

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

BIOLOGY

2803/01

Transport

Thursday

10 JANUARY 2002

Afternoon

1 hour

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number									
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TIME 1 hour

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 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 stages in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	7	
2	15	
3	5	
4	14	
5	13	
6	6	
TOTAL	60	

Answer **all** questions.

- 1 The need to develop transport systems in multicellular organisms is related to changes in the surface area to volume ratio that occur as the organisms get larger.
Fig. 1.1 shows two cubes, **A** and **B**, of different sizes, used to represent two organisms.

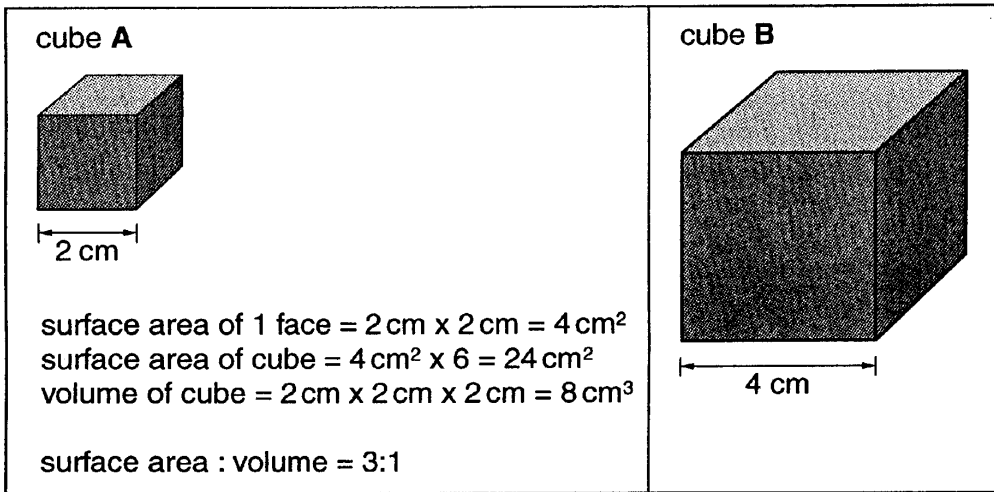


Fig. 1.1

- (a) Calculate the surface area to volume ratio of cube **B**. Show your working.

.....

[2]

- (b) Describe how the ratio of cube **B** has changed in comparison to cube **A**.

.....

[2]

- (c) Describe how such changes in ratio have influenced the need for transport systems in plants and animals.

.....

[3]

[Total : 7]

2 Fig. 2.1 shows a section through a typical dicotyledonous stem.

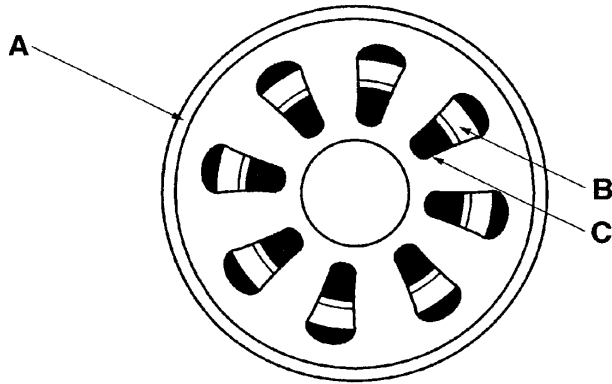


Fig. 2.1

(a) With reference to Fig. 2.1,

(i) name the tissues **A** to **C**;

A

B

C[3]

(ii) describe how the distribution of **B** and **C** would differ in a dicotyledonous root.

.....

.....

.....[2]

- 3 Insert the most appropriate word or words in the paragraph below on mammalian gas exchange.

The surface area of the lungs is greatly increased by large numbers of structures called which are the sites of gas exchange. The process of exchange is entirely by and this is made more effective by the fact that the walls of these structures consist of Their surfaces are moist and once oxygen has entered the capillaries it passes into the via the plasma and is rapidly transported away from the site of exchange, thus maintaining the needed for efficient exchange.

[Total : 5]

- 4 Fig. 4.1 shows a simplified diagram of the human heart and associated blood vessels in vertical section.

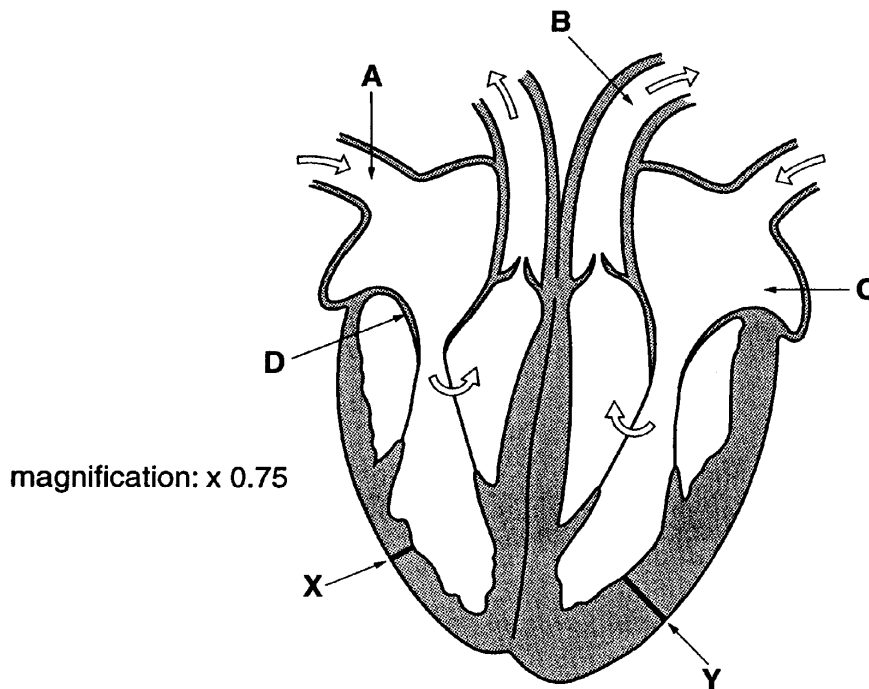


Fig. 4.1

(a) Name structures **A** to **D**.

A

B

C

D

[4]

(b) (i) The actual width of the wall at **X** is 4 mm. Calculate the actual width of the wall at point **Y** using the scale provided. Show your working.

.....

[2]

(ii) Explain the significance of this difference in thickness between the walls at **X** and **Y** in terms of the functioning of the heart.

.....

[3]

(c) Complete the table below by adding T (true) or F (false) against the statements about the cardiac cycle.

	T or F
cardiac muscle is myogenic	
contraction occurs in the diastolic phase	
the left and right ventricles contract at the same time	
when the left ventricle contracts, the semilunar valve in the aorta shuts	
the semilunar valves have tendons to prevent inversion	

[5]

[Total : 14]

- 5 Fig. 5.1 shows the structure of a capillary.

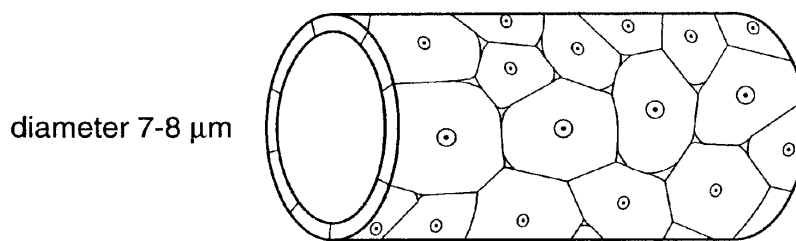


Fig. 5.1

- (a) Complete the table to state **three** features of capillaries which allow them to function effectively and explain how each helps with exchange between the blood and tissue fluid.

feature	explanation of the role in exchange

[6]

Fig. 5.2 shows some of the pressures involved in exchange between a capillary and the tissue fluid around it. **A** and **B** are points at opposite ends of the capillary.

Effective blood pressure = (SP + HP of blood) – (SP + HP of tissue fluid).

HP = hydrostatic pressure produced by the pumping of the heart.

SP = solute potential; an osmotic effect due to solutes dissolved in the blood or tissue fluid.

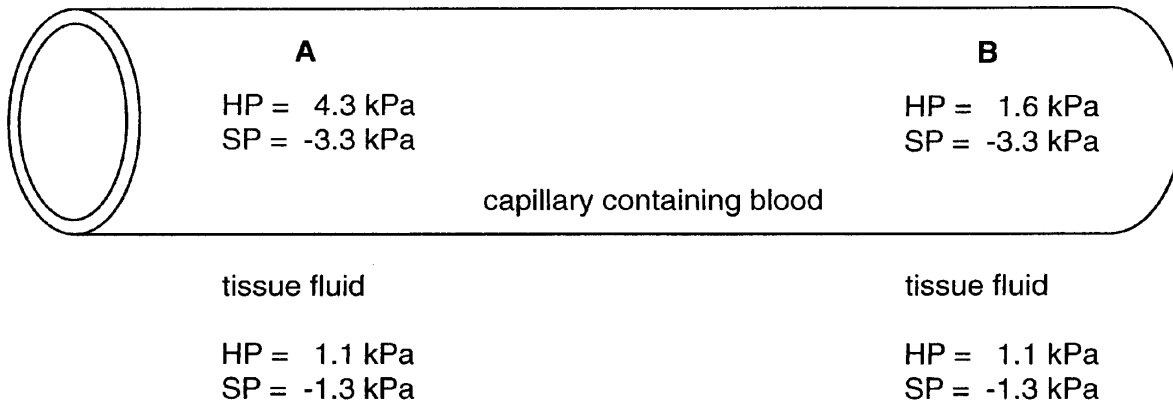


Fig. 5.2

(b) The effective blood pressure at **A** is 1.2 kPa.

(i) Calculate, showing your working, the effective blood pressure at **B**.

.....

[2]

(ii) Mark by means of an arrow on the diagram the direction the fluid will move between the blood and the tissue fluid at **A**. [1]

Some of the tissue fluid does not return to the capillaries, but enters another set of vessels.

(c) Name the fluid in these vessels and describe its composition.

name

composition

.....

[4]

[Total : 13]

- 6 Fig. 6.1 is a plan diagram of a transverse section of a leaf from *Nerium oleander*, a plant adapted to survive in dry areas. Detail of the lower epidermis that lines the stomatal chambers is shown in Fig. 6.2.

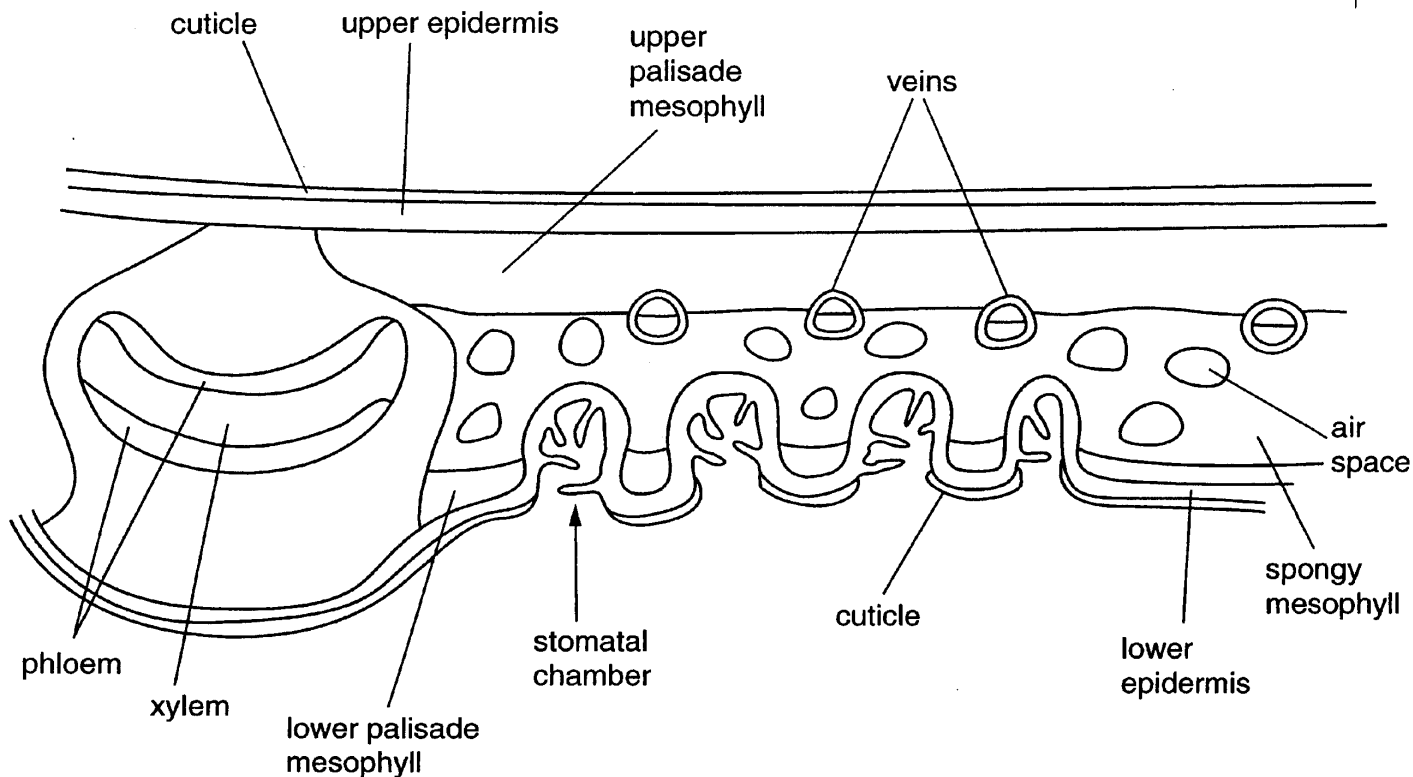


Fig. 6.1

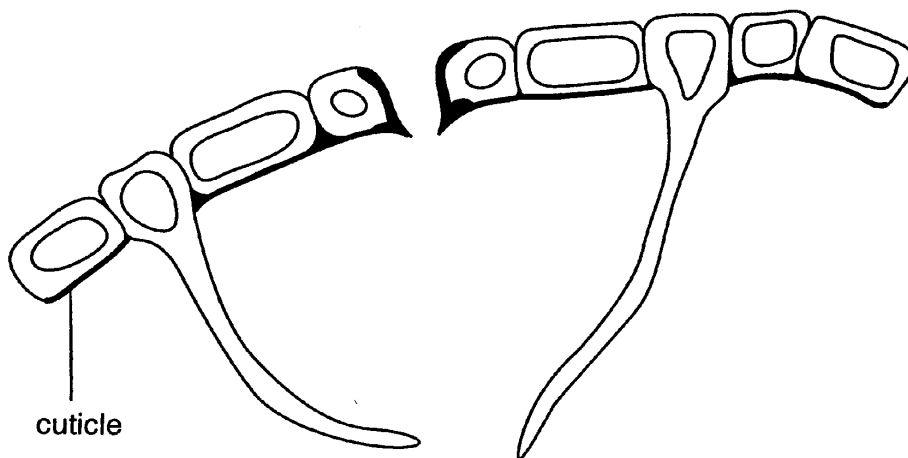


Fig. 6.2

Select **three** of the features shown on Fig. 6.1 and state how each feature helps the plant to survive in dry areas.

feature 1

.....

.....

feature 2

.....

.....

feature 3

.....

.....

[Total : 6]



RECOGNISING ACHIEVEMENT

Subject: Transport Code: 2803/01

Session: January Year: 2002

Mark Scheme

MAXIMUM MARK	60
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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.

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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 <u> </u> = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument
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Question	Expected Answers	Marks
1 (a)	1.5:1 / 3:2 ;; <i>calculation showing 96 & 64. 1 mark if ratio wrong</i> <i>ecf if calculation wrong, credit for 1 mark a correct ratio from calculation given</i>	2
(b)	dropped; by half / from 3:1 to 1.5:1 / 3:2 <i>ecf for number quote based on calculation in a halved / AW on its own = 2 marks</i> <i>ora based on volume part of ratio having increased acceptable</i>	2
(c)	1 diffusion not adequate; 2 as not enough area (relative to volume) ora; 3 (and) distance too great; 4 so specialised surfaces developed; 5 an e.g. of a specialised surface; 6 linked by transport systems / ref to going to all parts of body; 7 example of a substance transported e.g. named gas, nutrient / named nutrient; (named) waste / (named) hormones / heat / water / etc; <i>reject food / blood</i>	
	<i>AW applies throughout. Look for the implication of the principles.</i>	3 max

[Total: 7]

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Question	Expected Answers	Marks
2 (a) (i)	A = epidermis; B = phloem; <i>accept pholem etc.</i> C = xylem;	3
(ii)	1 central / AW; 2 star shaped / 3 – 5 arms / AW, xylem; 3 no pith / hole / AW; 4 phloem between xylem / on different radii / AW; <i>accept points on a diagram (xylem and phloem need to be labelled)</i>	2 max
(b)	<i>Pathway</i> P1 root hairs; P2 via cortex; P3 in symplast / or description; P4 or apoplast / or description; P5 or vacuoles; P6 in xylem; P7 mesophyll; P8 AVP e.g. endodermis; <i>Mechanism</i> M9 down water potential / symbol, gradient ; <i>reject 'along'</i> M10 most negative at leaf / atmosphere / AW; M11 evaporation / transpiration; M12 diffusion of water <u>vapour</u> ; M13 water under tension / suction / negative pressure / (transpiration) pull / AW; M14 ref cohesion / description in context; M15 ref Casparian strip / or described, blocking apoplast; M16 ref root pressure (in context); M17 osmosis (in context); M18 mass flow / hydrostatic gradient (in xylem)); M19 ref adhesion / description in context M20 ref columns of water / continuous flow / AW; M21 AVP e.g. capillarity;	Max 4 Max 6 max 9
	QWC – legible text with accurate spelling, punctuation and grammar;	1

[Total: 15]

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Question	Expected Answers	Marks
3	alveoli; A alveolus diffusion; thin / single / squamous / pavement, cell / epithelium / layer of cells; red (blood) cells / RBC / erythrocytes / haemoglobin; (steep / diffusion / concentration / oxygen) gradient / AW;	5

[Total: 5]

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Question	Expected Answers	Marks
4 (a)	A = vena cava; B = aorta; (<i>ignore dorsal</i>) C = left atrium; <i>accept atria</i> D = tricuspid / atrioventricular / AV, valve; (<i>accept tricupsid</i>) <i>(reject arterioventricular)</i>	4
(b) (i)	Y = 10.6 – 10.7 (mm);; <i>accept 11 / 11.0 (i.e. rounded up)</i> <i>(units not needed unless the answer has been changed into e.g. cm)</i> <i>(Working. $8/0.75$. $2\frac{2}{3} \times 4$. 1 mark if answer wrong)</i>	2
(ii)	left ventricle / Y, more muscular / muscle ora for X; (<i>i.e. a comparison</i>) more pressure / force (for Y) / ora for X; (<i>i.e. a comparison</i>) left ventricle pumps to whole body / AW; right ventricle pumps to the lungs; (Y pumps a further distance / ora = 1 mark) <i>ignore refs to thickness unqualified – in stem of question</i> <i>Mark (ii) independently of (i)</i>	3 max
(c)	T; F; T; F; F;	5
[Total: 14]		

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Question	Expected Answers	Explanation	Marks
5 (a)	<p><i>Feature</i></p> <p>narrow / small diameter /AW;</p> <p>gaps (in wall / AW);</p> <p>thin wall / single cell layer / AW; <i>reject membrane</i></p> <p>smooth (inner) surface / endothelium;</p> <p>large total surface area;</p>	<p><i>Explanation</i></p> <p>contact with many cells / short diffusion distance / rapid diffusion / reduced rate flow qualified / AW;</p> <p>allows fluid / nutrients / AW, out / cells / proteins cannot pass; <i>reject plasma</i></p> <p>short pathway / easy access to tissue fluid / rapid diffusion / AW;</p> <p>smooth flow / prevents turbulence / AW;</p> <p>slows flow for exchange / allows more exchange / AW; <i>reject easier</i></p>	6 max
	<p><i>roles must match features. Can credit correct feature alone.</i></p> <p><i>reject refs to capillary density.</i></p>		
(b) (i)	<p>B = - 1.5 (kPa);;</p> <p><i>look for attempt to use the relationship to credit working if answer wrong</i></p> <p><i>e.g. (-3.3+1.6)-(-1.3+1.1) = 1 mark.</i></p> <p><i>1.5 = 1 mark.</i></p>		2
(ii)	<p>out (of capillary);</p> <p>(Be careful to check for this. Put tick or cross by arrow)</p>		1

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(c) lymph; *accept lymphatic – adjectival to fluid in stem of question*

water;

urea;

carbon dioxide;

proteins (made in tissues); *reject plasma proteins*

lymphocytes / named lymphocyte / WBC; *reject macrophage*

antibodies / AW;

hormones;

fats / AW;

(named) minerals;

Accept little / AW glucose; little AW oxygen; no RBCs; no plasma proteins;

Reject waste, gases, nutrients. Take any three on list.

Max 2 for composition if RBCs or Plasma proteins mentioned as present

1

+3

max

[Total: 13]

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Question	Expected Answers	Marks
6 (a)	<p><i>No marks for the features. Must get at least 1 point from each choice. reject prevents as an absolute once then ecf reject refs to concentration gradients throughout</i></p> <p><i>cuticle</i> wax / waxy / impermeable / waterproof; <i>accept thick / a barrier</i> reduces water loss / transpiration / evaporation / AW; reflective / AW; reduces heating up / AW;</p> <p><i>epidermis</i> thick walled; water passes slowly / reduces water loss / AW; ref to thick(er) upper epidermis / AW;</p> <p><i>small air spaces</i> less surface area; less evaporation / transpiration / water loss / AW; from mesophyll / into spaces / AW; spaces become saturated faster / AW; reduced water potential / diffusion, gradient;</p> <p><i>hairs (accept any reasonable description)</i> reduces air movement; trap water vapour / moist air; <i>reject water unqualified</i> reduced, water potential / diffusion, gradient; less, diffusion / transpiration / water loss / AW;</p> <p><i>stomatal chambers / sunken stomata</i> saturated air builds up / AW; not easily blown away / AW; reduced, water potential / diffusion, gradient; less, diffusion / transpiration / water loss; <i>accept correctly qualified to presence on lower surface;</i></p> <p><i>mark first three features</i></p>	6 max

[Total: 6]