OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

BIOLOGY 2803/01

Transport

Monday **10 JANUARY 2005** Morning 45 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 45 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read the questions carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	16	
2	5	
3	13	
4	11	
TOTAL	45	

This question paper consists of 12 printed pages.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 **(a)** Flowering plants have two tissues to transport materials, xylem and phloem. Fig. 1.1 shows the outline of a transverse section of the **root** of a dicotyledonous flowering plant.

Sketch in and label the areas occupied by the xylem and phloem.

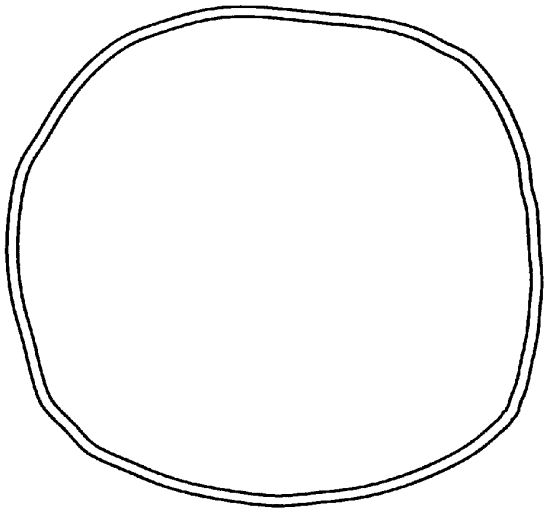

Fig. 1.1

[2]

(b) Fig. 1.2 is a scanning electron micrograph of some xylem vessels.

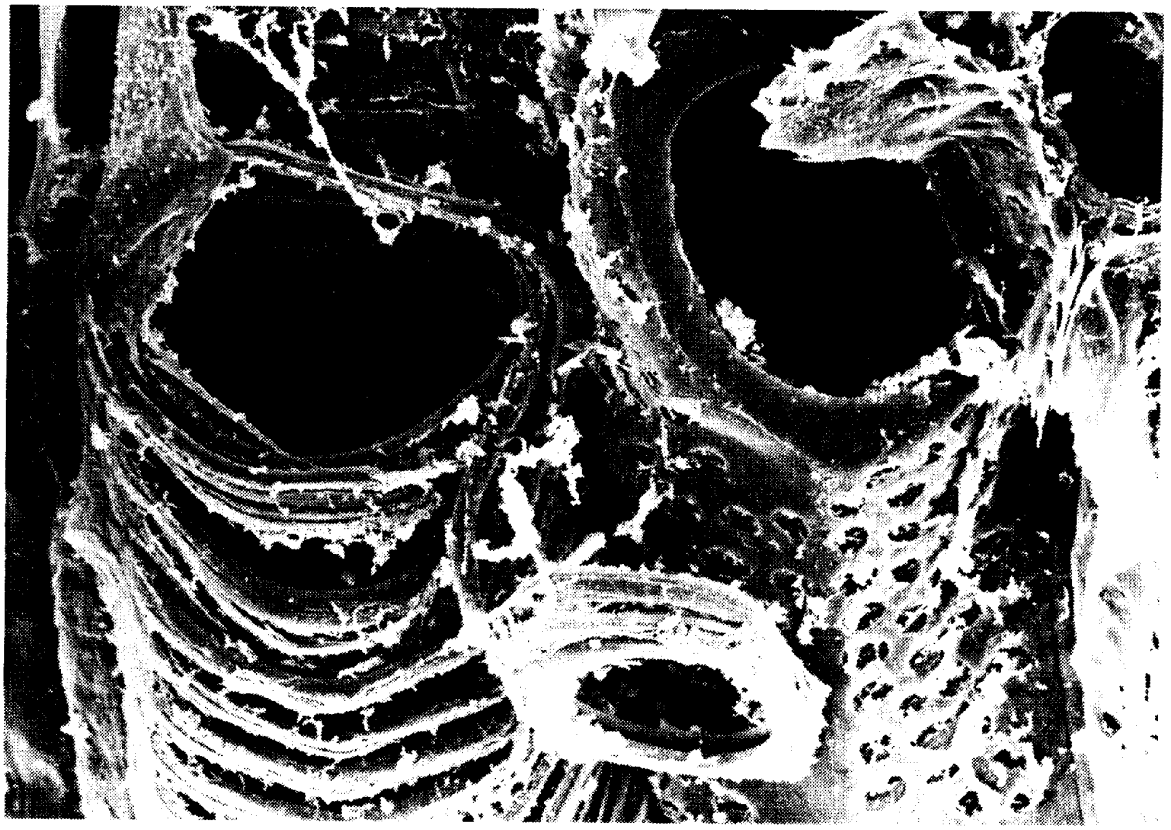

Fig. 1.2

Select **two** features **that are visible in the electron micrograph** and explain how these features help with the functioning of xylem vessels.

feature 1 .....

.....

.....

.....

feature 2 .....

.....

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.....[4]

(c) Various hypotheses for the mechanism of transport in phloem have been suggested. One hypothesis proposes that movement between sources and sinks occurs entirely passively by the process of mass flow.

Fig. 1.3 shows a physical model to illustrate the principle of mass flow.

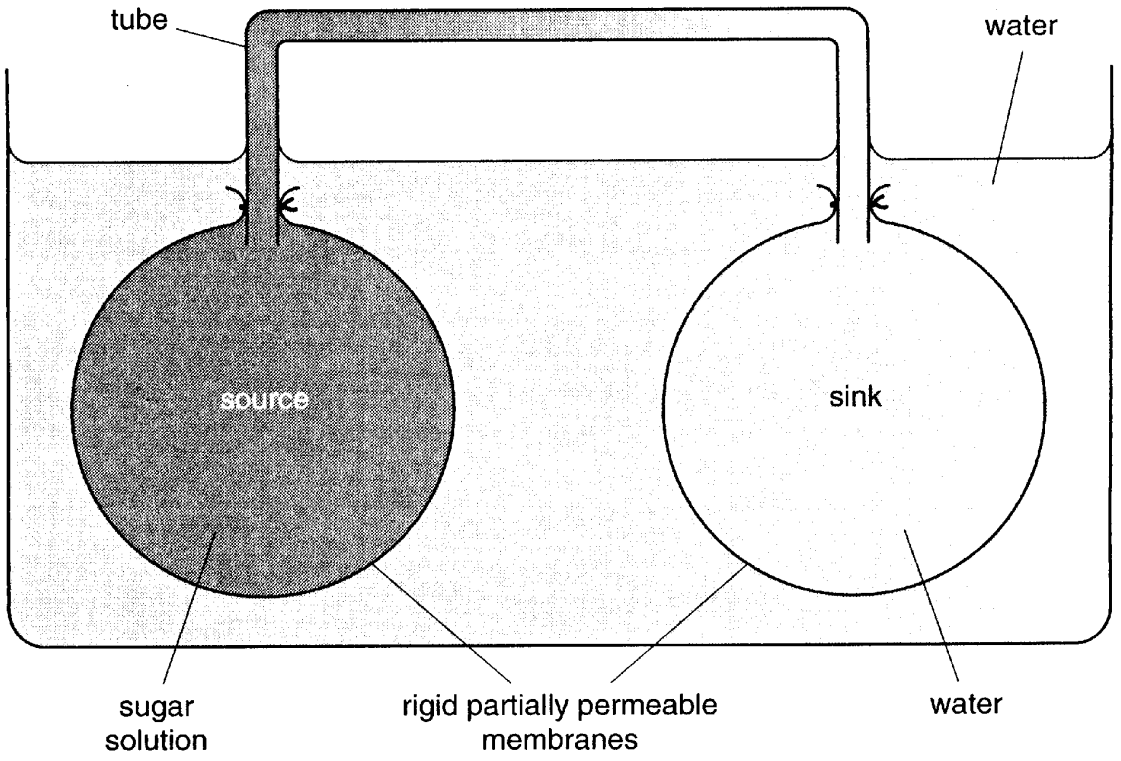

Fig. 1.3

(i) Give an example in plants of:

a source .....

a sink .....[2]

(ii) Use the information in Fig. 1.3 to explain how mass flow of materials between the source and the sink would be brought about.

.....

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.....

.....

.....[4]

For Examiner's Use

(d) There is evidence that sugar transport from sources to sinks in plants does not only involve passive movement by mass flow. There is also an active part to the mechanism.

(i) State **one** piece of evidence for the involvement of an active process.

.....

.....[1]

(ii) Describe an active mechanism which could possibly be involved in the transport of sugars from sources to sinks.

.....

.....

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.....

.....

.....[3]

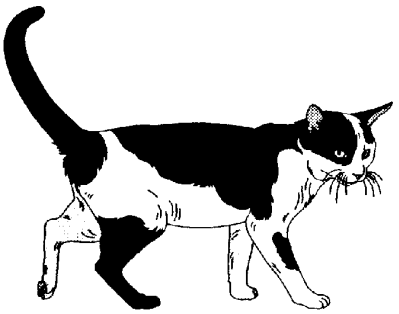
[Total: 16]

2 Use the most appropriate terms to complete the paragraph below about the role of haemoglobin.

Haemoglobin is a pigment found in the blood of mammals which has an important role in the transport of respiratory gases. Each haemoglobin molecule contains haem groups. In the lungs, oxygen binds with the atom of ..... in each haem group. The maximum number of molecules of oxygen that can be carried by one molecule of haemoglobin is ..... . In areas like muscle tissue where the partial pressure of oxygen is low, oxygen dissociates from the haem group. This dissociation is increased by the presence of carbon dioxide; this is called the .... Most of the carbon dioxide produced in respiring tissues diffuses into the red blood cells where the enzyme .... catalyses a reaction leading to the production of hydrogen ions and hydrogen carbonate ions. The hydrogen ions combine very readily with haemoglobin to form a compound known as .... The effect of this is to increase the release of oxygen from haemoglobin. [5]

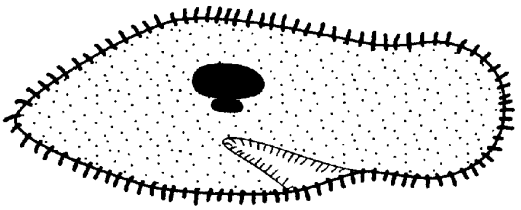
[Total: 5]

3 **(a)** Fig. 3.1 shows a mammal and a unicellular organism. The transport system in mammals is a double circulatory system driven by a pump (the heart), whilst unicellular organisms have no need for special transport systems.



mammal (cat)

X 0.075



unicellular organism
(*Paramecium*)
X 300

Fig. 3.1

(i) Explain what is meant by a *double circulatory system.*

.....

.....

.....

.....[2]

(ii) Explain **two** reasons why mammals need a circulatory system whilst unicellular organisms, such as that shown in Fig. 3.1, do not.

first reason .....

.....

.....

.....

second reason .....

.....

.....

.....[4]

(b) The cardiac cycle is the sequence of events which makes up one heart beat. Fig. 3.2 shows the events in the heart during one heart beat. The heart is viewed from the side.

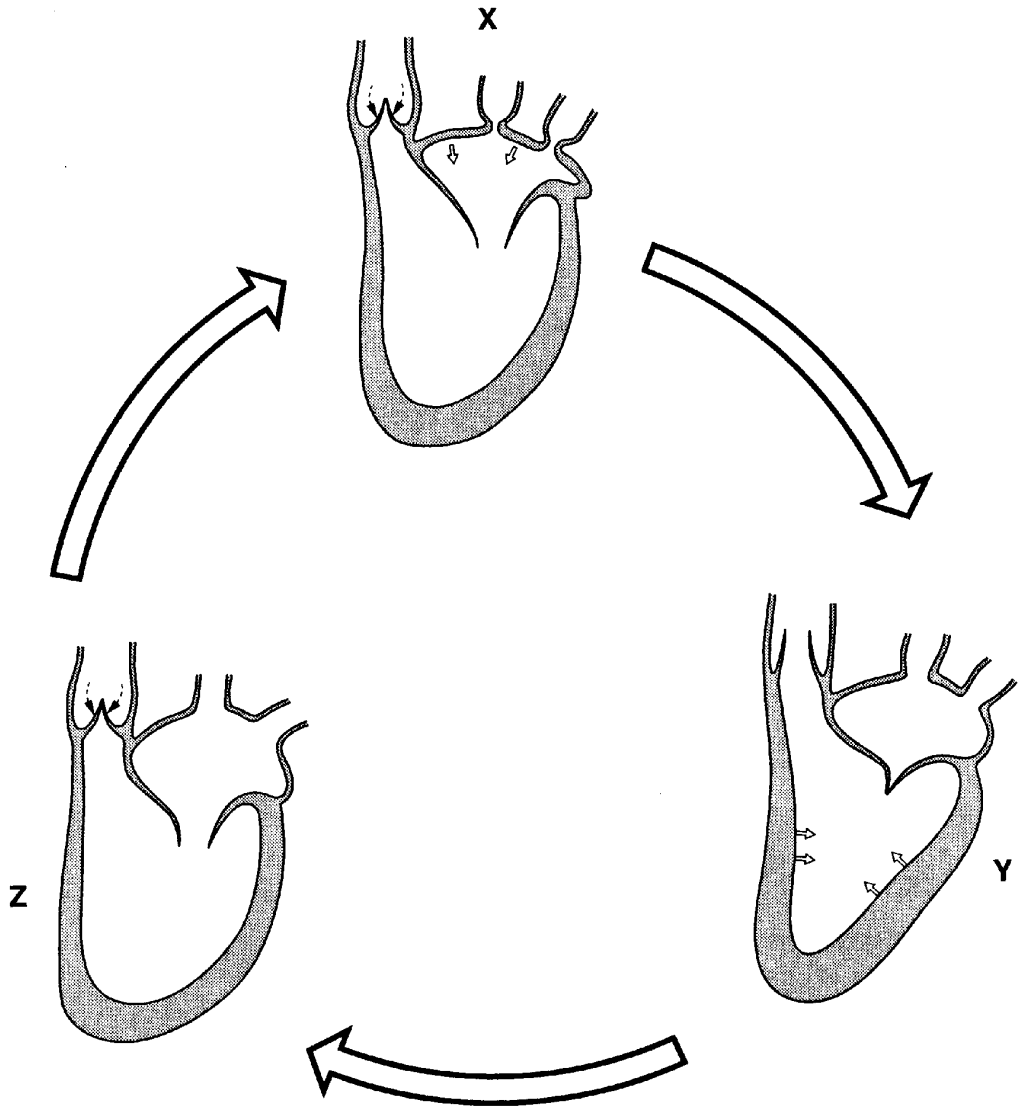


Fig. 3.2

For Examiner's Use

In this question, one mark is available for the quality of spelling, punctuation and grammar.

Using the information in Fig. 3.2, describe the sequence of events involved in one heart beat.

You may annotate **X**, **Y** and **Z** in Fig. 3.2 to help your answer. (Do **not** describe how the beat is initiated and controlled.)

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.....[6]

Quality of Written Communication [1]

[Total: 13]

[Turn over

For Examiner's Use

4 **(a)** Fig. 4.1 shows the changes in blood pressure as blood flows through various parts of the mammalian blood system.

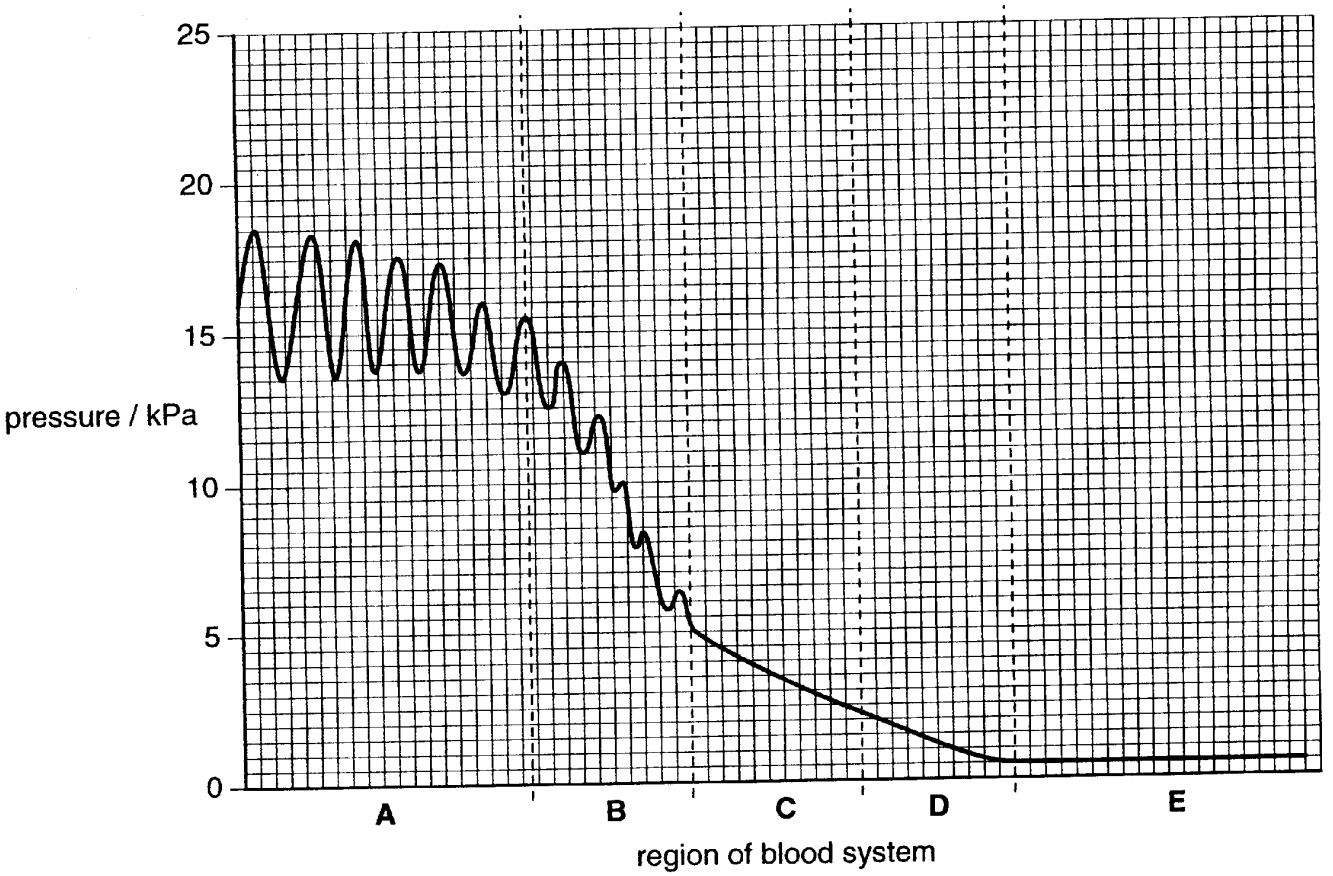

Fig. 4.1

(i) Calculate the drop in blood pressure from the **start** of region **B** to the **end** of region **D**. Show your working.

Answer =..... kPa [2]

(ii) Explain what brings about the drop in pressure between **B** and **D**.

.....

.....

.....

.....

.....[2]

(iii) Suggest why it is important that the pressure in region **C** is not as great as the pressure in region **A**.

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.....[2]

(b) Fig. 4.2 shows the structure of part of a capillary.

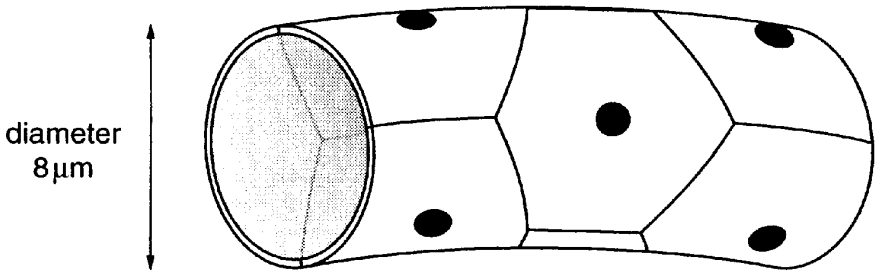

Fig. 4.2

(i) State which of the regions **A** to **E** shown on Fig. 4.1 represents the capillaries.

.....[1]

(ii) Select **two** structural features of capillaries and explain how each feature helps with the exchange of materials between the blood and the tissue fluid.

feature .....

role in exchange .....

.....

.....

feature .....

role in exchange .....

.....

.....

.....[4]

[Total: 11]

END OF QUESTION PAPER

RECOGNISING ACHIEVEMENT

2803/01 Transport

January 2005

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'), mark the first answer(s) given up to the total number required. Examiners will be expected to use their professional judgment in marking answers that contain more than the number required. Advice about specific cases will be given at the standardisation meeting.

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
	R	=	reject
	( )	=	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
	A	=	accept
	ora	=	or reverse argument

Question **Expected Answers** **Marks**

1 **(a)** 3 to 5 armed star of xylem with phloem more or less between **;**
R if star too close to the edge
xylem and phloem correctly labelled **;**

ecf - if stem drawn, credit correct xylem and phloem labels **2**

(b) lack of contents / no cytoplasm / hollow / lumen / continuous / AW **;** **A** lack of end walls
less resistance to flow / more space linked to idea of lack of contents / AW **;**
treat large as neutral

thickening / rings / spirals / lignin (in the wall) **;** *treat cellulose as neutral*
prevents collapse / gives support / adhesion of water **;**
R strength / rigid, unqualified **R** ideas on resisting positive pressure

pits / AW **;** **A** pores / holes (in side walls)
allow lateral movement / AW**;** **R** 'let things in or out' unqualified **4 max**

(c) **(i)** *source* – leaf / storage organ / named storage organ **;** **A** root qualified
sink – root / tuber / storage organ / (young) growing region / leaf qualified / flower / bud / fruit / seed **;**

R individual cells but **A** tissue <u>areas</u> such as mesophyll **2**

(ii) *max 2 if no reference to diagram*

water will enter source **;**
by osmosis **;**
down / AW , a <u>water potential</u> gradient **;**
increase in (hydrostatic) pressure**;**
as source / sink cannot expand / AW **;**
force / AW, solution along (tube to sink) **;**
AVP **;** e.g. explanation of mass flow **4 max**

(d) **(i)** ATP involved / respiration involved / many mitochondria in companion cells / reduced by metabolic inhibitors / oxygen dependent / temperature dependent / loading against a concentration gradient / AVP **;**

if evidence not given here look for it and credit it in part (ii) **1**

(ii) <u>loading</u>, into companion cell / from transfer cell / into sieve tube / into phloem – implied **;**
H ions / protons, pumped out of, companion cell / sieve tube / phloem **;**
diffuse back in with sucrose **;**
protein carrier / co-transporter **;**
possible active unloading by reverse mechanism **;**

AVP to cover alternative mechanisms **;;;**
e.g. electro-osmotic theory
K^+ pump
via companion cell
electrochemical gradient
sieve pores provide a capillary bed / AW **3 max**

[Total: 16]

Question	Expected Answers	Marks
2 (a)	iron / Fe **;** **A** Fe^{++} four / 4 **;** Bohr, effect / shift **;** carbonic anhydrase **;** haemoglobinic acid **;** **A** reduced haemoglobin **A** HHb	5

[Total: 5]

Question			Expected Answers	Marks
3	(a)	(i)	(blood flows) twice through the heart / AW **;** for one circuit / cycle (of the whole body) / AW **; A** for one heart beat ref pulmonary **and** systemic systems / to lungs **and** to (rest of) body **; R** systematic	**2 max**
		(ii)	*read whole answer and look for any two linked ideas from* • *size* • *activity* • *SA:V ratio* *ora if answered in terms of* Paramecium *size* (mammals) larger / AW **;** cells deep in the body **;** regions requiring materials separated by a distance / need to get materials to all parts / AW **;** diffusion too slow / AW **;** max 2 *activity* (mammals) more (metabolically) active / AW **;** need more materials / more rapid supply / more removal of wastes **;** *SA:V ratio* (mammals) surface area:volume ratio reduced / AW **;** diffusion alone not effective / AW **;** *must be linked to SA:V*	**4 max**
	(b)		*look at and credit any annotations on diagram* *if sequence gets lost do not award the marking points that follow and are directly linked, but give any general ones* **1** atrial systole / atria contract **;** **2** blood passes into ventricles **;** **3** veins / blood vessels, entering heart closed / AW **;** **4** atrioventricular / alternative names, valves open **;** **5** ventricular systole / ventricles contract **;** **6** blood to, the arteries / named arteries **;** **7** (via) open, semilunar / AW, valves **;** **8** atrioventricular valves shut to stop backflow **;** **9** relaxation / diastole, of ventricles (and atria) **;** **10** semilunar / AW, valves shut to stop backflow **;** *may be mentioned at X – only credit once* **11** ref to **X**,**Y** and **Z ;** ***X*** *= 1-4* ***Y*** *= 5-8* ***Z*** *= 9-10*	**6 max**
			QWC – legible text with accurate spelling, punctuation and grammar;	**1**
				[Total: 13]

Question			Expected Answers	Marks
4	(a)	(i)	*award two marks if correct answer (15) is given* 15 **;;** *ignore signs* *if answer incorrect give one mark for indication that 15.5* ***and*** *0.5 read off graph* *if 15 obtained by wrong calculation = 1*	**2**
		(ii)	qualified ref to distance from heart e.g. further **;** friction / resistance (to flow) **;** ref to increasing volume of e.g. capillaries**; A** surface area of capillaries idea of dissipation of energy in elastic recoil **;**	**2 max**
		(iii)	stop damage to, capillaries / arterioles / AW **; A** stops bursting ref to, lack of (much) elasticity in these vessels / thin walls / AW **;** ora for nature of artery wall *max one mark if only veins mentioned* slows flow rate **;** to allow (time for) exchange **;**	**2 max**
	(b)	(i)	C **; R** more than one letter i.e. a 'list'	**1**
		(ii)	*feature and role must match. Correct features are stand alone marks. Look at the given role to see if it informs the feature.* thin wall / single cell layer / AW **; R** membrane / thin cell wall **A** *statement which gives one cell thick, treating thin cell wall as neutral in this case* short pathway / ease of access to tissue fluid AW, rapid / easy, diffusion **;** smooth, (inner) surface / endothelium **; A** epithelium **R** refs to smooth muscle reduced friction / smooth flow / reduced turbulence / reduced resistance / AW **;** (small) gaps / pres / holes, between endothelial cells / in wall / AW **;** allows nutrients / named nutrients / fluid / AW, out, / (most) cells / proteins cannot pass **;** **R** refs to plasma **A** refs to, phagocytes / AW, passing narrow / small (diameter) / figure quoted / AW **;** idea of contact with many cells / short diffusion distance / rapid diffusion / reduced rate of flow qualified **;** large, total surface area / cross-sectional area **;** allows more exchange / slows flow for exchange / close to all the cells in the body**;** **R** easier / more efficient ideas unless qualified	**4 max**
				[Total: 11]