RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

Advanced Subsidiary General Certificate of Education

HUMAN BIOLOGY
Blood, Circulation and Gaseous Exchange

2856

Specimen Paper 2003

Additional materials: Ruler (cm/mm)
Electronic calculator

TIME 1 hour

Candidate Name	Centre Number	Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and candidate number in the spaces above.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Answer **all** the questions.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

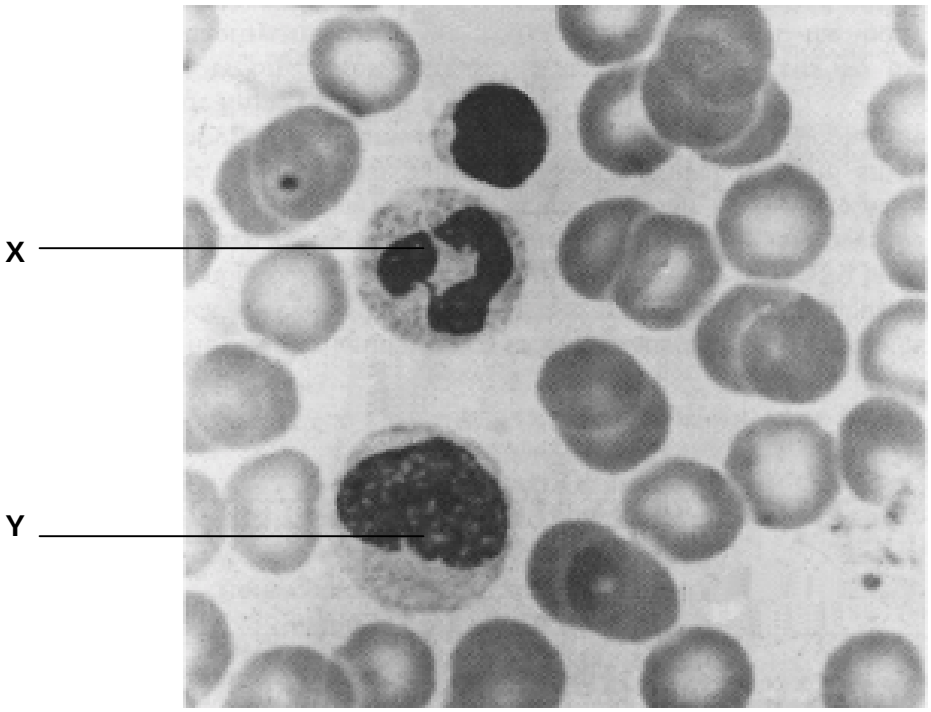
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 60.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- *You will be awarded marks for the quality of written communication where an answer requires a piece of extended writing.*

FOR EXAMINER'S USE		
Question number	**Max.**	**Mark**
1	**12**	
2	**9**	
3	**15**	
4	**11**	
5	**13**	
TOTAL	**60**	

1 Samples of human blood are taken by hospital laboratories in order to help diagnose various conditions. Blood smears (blood films) are made using differential staining techniques, so that the different kinds of cells can be viewed under the microscope.

Fig 1.1 shows a photomicrograph of a blood smear.

Fig 1.1



Magnification x 2100

(a) **(i)** Identify the cells labelled **X** and **Y**.

X _____

Y _____ **[2]**

(ii) Calculate the actual diameter of cell **Y**. Show your working below.

_____

_____

Answer: _____ μm **[2]**

(b) State what is meant by a differential stain.

_____

_____

_____ **[2]**

1 **(c)** It is essential that doctors understand how blood is matched and are able to give the correct types of blood in transfusions.

Complete the table below to show the antibodies present in the plasma of people with different blood groups.

blood group	antigen on red cells	antibodies in plasma
A	A	_____
B	B	_____
AB	A and B	_____
O	none	_____

[2]

(d) **(i)** Explain why blood group O can be given to anyone needing a blood transfusion.

_____

_____

_____ **[2]**

(ii) State and explain what might happen if large quantities of blood group A was accidentally transfused into a person with blood group B.

_____

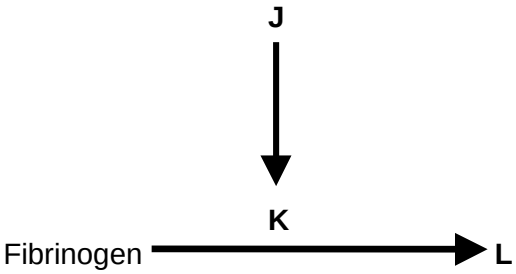
_____

_____ **[2]**

2 A blood clot forms when a soluble protein in the plasma, fibrinogen, is converted to an insoluble protein.

Fig 2.1 is a diagram that shows three substances **J**, **K** and **L**, involved in blood clotting.

(a) Name the substances **J**, **K** and **L**.



J _____

K _____

L _____

Fig 2.1 **[3]**

(b) Deep vein thrombosis (DVT) refers to the formation of a thrombus (blood clot) within a deep vein, commonly in the thigh or calf. The blood clot can either partially or completely block the flow of blood in the vein. In a recent survey it was found that up to 10% of travellers on long haul flights may develop potentially dangerous blood clots.

Describe the symptoms of deep vein thrombosis and outline the ways in which long haul travellers can minimise the risk of DVT.

[6]

3 **Fig 3.1** shows a cross section through the heart as seen from the front.

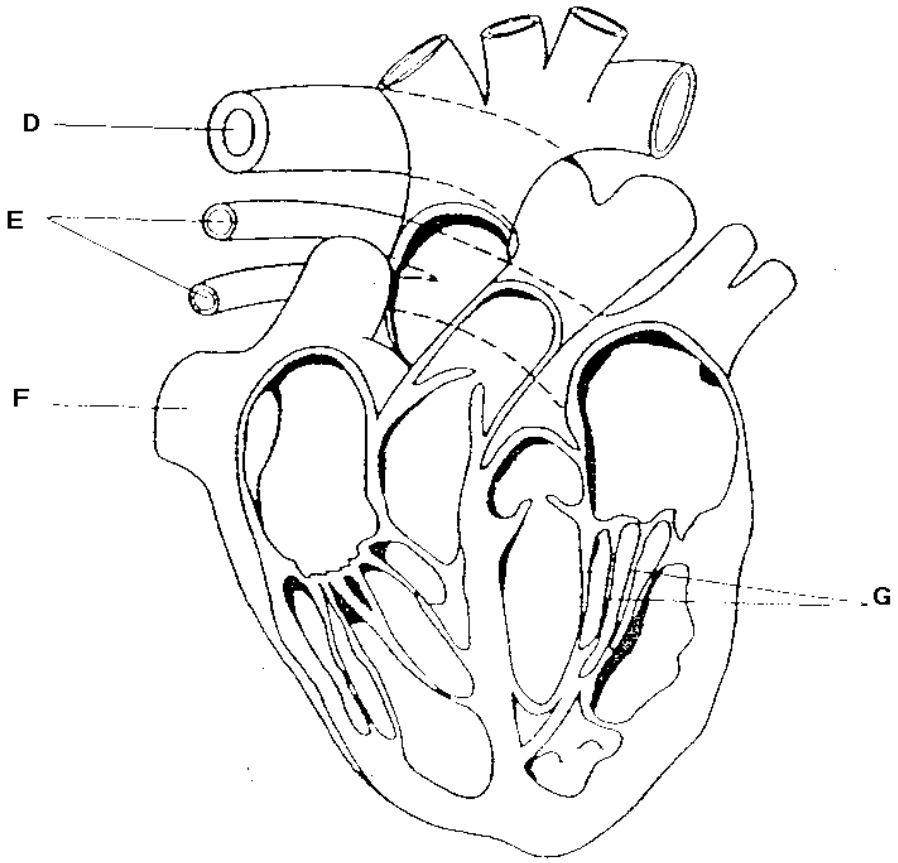


Fig 3.1

(a) Name the parts **D**, **E**, **F** and **G**.

D _____

E _____

F _____

G _____ **[4]**

3 **(b)** A trainee doctor is learning about the structure, function and diseases of the heart. As part of the training the doctor must learn about electrocardiogram (ECG) traces.

Fig 3.2 shows an electrocardiogram (ECG) trace for a normal cardiac cycle and information about pressures in the left chambers of the heart and aorta.

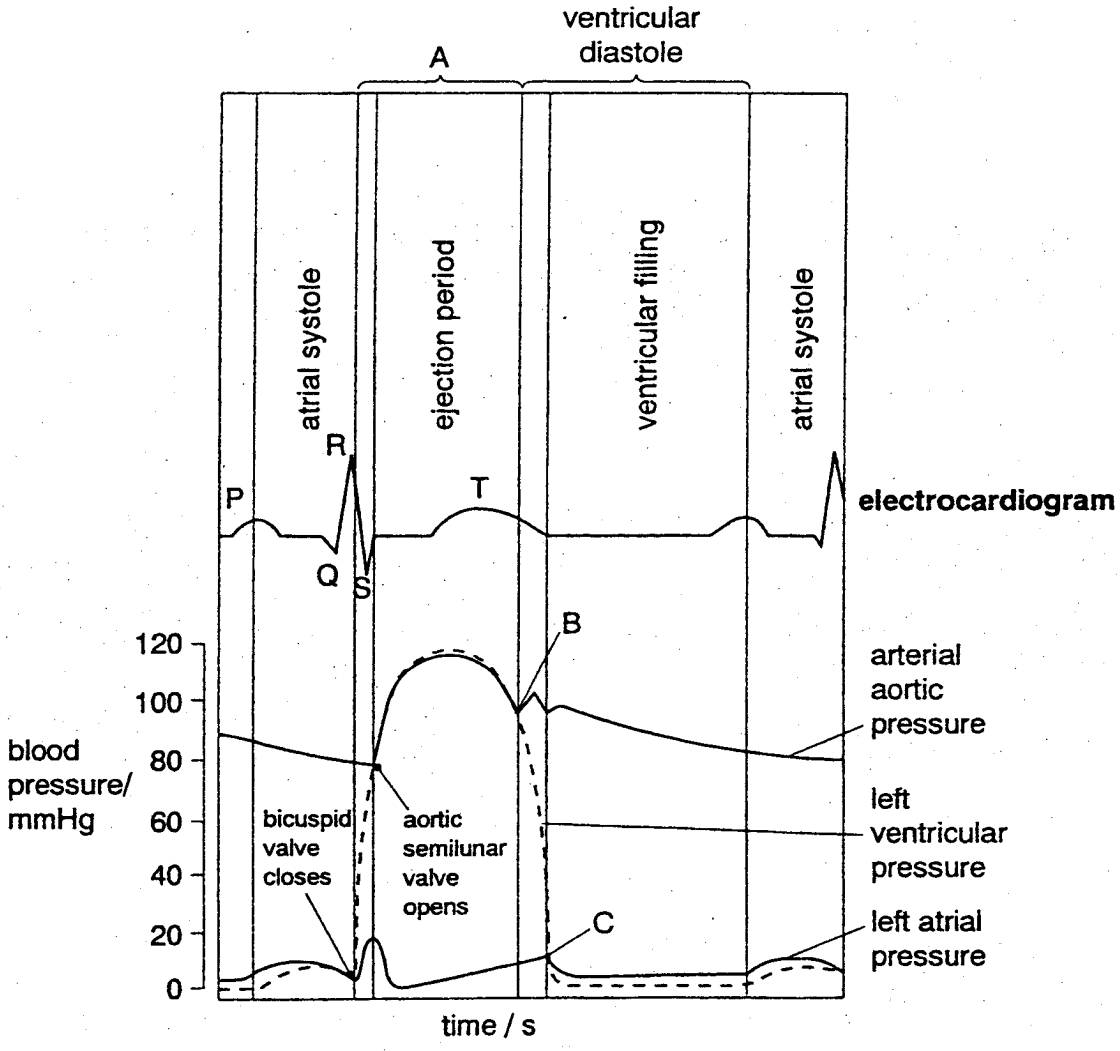


Fig 3.2

3 (b) (i) Using the information given in **Fig 3.2**, complete **Table 3.1** to show which letter, from **A** to **C** and from **P** to **T**, corresponds to which activity of the heart. The first has been done for you.

Table 3.1

Heart Activity	Letter
ventricular repolarisation	**T**
ventricular systole	
aortic semilunar valve closes	
bicuspid valve opens	
atrial depolarisation: spread of an impulse from the sinoatrial node to the two atria	

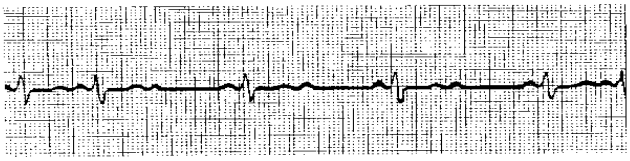
[4]

(ii) Describe the electrical activity in the heart during the QRS wave complex of a normal ECG.

[3]

3 **(c)** **Fig 3.3** shows two abnormal ECG traces from two patients **M** and **N**.

Patient M



Patient N

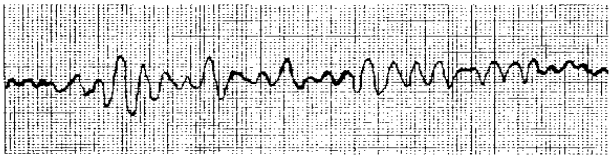


Fig 3.3

Using the information in **Fig 3.3**, name the conditions shown by patient **M** and patient **N**.

M _____

N _____ **[2]**

(d) State a reason for the condition shown in patient **N**.

_____ **[1]**

(e) Suggest why bradycardia may be useful to an athlete.

_____ **[1]**

4 **Fig 4.1** shows the death rates from coronary heart disease (CHD) for men aged 35 to 74 between 1968 and 1992 for four countries, Finland, UK, Australia and Japan.

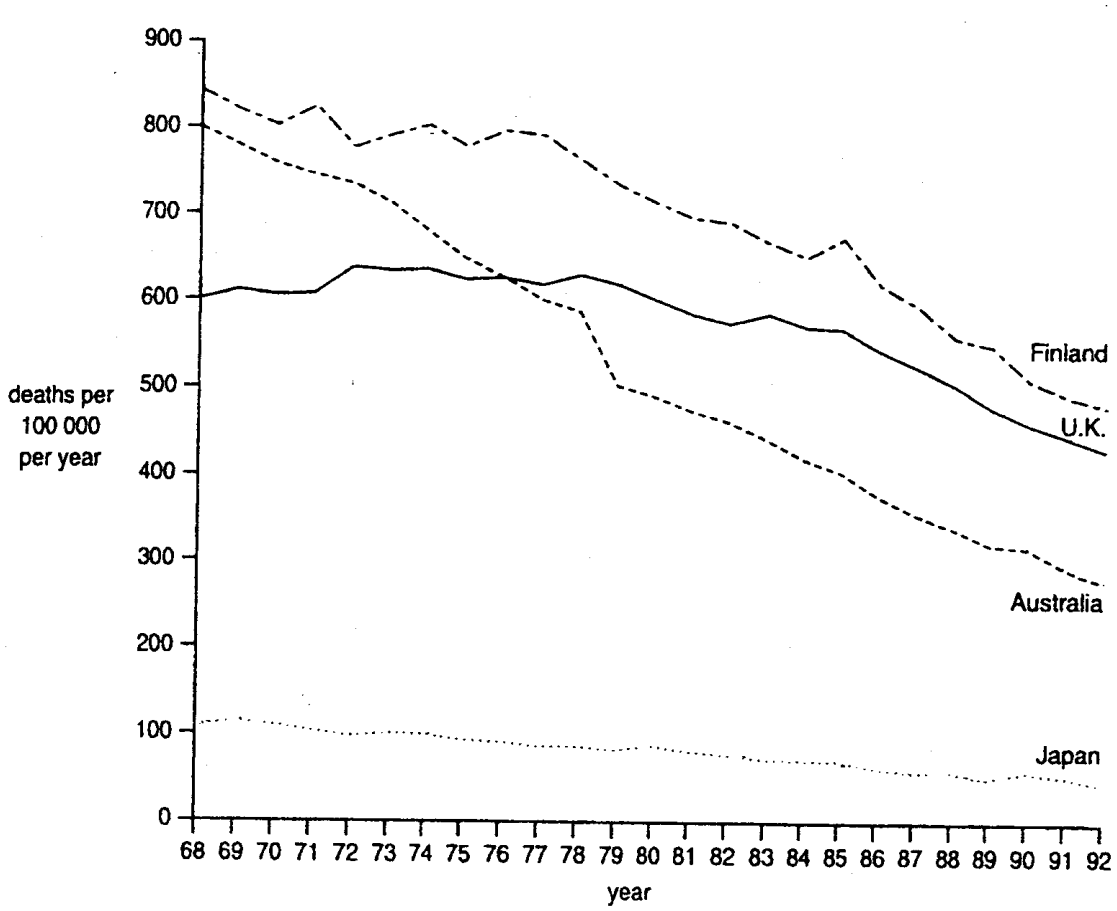


Fig. 4.1

(a) With reference to **Fig 4.1**, compare the death rates from CHD in the UK with those in Australia over the period between 1968 and 1992.

[3]

4 **(b)** *In this question, one mark is available for the quality of written communication.*

Explain how smoking contributes to the development of coronary heart disease (CHD).

[7]

Quality of Written Communication [1]

5 Emphysema is a chronic lung disease in which long-tem damage to the walls of the alveoli leads to the build up of scar tissue in the lungs.

Fig 5.1 shows the alveoli of someone suffering from emphysema.

A shows damaged alveolar walls and scar tissue.
B shows abnormally large air spaces.

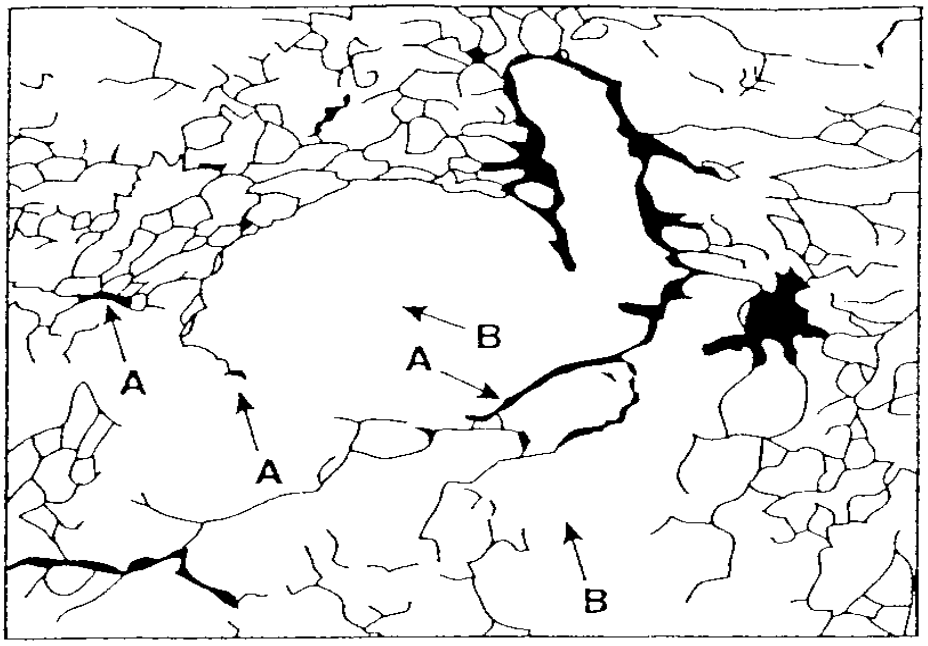


Fig. 5.1

(a) Explain the effects that loss of alveoli and build up of scar tissue will have on lung function.

_____

_____

_____

_____ **[4]**

5 **(b)** Peak flow tests are used in hospitals to diagnose emphysema. A patient is asked to breathe hard into a meter and **two** measurements are taken.

Measurement 1: the volume of air that is forcibly exhaled in one second.

Measurement 2: the maximum volume of air that can be forcibly exhaled.

If the value for the % ratio: $\frac{\text{measurement 1}}{\text{measurement 2}}$ is above 80%, the person has healthy lungs.

Table 5.1 shows the results of tests carried out on several workers from a cement manufacturing company. The data were collected before Health and Safety at Work legislation was introduced.

Table 5.1

Worker	Working conditions	Smoker/ non-smoker	Gender	Measurement 1/ dm^3	Measurement 2/ dm^3	% ratio
A	office only	smoker	female	1.5	2.2	
B	office only	smoker	female	1.7	2.4	70.8
C	dusty factory	non-smoker	male	2.3	4.0	57.5
D	dusty factory	smoker	male	1.9	4.1	46.3
E	dusty factory	non-smoker	male	3.4	3.9	87.1
F	moving between office and dusty factory	non-smoker	male	2.7	3.5	77.1
G	dusty factory	smoker	female	1.5	2.5	60.0
H	dusty factory	smoker	female	1.3	2.3	56.5
I	moving between office and dusty factory	non-smoker	female	1.9	2.5	76.0

(i) Calculate the % ratio for worker **A** and enter your result in **Table 5.1**. **[1]**

(ii) The company doctor regarded the % ratio for worker **E** as unusual. Using the information in **Table 5.1**, explain why the doctor thought that this result was unusual.

[3]

5 **(b)** **(iii)** Suggest **two** reasons that may account for the unusual results shown by worker E.

1 _____

_____

2 _____

_____ **[2]**

(iv) Discuss the benefits of carrying out health checks on workers.

_____

_____

_____

_____

_____

_____ **[3]**

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MARK SCHEME

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1 Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.

2 Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If **two** (or more) responses are required for one mark, use only **one** tick. Half marks (½) should never be used.

3 The following annotations may be used when marking. **No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.**

X	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

4 The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5 In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), examiners should look at the responses given and make a judgement as to whether they are correct, incorrect or 'neutral'. They should then mark the first answer(s) given (unless they are judged to be 'neutral') up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6 Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7 Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8 An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct **and** answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking point
	;	=	separates marking points
	NOT	=	answers which are not worthy of credit
	( )	=	words which are not essential to gain credit
	____	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	ora	=	or reverse argument

Question	Answer	Mark
1(a)(i)	X= phagocyte / neutrophil/macrophage; Y= lymphocyte;	**2**
1(a)(ii)	22 / 25mm x 1000 2100; = 10.48 / 11.9µm;	**2**
1(b)	one that differentiates between types of cells / AW; by staining them different colours; named example;	**2 max**
1(c)	anti-b / b anti-a / a none / neither anti-a / a and anti-b / b *at least 2 correct;* *all 4 correct*;;	**2**
1(d)(i)	no antigens on cell membrane; cannot stimulate an agglutination reaction / doesn't clump; universal donor;	**2 max**
1(d)(ii)	transfusion reaction / die; donor's rbc's are attacked by recipients agglutinins / AW; clumped rbc's burst / lyse: hinders flow of blood in small vessels; reduces oxygen carrying capacity;	**2 max**
	Total mark:	**12**
2(a)	J= prothrombin; K= thrombin; L= fibrin;	**3**

Question	Answer	Mark
2(b)	*Symptoms:* tenderness / redness / pain / swelling, in affected area; fever; rapid heart rate; sudden, unexplained cough; joint pain/soreness; pulmonary embolism; AVP; **[3 max]** *to minimise risk* avoid prolonged bed rest prior to flying; keep moving limbs/clench muscles on regular basis; stop smoking; support stockings; aspirin before flying; loose clothing; drink plenty of water; avoid alcohol; if susceptible, take prescribed drugs eg heparin before flying; AVP; **[3 max]**	**6 max**
	Total mark:	**9**
3(a)	D= pulmonary artery; E= pulmonary vein(s); F= vena cava / inf' vena cava; G= chordae tendinae / tendons supporting valve;	**4**
3(b)(i)	T;B;C;Q:	**4**
3(b)(ii)	impulse reaches apex heart; through Purkyne fibres; ventricular depolarization / excitation spreads through ventricular muscle; preceeds ventricular systole;	**3 max**
3(c)	M=(second degree) heart block; N= ventricular fibrillation;	**2**
3(d)	acute heart attack; electrical shock;	**1 max**
3(e)	heart rate lower to achieve same cardiac output / AW;	**1**
	Total mark:	**15**
4(a)	Australian death rate falls continuously from 1968 to 1992; sharp fall from 1970 to 1979; UK death rate increased from 1968 to 1971; remained constant until 1978; when it began to decline (until 1992); figs to illustrate;	**3 max**

Question	Answer	Mark
4(b)	nicotine makes platelets sticky; reduces ability to remove blood clots; increases chance of blood clotting; increases risk of coronary thrombosis; CO combines permanently with Hb / carboxyhaemoglobin; less oxygen transported; as a result, heart works harder to supply tissues with oxygen; constricts coronary arteries; atherosclerosis; increase in blood cholesterol; fewer antioxidants; ref. to free radicals; ref. to low density lipoproteins / high density lipoproteins; increase in blood pressure: AVP;;	**7 max**
	QWC: legible text, accurate spelling, punctuation and grammar	**1**
	Total mark:	**11**
5(a)	reduces surface area for gas exchange; air not, moved in and out of lungs / ventilated, adequately; barrel chest; reduced oxygen intake and carbon dioxide output; leads to increased breathing rate / rapid breathing; wheezing and breathlessness; AVP;	**4 max**
5(b)(i)	68.2 / 68.18;	**1**
5(b)(ii)	*For E* % ratio higher than the others; measurement 1 higher than the others; comparisons with other workers using figures from table;;	**3 max**
5(b)(iii)	may have only just joined firm; may wear a mask; may be aerobically fit; inadequate measurement / AW; AVP;; *Accept the first answer given on each answer line (unless the first is judged to be 'neutral'). If all the answer(s) given on one answer line are neutral, then look for a second correct answer on another line.*	**2 max**
5(b)(iv)	to avoid litigation; to improve working conditions; benefit of early diagnosis; preventative measures may be introduced; well being of work-force; decreases days lost / increases productivity;	**3 max**
	Total mark:	**13**
	PAPER TOTAL:	**60**