

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary GCE**

**BIOLOGY**

**2803/01**

Transport

Thursday

**8 JANUARY 2004**

Morning

45 minutes

Candidates answer on the question paper.

Additional materials:

- Electronic calculator
- Ruler (cm/mm)

Candidate Name

Centre Number

Candidate  
Number

	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> </tr> </table>							<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> <td style="width: 10%; height: 20px;"></td> </tr> </table>						

**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 each question 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.

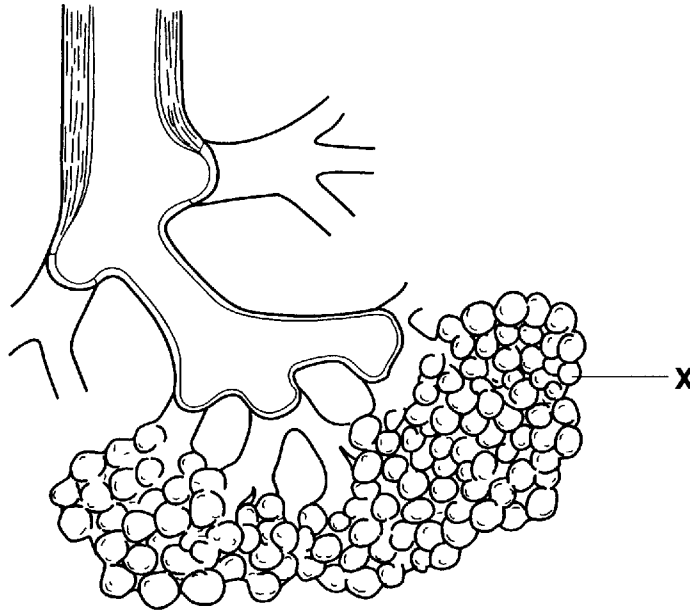
<b>FOR EXAMINER'S USE</b>		
<b>Qu.</b>	<b>Max.</b>	<b>Mark</b>
1	6	
2	13	
3	9	
4	6	
5	11	
<b>TOTAL</b>	<b>45</b>	

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**This question paper consists of 11 printed pages and 1 blank page.**

Answer **all** the questions.

- 1 Many small animals rely on diffusion across outer surfaces of their bodies for gas exchange. Mammals have lungs for gas exchange. Fig. 1.1 shows the structure of part of a mammalian lung and associated airways.



**Fig. 1.1**

- (a) (i) Name structure **X**.

.....[1]

- (ii) Describe the process by which gases are exchanged at **X**.

.....  
 .....  
 .....  
 .....  
 .....  
 .....[3]

- (b) Explain why mammals have large numbers of structure **X** in their lungs.

.....  
 .....  
 .....  
 .....[2]

[Total: 6]

2 Fig. 2.1 shows the formation and drainage of tissue fluid in a mammal.

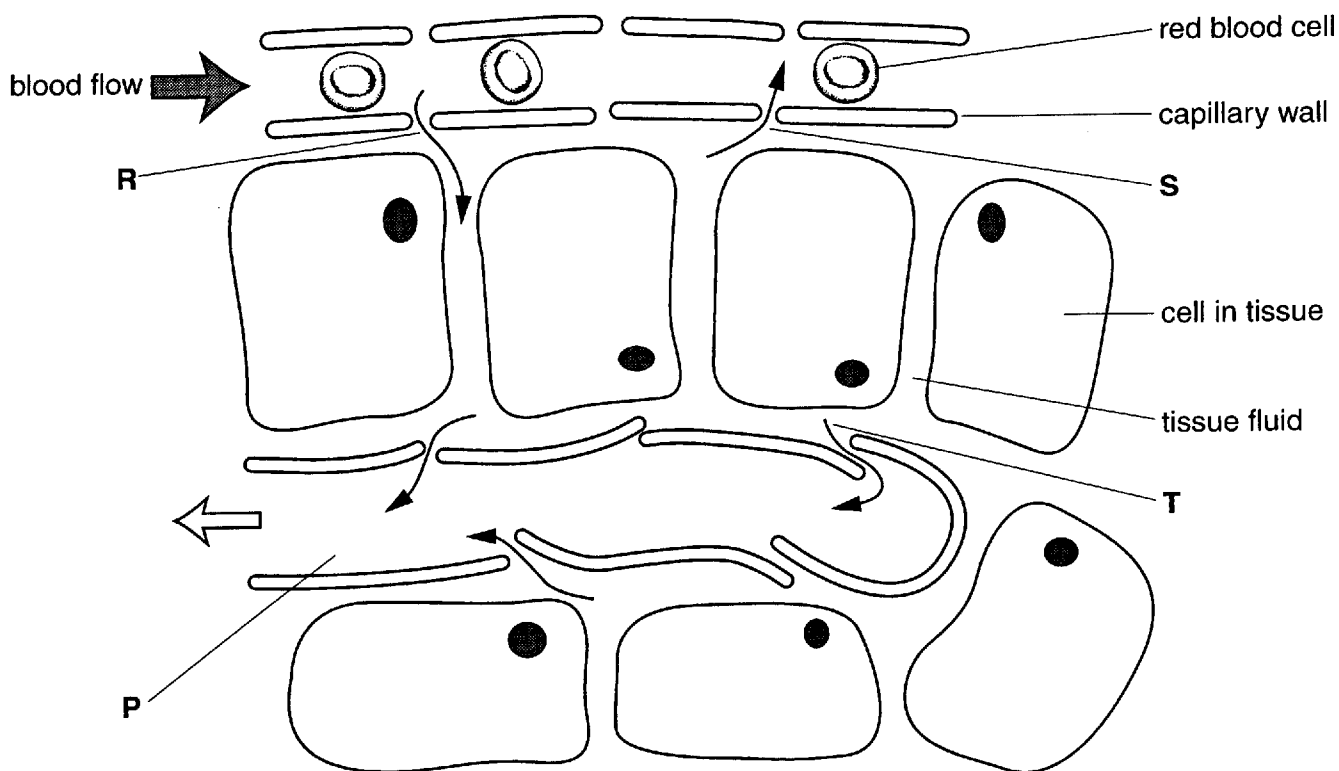


Fig. 2.1

(a) (i) Complete the table to give **three** differences between tissue fluid and blood.

tissue fluid	blood

[3]

(ii) Name the type of vessel labelled **P** in Fig. 2.1.

.....[1]



- (c) Suggest what could happen in the tissues of a person if the drainage at **S** and **T** was inefficient.

.....

.....

.....

.....[2]

[Total: 13]

- 3 Fig. 3.1 shows the distribution of some of the tissues in a transverse section of a plant organ. Fig. 3.2 is a photograph showing details of two cells, **D** and **E**, from one of the tissues.

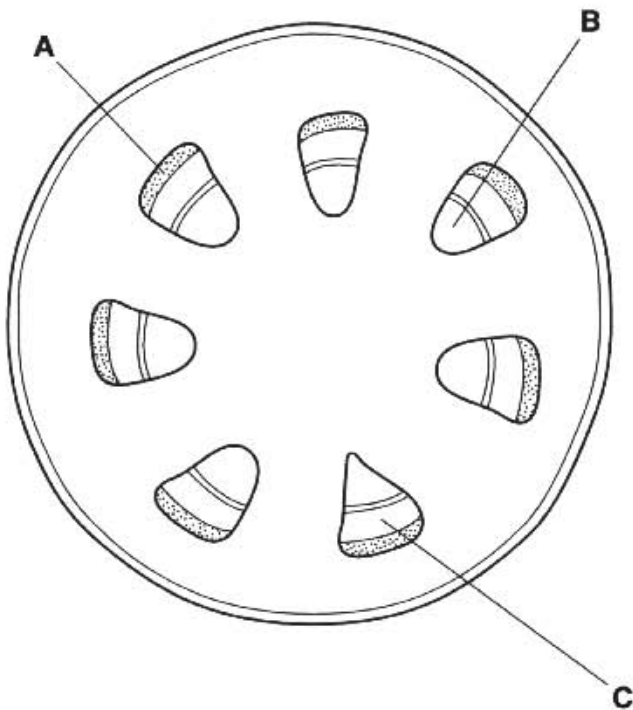


Fig. 3.1

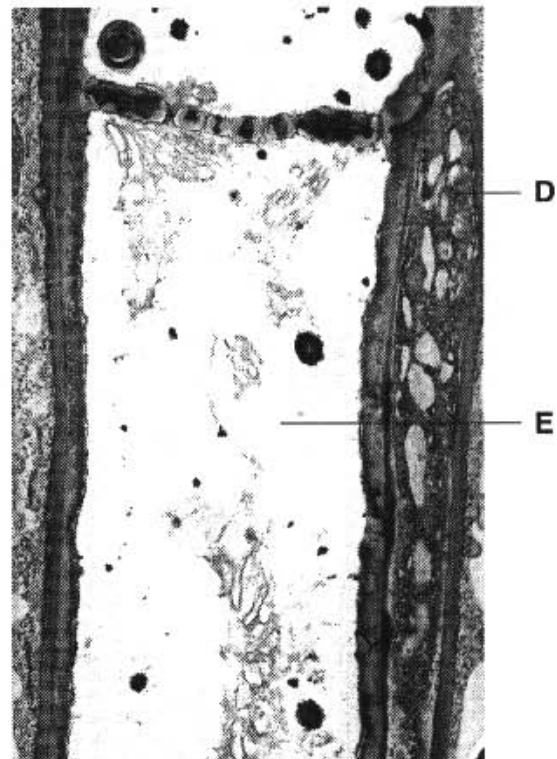


Fig. 3.2

- (a) Name the plant organ shown in Fig. 3.1.

.....[1]

- (b) Name the tissue shown in Fig. 3.2.

.....[1]

- (c) State in which region, **A** to **C** of Fig. 3.1, you would expect to find the tissue shown in Fig. 3.2.

.....[1]

- (d) Complete the table below by:

- **stating three** features or properties of cells **D** or **E** in Fig. 3.2 which adapt them to their function;
- **explaining** how the features or properties you have given help the tissue to carry out its function.

Make it clear in your answer which cell, **D** or **E**, you are describing for each feature you give.

feature or property	how the feature or property helps the tissue to carry out its function

[6]

[Total: 9]

4 Fig. 4.1 shows some plants growing in desert conditions. Such plants are known as xerophytes.

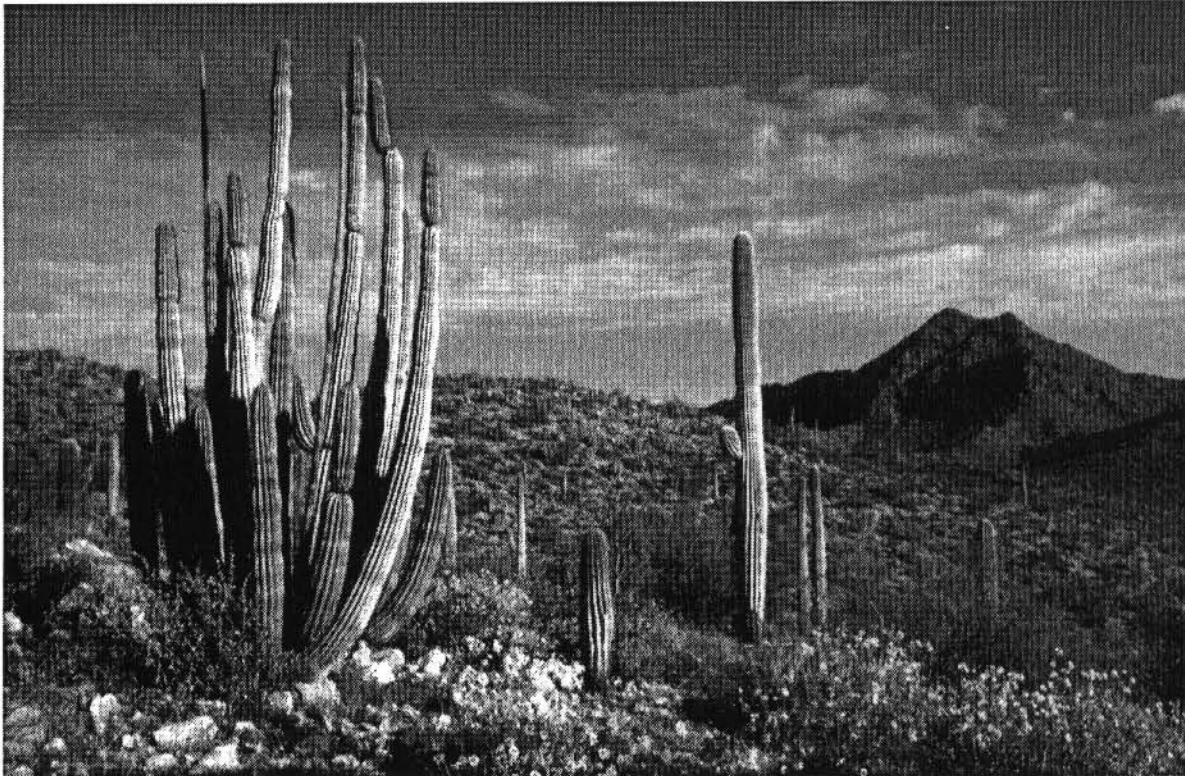


Fig. 4.1

Suggest how each of the following features of xerophytic plants helps them to survive in their habitat.

(a) The stomata are shut during the day and open at night.

.....

.....

.....

(b) The leaves of some plants are reduced to spines or needles.

.....

.....

.....

(c) The epidermis may be covered by hairs.

.....

.....

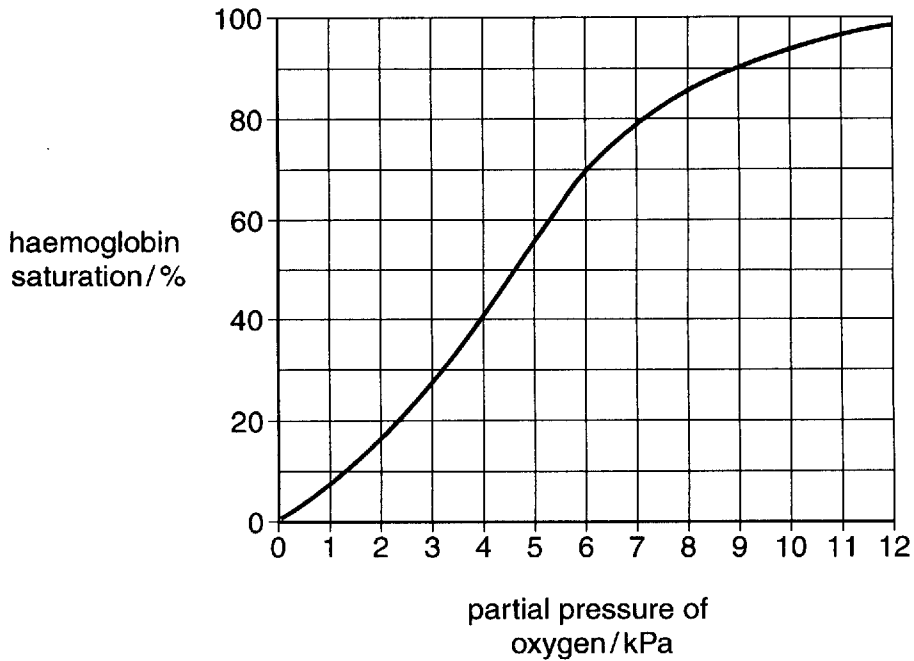
.....[6]

[Total: 6]

**Turn over for Question 5**

5 Haemoglobin is a pigment which can combine with oxygen and is found in red blood cells.

Fig. 5.1 shows the sigmoid (S-shaped) dissociation curve for maternal haemoglobin.



**Fig. 5.1**

(a) (i) Using Fig. 5.1, state the likely partial pressure of oxygen in the pulmonary vein leaving the lungs and in a vein leaving a muscle during strenuous exercise.

pulmonary vein ..... kPa

vein leaving a muscle during strenuous exercise ..... kPa [2]

(ii) On Fig. 5.1, sketch the curve for fetal haemoglobin. [2]

(iii) Using Fig. 5.1, explain why it is important that fetal haemoglobin and maternal haemoglobin are different.

.....

.....

.....

.....

..... [3]

**(b)** Buffers are substances that regulate pH by releasing or accepting hydrogen ions (H<sup>+</sup>). Haemoglobin acts as a buffer in the blood.

**(i)** Describe how the production of carbon dioxide during respiration leads to a higher concentration of hydrogen ions in the blood.

.....

.....

.....

.....

.....

.....

.....

.....

**(ii)** Describe how haemoglobin acts to reduce the concentration of hydrogen ions in the blood.

.....

.....

.....

.....[4]

[Total: 11]

**END OF QUESTION PAPER**

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*Copyright Acknowledgements:*

Q.1 Fig. 1.1     '*Advanced Human Biology*', Fig. 12.2, p.218, by J. Simpkins and J. I. Williams. Published by Unwin Hyman, 1988 (ISBN 0 7135 2769 2).

Q.3 Fig. 3.2     © Biophoto Associates.

Q.4 Fig. 4.1     © Biophoto Associates.

Q.5 Fig. 5.1     data from '*Exchange and Transport*', Fig. 158, p.85, by ABAL. Published by Cambridge University Press, 1984 (ISBN 0 521 2882 3).

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**2803/01 Transport**

**January 2004**

**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 ( $\frac{1}{2}$ ) 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. 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.

<b>Mark Scheme</b> Page 3 of 8	<b>Unit Code</b> <b>2803/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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<b>Abbreviations, annotations and conventions used in the Mark Scheme</b>	/ = alternative and acceptable answers for the same marking ; = point NOT = separates marking points R = answers which are not worthy of credit ( ) = reject — = words which are not essential to gain credit ecf = (underlining) key words which <b>must</b> be used to gain credit AW = error carried forward A = alternative wording ora = accept or reverse argument
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Question	Expected Answers	Marks
1 (a) (i)	alveolus / alveoli; <b>R</b> air sac	1
	(ii) <i>no mark for diffusion alone</i>	
	down a gradient / from high to low (concentrations); oxygen at high(er) concentration in lung / ora; dissolves in / crosses, water film; (aqueous) path short / short diffusion path; reverse gradient for carbon dioxide; ref to random molecular movement involved in diffusion; ref to maintenance of a steep gradient;	3 max
(b)	(generally) larger / correct ref to size; surface area decreased relative to volume / ora; lung / alveoli, gives increased area (for gas exchange); need for more oxygen; due to, high (metabolic) activity / much respiration / more energy need; cannot exchange across outer surface / no alternative surface; high demand for carbon dioxide removal / AW;	2 max

[Total: 6]

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
<b>2 (a) (i)</b>	<p><i>tissue fluid</i></p> <p>no red blood cells <b>R</b> Hb            few / no, (plasma) proteins            a few white blood cells <b>R</b> none            no platelets            always low pressure            some fats            not in vessels / AW</p> <p>qualified ref to differences in dissolved gas levels;</p> <p>AVP; e.g. qualified ref to, difference in, speed of flow / water potential            / ion content            functional difference, such as exchange medium v. transport            medium;</p>	<p><i>blood</i></p> <p>red blood cells;            (plasma) proteins;            full range / more, white blood cells;            platelets;            pressure higher / variable;            more fats;            contained in vessels;</p> <p><b>3 max</b></p>
<b>(ii)</b>	lymphatic / lymph; <b>A</b> lacteal	<b>1</b>
<b>(b)</b>	<p><b>1</b> pressure high at <b>R</b> / AW;  <b>2</b> ref to heart action causing (hydrostatic) pressure;  <b>3</b> greater than, osmotic effect / water potential effect / AW; <b>A</b> solute potential  <b>4</b> capillary wall, is leaky / has pores / AW;  <b>5</b> lets, fluid / water / plasma / liquid, through <u>and</u> dissolved substances /            named substance(s);  <b>6</b> red blood cells / proteins / some WBC's, cannot get out because too large;  <b>7</b> pressure low(er) at <b>S</b>;  <b>8</b> ref to osmotic effect / water potential effect; <b>A</b> solute potential  <b>9</b> due to plasma proteins;  <b>10</b> return of fluid / AW, at <b>S</b> / AW;  <b>11</b> valves / pores, at <b>T</b> / lymph vessel / AW; <b>R</b> semi lunar valve  <b>12</b> allow, fluid / water / liquid, into lymph vessel / out of tissue fluid;  <b>13</b> allow proteins out of tissue fluid;</p>	<p><b>6 max</b></p> <p><b>QWC – clear, well organised using specialist terms</b></p> <p><b>1</b></p>

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**Question 2 continued**

**Marks**

- (c) fluid / AW collects; R if suggests collection in cells  
 (tissue) swells / AW; R turgid R if implies cells swell  
 oedema;  
 especial danger, in lungs / pulmonary oedema;  
 ref to build up of proteins (from tissues);  
 AVP e.g. loss of blood volume;

**2 max**

**[Total: 13]**

<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
3 (a)	stem;	1
(b)	phloem; R sieve tube, phloem vessel , single cell type	1
(c)	C;	1

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- (d) *feature and role must match for 2 marks*  
*mark for feature may be awarded even if role is incorrect*  
*both marks may be given in right hand column.*

*feature*

*how it helps*

*either **D** or **E***

living;

allows active process / AW;  
stops escape of metabolites;

hydrogen pump / co-transporter;

(role in) loading / AW;

plasmodesmata / connections between  
sieve tube and companion cell;

allow exchange /AW;

**D / companion cell**

(many) mitochondria  
much respiration / metabolically active;

provide, energy / ATP;

nucleus;

controls functioning of both cells;

**E / sieve tube**

clear of most organelles /  
organelles at edge / little cytoplasm / AW;  
**R** empty  
(if specific organelles given, need at least 2)

less resistance / ease of transport  
/ AW / more space for transport;

long / elongated / AW;

less resistance / ease of  
transport / AW;

sieve plate / (sieve) pores;

connects elements / lets  
materials through / AW;  
**A** reduces resistance

joined end to end;

continuous / long distance,  
transport;

bi-directional flow;

allows sugar to go to sink both up  
and downward / AW;

**6 max**

**[Total: 9]**

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
<b>4</b>	<i>mark for transpiration / evaporation is not freestanding, in each case it must be related to the feature in each section</i>	
<b>(a)</b>	transpiration / evaporation / AW, occurs via stomata; <b>R</b> water loss (generally) warm(er) in day; more evaporation / transpiration will occur (in context); ref to steeper water potential gradient; shutting, stops / reduces, this loss;  <i>ora for open at night</i>	<b>2 max</b>
<b>(b)</b>	small surface area; less transpiration / evaporation / AW ( in context); <b>R</b> water loss <b>R</b> no transpiration fewer stomata / AW; protection against grazing / AW;	<b>2 max</b>
<b>(c)</b>	hairs trap, water vapour / moisture in air; <b>R</b> just moisture prevent wind effect / AW; reduces water potential gradient; less, transpiration / evaporation / AW (in context); <b>R</b> water loss <b>R</b> no transpiration correct ref to condensation of water vapour;	<b>2 max</b>
		<b>[Total: 6]</b>

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
<b>5 (a) (i)</b>	10 - 12; 1 - 4;  <i>if range given, both figures must be within the range</i>	<b>2</b>
<b>(ii)</b>	to the left and sigmoid; start and finish at the same points as the maternal curve;  <i>if curve drawn on right can still give start and finish points if reasonably sigmoid</i>	<b>2</b>
<b>(iii)</b>	to allow, fetus / fetal haemoglobin, to get oxygen (at placenta); at, low / same, partial pressure of oxygen; maternal haemoglobin releases oxygen / AW; ref to higher affinity of fetal haemoglobin (allows it to pick oxygen up);	<b>3 max</b>
<b>(b) (i)</b>	ref carbon dioxide (diffusion / AW, from tissues) to <u>red</u> blood cells; carbon dioxide reacts with water; to give carbonic acid; ref to carbonic anhydrase; carbonic acid, dissociates / AW, releasing, H <sup>+</sup> / hydrogen ions;  <i>direct reaction of carbon dioxide to H<sup>+</sup> and HCO<sub>3</sub><sup>-</sup> = 2 marks</i>	<b>3 max</b>
<b>(ii)</b>	H <sup>+</sup> / hydrogen ions, combine with / AW, haemoglobin; <b>R</b> 'mops up' unqualified forms <u>haemoglobinic acid</u> / HHb;  <i>accept words or symbols throughout</i>	<b>1 max</b>
		<b>[Total: 11]</b>