctors took a look at his leg. It was not good news. "I was told that my leg would need to be amputated above the knee," says Gareth. "I already knew that it would not survive – there was simply nothing they could do. Even though I had already told myself my leg would be amputated, hearing the actual words was still heart–wrenching."

After months of operations, involving a total of 33 units of blood products, Gareth is looking positively to the future and has far from lost his passion for motorsport and hopes to ride again.

He says, "I'm still working hard with my physio and hope to get in a position where I can be fitted with a flexible knee limb.

Before something like this happens it is easy to go through life blinkered, but now I'm glad to be alive and appreciate each and every day. And, without blood donors I definitely would not be here."

Blood Donation

Blood Service organisations collect, test, process and distribute blood. They rely entirely on voluntary donors to maintain supplies to Welsh hospitals.
The Welsh Blood Service needs to collect over 400 donations of blood everyday and demand has risen steadily over the last 10 years as medical techniques become more sophisticated.

Blood Groups

What is a blood group?

Red blood cells have certain proteins on their surface, called antigens. There are various types of red blood cell antigens - the ABO and rhesus types are the most important. Your genetic make-up which you inherit from your parents determines which antigens occur on your red blood cells. Your blood group is said to be:

- A+ (A positive) if you have A and rhesus antigens.
- A– (A negative) if you have A antigens, but not rhesus antigens.
- B+ (B positive) if you have B and rhesus antigens.
- B– (B negative) if you have B antigens, but not rhesus antigens.
- AB+ (AB positive) if you have A, B and rhesus antigens.
- AB– (AB negative) if you have A and B antigens, but not rhesus antigens.
- O+ (O positive) if you have neither A nor B antigens, but you have rhesus antigens.
- O– (O negative) if you do not have A, B or rhesus antigens.

The following chart shows blood group compatibility:

Donor

Recipient	O–	O+	B–	B+	A–	A+	AB–	AB+
AB+	●	●	●	●	●	●	●	●
AB–	●		●		●		●	
A+	●	●			●	●		
A–	●				●			
B+	●	●	●	●				
B–	●		●					
O+	●	●						
O–	●							

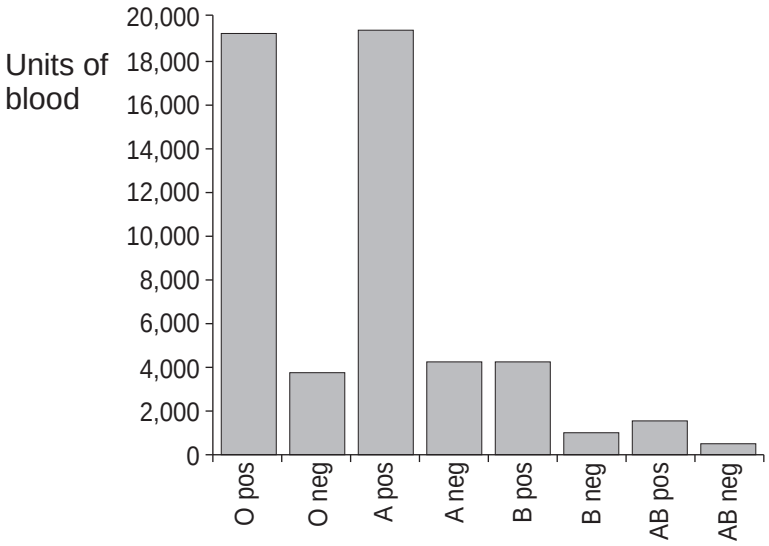
Key
● = Compatible

Turn over.

Blood Stock Levels

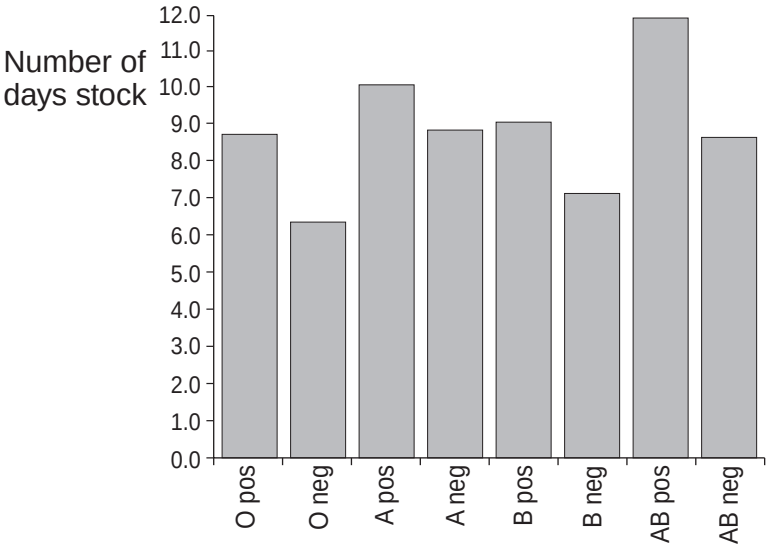
Blood stock levels are updated daily and the data published on the web. The charts below give the stock levels on the 14 May 2011.

Stock Level on 14 May 2011



Group	Stock Level (units)
O+	19,234
O-	3,850
A+	19,244
A-	4,052
B+	4,098
B-	850
AB+	1,579
AB-	381
Total	53,288

Days Stock on 14 May 2011



Group	Days Stock
O+	8.73
O-	6.24
A+	10.16
A-	8.87
B+	9.07
B-	7.02
AB+	12.34
AB-	8.66

About blood

Between 7 - 10% of a person's mass is blood.

Mass is a good guideline for blood volume in people of average build. This is why there is a minimum mass limit of 50 kg (7st 12lbs) for donating blood because if more than 13% of blood volume is taken there is more risk of the donor feeling faint after donating. People who are very overweight may not be allowed to give blood for their own safety.

Blood is a defence against infection and takes waste material to the kidneys. It carries oxygen and carbon dioxide to and from the tissues and the lungs.

It carries food to the tissues, regulates the chemicals in the body and regulates the temperature of the body.

Why are blood donations needed?

Throughout medical history it has been proved that blood and its by-products have played a vital role in saving lives. Most donors do not realise what their donations are used for. The blood collected is not just used for emergency operations or accident victims. So many patients could not survive without blood transfusions, such as anyone having a kidney, liver or an organ transplant; leukaemia and cancer patients; patients having cardiac operations and many premature babies.

Today the Welsh Blood Service is required to supply 400 donations a day to the hospitals in South, West and Mid Wales. A single donation can be broken down into its different components, so it can be used in various ways. These components all have differing life spans:

- Red cells can be stored for 35 days at 4°C.
- Platelets can be stored for only 5 days at 22°C. Platelets are collected from whole blood donations and through a special machine method of collection called plateletpheresis.
- Fresh Frozen Plasma can be stored for 1 year at –40°C. Clotting factors such as Factor VIII are also removed from plasma to treat patients with haemophilia and to make immunisations such as anti-tetanus.
- White cells need to be used within 24 hours of collection. They are used in rare circumstances to help treat severe infection that will not respond to antibiotics. All but these special donations have the majority of white cells filtered out – a process called leucodepletion.

How blood is used

Whole blood

This is rarely used these days, only really in instances of severe blood loss. It's usually separated into its individual components.

Red cells

Figure 1 Red cells

90 These are used in the treatment of all kinds of anaemia which can't be medically corrected, such as when rheumatoid arthritis or cancer is involved, when red cells break down in the newborn, and for sickle cell disease. They're also essential to replace lost red cells due to blood loss in childbirth, accidents, and after surgery.

Platelets (thrombocytes)

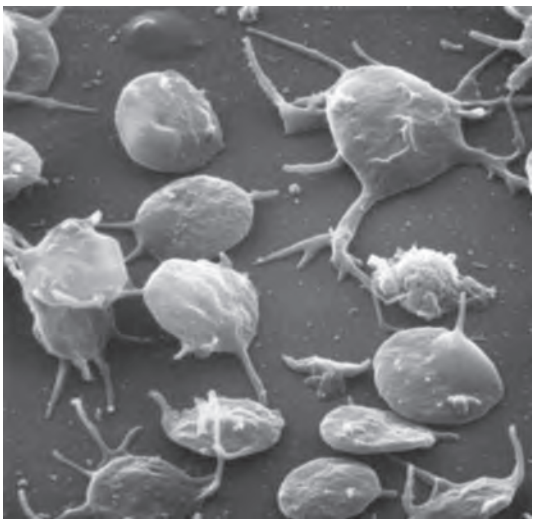


Figure 2 Platelets

Platelets, or **thrombocytes** are small, irregularly shaped clear cell fragments that circulate in the blood and are involved in formation of blood clots. Platelets can be used in bone marrow failure, post transplant and chemotherapy treatments, and leukemia. Platelets can be of huge benefit to the recipient.

Plasma

Plasma is the yellow-coloured liquid component of blood, in which blood cells are suspended.

Fresh frozen plasma is used after obstetric loss of blood (which is usually childbirth), during cardiac surgery, and to reverse any anti-coagulant treatment. It's also used to replace clotting factors after massive transfusions or when they are not being sufficiently produced, such as liver disease.

There is also processed plasma, which has several important uses. For instance, it is used in the treatment of haemophilia including treating sufferers of Christmas disease, a life-threatening form of haemophilia. Processed plasma is also used to help produce stronger antibodies against diseases like tetanus, hepatitis, chickenpox and rabies. It also helps generate anti-D immunoglobulin, which is used for RhD negative pregnant women carrying RhD positive babies. It virtually eliminates the chances of the next foetus suffering from a dangerous condition called rhesus hemolytic disease.

Additionally there is a protein called albumin contained in plasma, which is extremely beneficial for burn victims.

Why blood is vital even for the dying

Everyone knows blood is literally a lifesaver for those who've been in an accident or need it to help survive treatments and operations. But for some, whose illness has no cure and that last battle they face just can't be won, a blood transfusion can help to improve their quality of life during their final months, weeks or even days.

Llinos Morgan, a Community Nurse who gives transfusions to the terminally ill in their own homes, says, "These vital transfusions give patients a better quality of life. It gives them the energy and ability to enjoy this precious, final time with their families."

But this time is often a gift that only blood can provide. In some serious accidents, its use can mean that a critically ill patient can stay alive long enough for their loved ones to reach the hospital to see them, one last time.

The top 10 users of blood

Users of blood	%
Anaemia (medical)	23
Orthopaedics	14
Haematology	15
Gastro intestinal bleeding	11
General Surgery	10
Cardio thoracic surgery	6
Obstetrics & Gynaecology	6
Vascular surgery	5
Urology	3
Trauma including road accidents	2

Who can give blood?

Most people are OK to give blood but checks are made each time a person donates just in case blood can't be taken. This is because they have to take good care of donors when they give blood and be sure of both the donors safety, and the safety of any patients who may receive the blood.

In order to become a blood donor you must be in:

1) good general health

2) be over 17 and under 66 (for the first donation)

3) weigh at least 50 kg (7 stone 12 lbs).

Although most people are potentially able to give blood, there are some who should not. There are two main reasons why donation may be refused.

1. If evidence suggests that donating blood could potentially harm the donor, then to protect their safety they are asked not to donate.

2. Likewise if there is evidence suggesting that the patient may be harmed by receiving it, then the blood donation should not be made. This would include the situation where a specific behaviour may have put the donor at a higher risk of an infection which could be transmitted to a patient by blood.

Standard procedure for blood donation

Preparation for Venepuncture

Figure 3 A blood pack

Blood must be drawn from a suitable vein in an area that is free of skin lesions. The veins can be made more prominent by using appropriate means of venous occlusion. Although it is not possible to guarantee sterility of the skin surface for venepuncture, a strict standardized and validated procedure for the preparation of the venepuncture site should be in operation to achieve surgical cleanliness and thus to provide maximum possible assurance of a sterile product. The antiseptic solution used must be allowed to dry completely after application to the donor's skin, or the skin wiped dry with sterile gauze before venepuncture. Thereafter, the prepared area must not be touched with fingers before the needle is inserted.

Preparation of the blood pack

The blood collection set must be in date and inspected for any defects. These are sometimes obscured by the label attached to the container, so careful inspection is required. The blood pack is positioned below the level of the donor's arm and the blood collection tube must be clamped off.

Performance of the venepuncture

Venepuncture should only be undertaken by authorized and trained personnel. If local anaesthetic is used, this should be a licensed medicinal product and injected in a manner which avoids any chance of donor-to-donor cross-infection (e.g. using individual disposable syringes and needles). A record of the batch number(s) should be made at each blood collection session and be capable of being related to individual donors.

Containers of local anaesthetic should be inspected for any leakage and if glass, inspected for cracks. Any suspect containers should be rejected.

Unused material must be discarded at the end of each donor session.

An aseptic technique must be used for drawing up the local anaesthetic into the syringe and the needle changed prior to the injection of the local anaesthetic.

Items used for venepuncture must be sterile, single use and disposable. If the dry outer wrapping of sterile packs becomes wet the contents must not be used. Prior to use, session staff must ensure that the materials used for venepuncture are sterile, in date and suitable for the procedure to be undertaken. The sterile donor needle should not be uncovered and its tamper-proof cover checked for integrity immediately prior to the venepuncture.

As soon as the venepuncture has been performed, the clamp on the bleed line must be released.

It is important that a clean skilful venepuncture is carried out to ensure the collection of a full, clot-free unit of blood suitable for the preparation of labile blood components.