

- Q1.** Water can be lost from the body in several ways.
The table shows the volume of water lost by a man on a cold day.

Way in which water is lost	Volume of water lost in cm ³
In urine	2000
Through skin	600
Breathed out	300
In faeces	100
Total	3000

- (a) Calculate the proportion of water that the man lost through his skin.
Show clearly how you work out your answer.

.....
.....

Proportion =

(2)

- (b) More water is lost through the skin on a hot day than on a cold day.

- (i) Explain why.

.....
.....

(1)

- (ii) To maintain water balance in the body, the total volume of water taken in must equal the total volume of water lost.

Give **two** ways this is achieved on a hot day, when compared to a cold day.

Tick (✓) **two** boxes.

The volume of water in the urine decreases.

The volume of water in the faeces increases.

The volume of water taken as food or drink increases.

The volume of water breathed out decreases.

(2)

- (c) Use words from the box to complete the sentences.

bladder kidney liver stomach
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The body cannot store amino acids.

The body converts the amino acids it cannot use into urea.

- (i) Urea is made in the

(1)

- (ii) Urea is removed from the blood by the

(1)

- (iii) Urine is stored in the

(1)

(Total 8 marks)

Q2. (a) (i) Blood is part of the circulatory system.

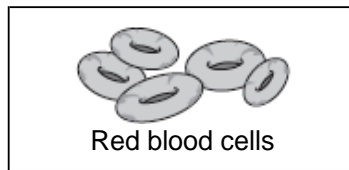
Draw **one** line from each part of the blood to its correct function.

Part of the blood

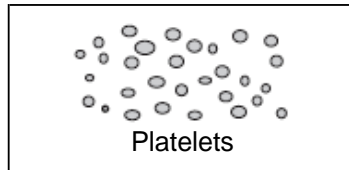
Function



carry glucose around the body



carry oxygen around the body



help the blood to clot

destroy microorganisms

(3)

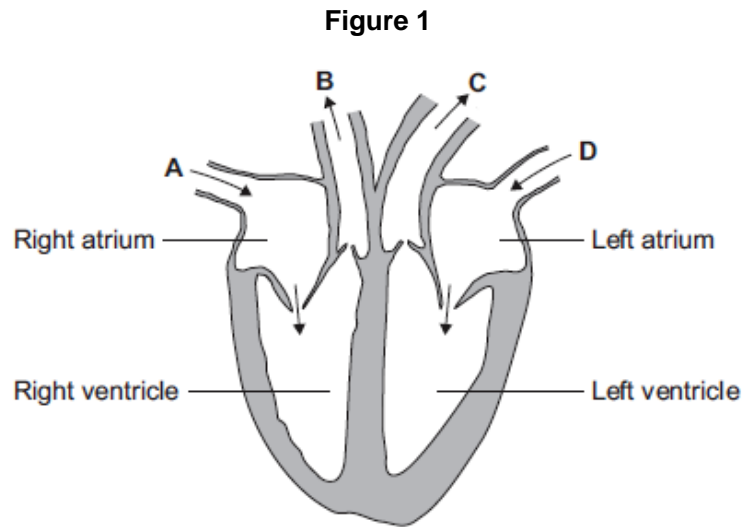
(ii) Name **one** waste product that is transported by the blood plasma.

.....

(1)

(b) The heart is also part of the circulatory system.

Figure 1 shows a section through the human heart.



(i) Which arrow, **A**, **B**, **C** or **D**, shows blood leaving the heart in the pulmonary artery to go to the lungs?

(1)

(ii) Which arrow, **A**, **B**, **C** or **D**, shows blood from the lungs entering the heart in the pulmonary vein?

(1)

(iii) Valves in the circulatory system make sure blood only travels in one direction.
Name the type of blood vessel that has valves.

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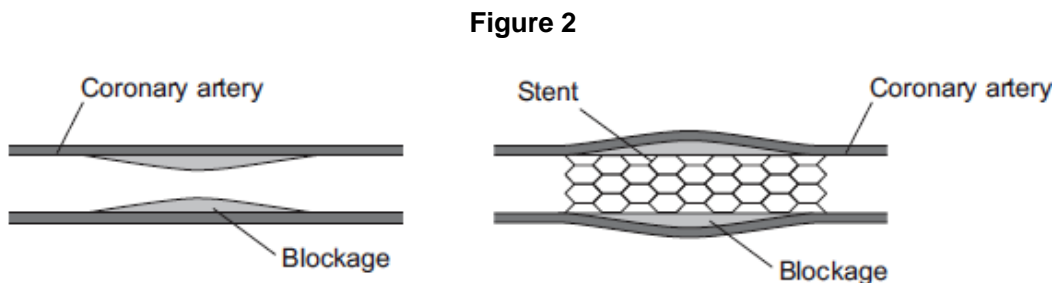
(1)

(c) A person's coronary artery has become narrower.

The person has a heart attack.

A doctor puts a stent into the person's coronary artery.

Figure 2 shows a stent inside a coronary artery.



(i) How does the stent help to prevent another heart attack?

Give **one** way.

.....
.....

(1)

(ii) **Figure 3** shows a surgeon putting a stent into a patient.

Figure 3



© Science Photo Library

The surgeon puts the stent into an artery in the leg. He moves the stent through the artery to the coronary artery.

Suggest **two** possible risks of this operation.

1

.....

2

.....

(2)
(Total 10 marks)

Q3. Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

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.....

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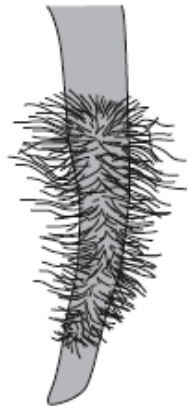
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(3)

(b) The image below shows part of a plant root.



The plant root is adapted for absorbing water from the soil.

Use information from the diagram to explain how this plant root is adapted for absorbing water.

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.....

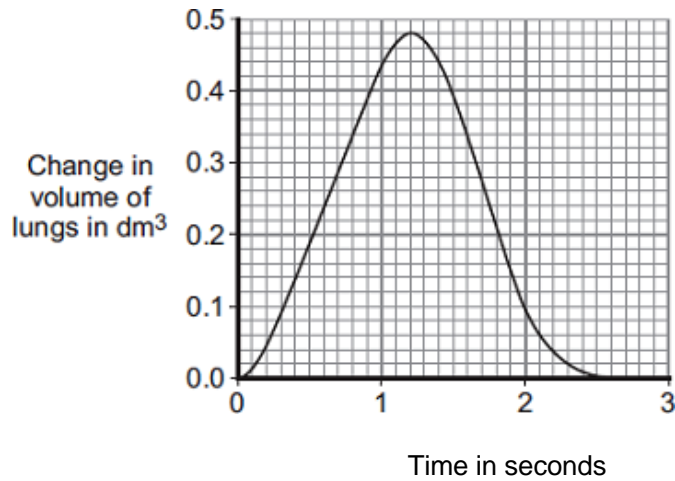
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(3)
(Total 6 marks)

Q4. The diaphragm and ribcage move air into the lungs and out of the lungs.

The graph shows changes in the volume of the lungs in one breathing cycle.



(a) (i) Describe the changes in the volume of the lungs in one breathing cycle.

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.....

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.....

(3)

(ii) Explain how the diaphragm and ribcage cause the changes in lung volume shown in the graph.

.....

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.....

.....

(3)

- (b) Sometimes patients are unable to breathe for themselves. Mechanical ventilators are used to make these patients breathe.

Photograph 1 shows a patient in an iron lung ventilator.

Photograph 1



CDC [Public domain], via Wikimedia Commons

Air is pumped out of the iron lung, creating a very low pressure. This low pressure causes the thorax to expand, causing air to flow into the lungs. When air is pumped back into the iron lung the pressure inside the tank increases, causing air to move out of the lungs.

Photograph 2 shows a modern ventilator.

Photograph 2



By Calleamanecer (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Modern ventilators increase the pressure in the patient's airways using a tube put into the trachea.

The increased pressure in the patient's airways causes air to flow into the patient's lungs. Then, the ventilator causes the pressure in the patient's airways to drop to zero, and the patient breathes out.

- (i) The ventilators shown in **Photographs 1** and **2** make the patient inhale in a very different way.

Describe this difference.

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.....
.....

(2)

(ii) The iron lung ventilator was used mainly in the 1900s.

Most patients are now treated with the type of ventilator shown in **Photograph 2**.

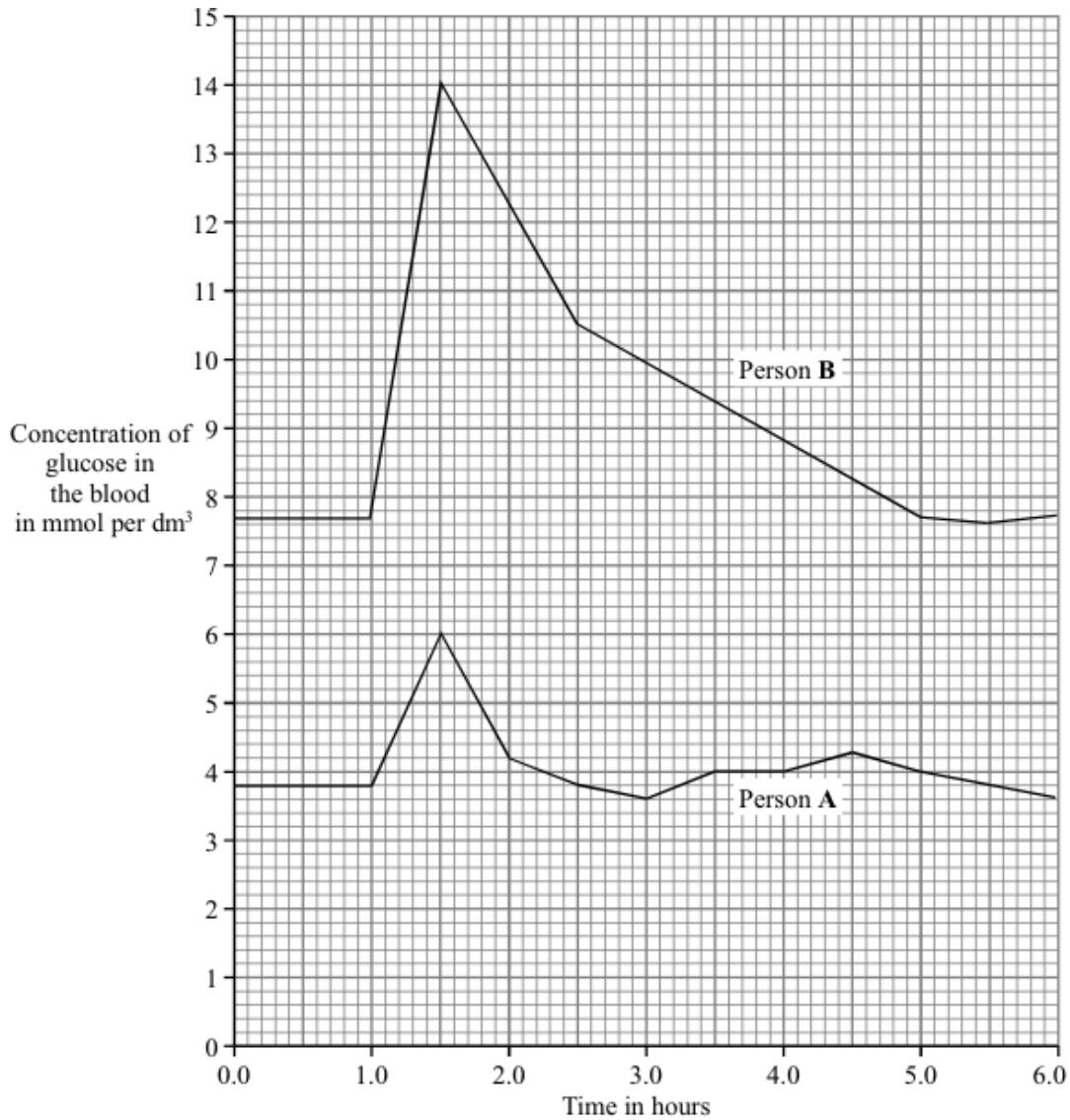
Give **one** advantage and **one** disadvantage of using the modern ventilator rather than the iron lung ventilator.

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(2)

(Total 10 marks)

Q5. The graph shows the concentration of glucose in the blood of two people. Person **A** is a non-diabetic. Person **B** has diabetes. Each person ate 75 grams of glucose at 1.0 hours.



- (a) (i) What was the maximum concentration of glucose in the blood of Person **A**?
 mmol per dm³ (1)
- (ii) After eating the glucose, how long did it take for the concentration of glucose in the blood of Person **B** to return to normal?
 hours (1)
- (b) A diabetic person does not produce enough insulin.
- (i) Which organ produces insulin?
 (1)

(ii) Write the letter **X** on the graph to show one time when the blood of Person A would contain large amounts of insulin.

(1)

(c) A high concentration of glucose in the blood can harm body cells as a result of osmosis. Explain why.

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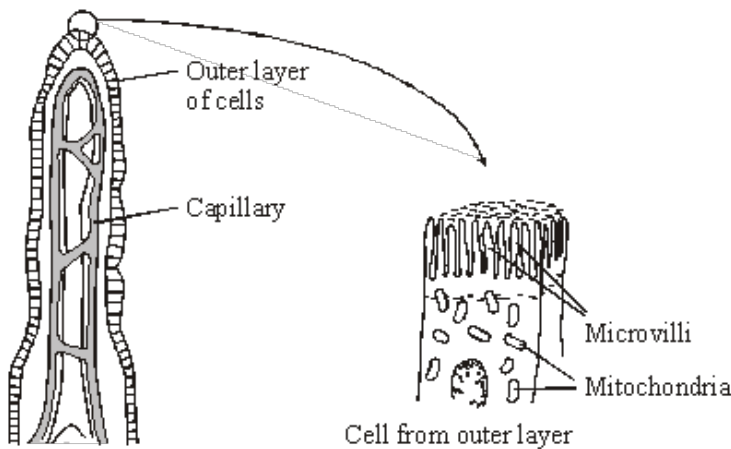
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(4)
(Total 8 marks)

Q6. The small intestine is lined with millions of villi. The diagram shows the structure of a villus.



In the small intestine, some of the products of digestion are absorbed into the blood by *active transport*.

(a) Explain what is meant by *active transport*.

.....

.....

.....

.....

(2)

- (b) How do microvilli and mitochondria help in the active transport of the products of digestion from the small intestine into the blood?

Microvilli

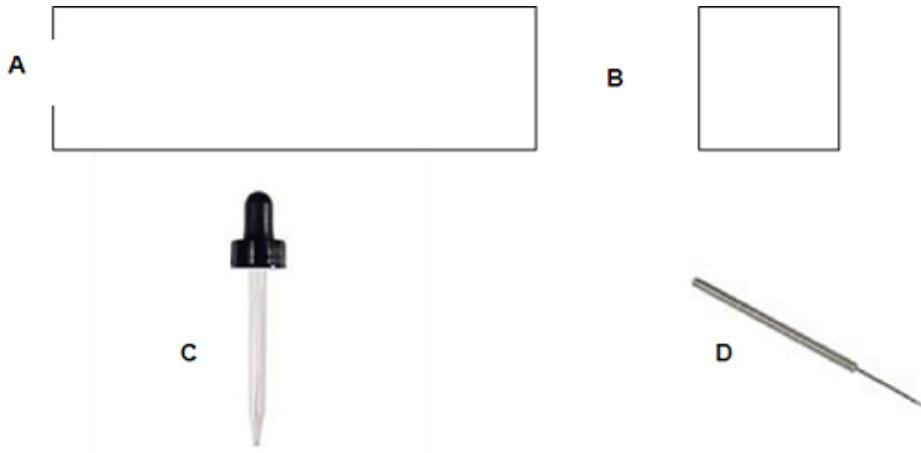
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Mitochondria

.....

(2)
(Total 4 marks)

- Q7.** (a) The diagrams show apparatus you could use to mount a piece of leaf epidermis for examination under a microscope.



- (i) Name the pieces of apparatus labelled **A**, **B**, **C** and **D** on the diagram.

A

B

C

D

(4)

- (ii) Describe how you would use **A**, **B**, **C** and **D** to mount a piece of leaf epidermis for examination under a microscope.

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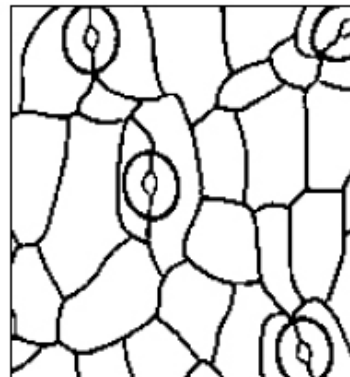
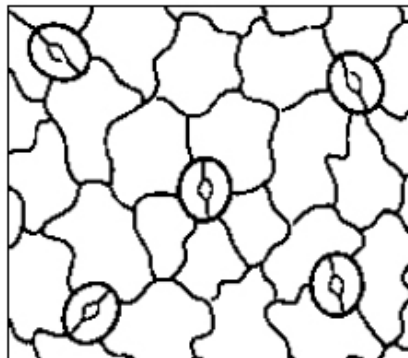
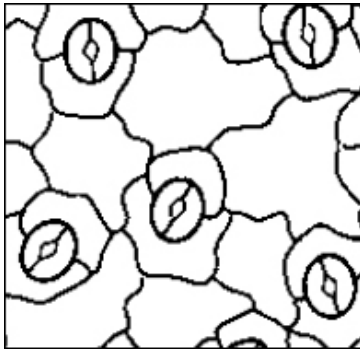
.....

(3)

- (b) A student used a grid on a microscope to estimate the number of stomata in some leaf epidermis.

The drawings show four of the grid squares the student observed.

Each grid has an area of 0.0001 mm².



- (i) Calculate the mean number of stomata per grid square.

.....

.....

Mean number of stomata per grid square

(2)

(ii) Calculate the mean number of stomata per 1 mm² of leaf epidermis.

.....

Mean number of stomata per 1 mm²

(2)

(iii) Each side of a grid square has a length of approximately 0.003 mm.

Use this information to estimate the length of a guard cell.

.....

Estimated length of guard cell mm

(2)

(c) A group of students looked at stomata on four different species of plant, **W**, **X**, **Y** and **Z**.

The students estimated the number of stomata per cm² on the upper and lower surfaces of the leaves of the four species.

The results are shown in the table.

Plant species	Estimated number of stomata per cm ² of leaf surface	
	Upper surface of leaf	Lower surface of leaf
W	4000	28 000
X	0	800
Y	8500	15 000
Z	8000	26 000

(i) Which plant species, **W**, **X**, **Y** or **Z**, probably lives in a dry region?

Explain why you have chosen this species.

.....

.....

.....

.....

.....

(3)

- (ii) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this feature could improve the chances of the survival for the plants.

.....

.....

.....

.....

(2)
(Total 18 marks)

M1. (a) $\frac{1}{5}$ / 20% / 1 in 5 / 1 : 4 / 0.2 /
any correct proportion
ignore working
*do **not** allow 1 : 5*

$\frac{600}{3000}$ / 600 : 2400 / 600 in 3000
award 1 mark for
*selection of 3000 **and** 600*

2

(b) (i) sweat / sweating / perspiring
allow cooling / for cooling / to lose heat / to cool

1

(ii) the volume of water in the urine decreases.

1

the volume of water taken as food or drink increases.

1

(c) (i) liver
apply list principle

1

(ii) kidney
apply list principle

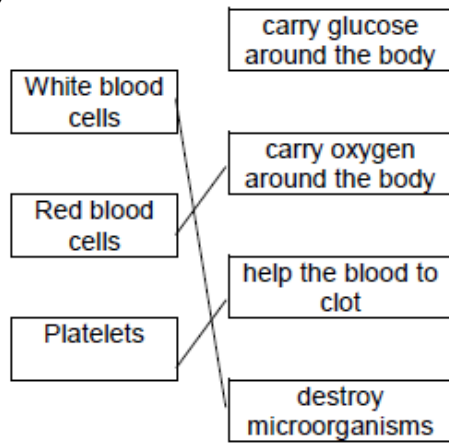
1

(iii) bladder
apply list principle

1

[8]

M2. (a) (i)



one mark for each line
extra line negates a mark

3

(ii) any **one** from:

- carbon dioxide / CO₂
 - urea
- do **not** allow urine
ignore water
ignore ions

1

(b) (i) B

1

(ii) D

1

(iii) vein

accept correct named
examples

1

(c) (i) any **one** from:

- keeps artery / blood vessel open **or** widens artery / blood vessel
- allows (more) blood to heart / cardiac muscle
- (allows) blood to flow more easily
- allows (more) oxygen to heart / cardiac muscle

1

(ii) any **two** from:

- bleeding
allow blood clots
- infection
- damaging blood vessels
- damaging the heart
- risk from anaesthetic

2

[10]

M3. (a) any **three** from:

- (water through a) partially permeable
accept 'semi permeable' / selectively permeable
- membrane
- from dilute to (more) concentrated solution
allow 'from a high concentration of water to a lower concentration (of water)'
allow 'from high water potential to low water potential'
allow 'down a concentration gradient of water'
*do **not** accept 'along a concentration gradient of water'*
- (it's a) passive (process)
allow requires no energy

3

(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

[6]

M4. (a) (i) rise then fall

1

to peak at 0.48 dm^3 / after 1.2s

1

(fall) back to 0 / (falling) back after 2.5s

allow 2.6s

allow after a further 1.3s / 1.4s

1

(ii) rise / air in caused by upward/outward movement of ribcage

1

decrease / air out caused by return of ribcage to original position/downward

1

and (rise / air in) by downward movement / flattening of diaphragm

or

(decrease / air out) by upward movement / doming of diaphragm

ignore contraction and relaxation of muscles

ignore reference to pressures, ribcage expanding

1

- (b) (i) in iron lung atmospheric / outside pressure forces air into lungs
allow air sucked / drawn into lungs

1

in modern respirator air forced (mechanically) into lungs

allow for one mark pressures acts externally in iron lung and internally in modern ventilator

1

- (ii) advantage

any **one** from:

- more freedom of movement for patient
- more portable
- does not affect blood flow in lower body
ignore cost

1

disadvantage

any **one** from:

- (tube in trachea) uncomfortable
- more difficult to eat / talk
allow it can damage / overinflate the lungs / over breathe

1

[10]

- M5.** (a) (i) 6

1

- (ii) 4

1

- (b) (i) pancreas

ignore islets of langerhans

1

- (ii) 'X' anywhere between >1 and ≤ 2 hours
anywhere in that column

1

(c) any **four** from:

water movement

do **not** accept solution

out of cells

dilute to concentrated solution

accept reference to correct gradient -

high Ψ to low Ψ **or** high to low 'water concentration'

must be unambiguous – i.e. **not** 'high to low concentration'

accept low to high concentration

reference to partially / selectively

permeable membranes **or** described

cells shrink / get smaller

allow crenated

ignore plasmolysed / flaccid / floppy

etc

4

[8]

M6. (a) any **two** from:

- transport up / against concentration gradient / low to high concentration
- uses energy
- use of protein / carrier

2

(b) microvilli – large(r) surface area

accept have carriers

1

mitochondria – release energy **or** make ATP

do **not** accept 'makes energy'

1

[4]

M7. (a) (i) **A** – slide

1

B – coverslip

1

	C – (teat / bulb) pipette	1
	D – (mounted) needle	1
(ii)	place epidermis on (centre of) slide	1
	use pipette to add drop of liquid/ water / stain to epidermis	1
	use needle to lower coverslip onto liquid	1
(b) (i)	$18 \div 4$	1
	$= 4.5$	1
	<i>correct answer with or without working gains 2 marks</i>	
(ii)	$(1 \div 0.0001) \times 4.5$	1
	$= 45\ 000$	1
	<i>correct answer with or without working gains 2 marks</i>	
	<i>allow ecf from part (b)(i)</i>	
(iii)	$0.003 \div (\text{eg } 4 / 5 / 6)$	1
	0.0006	1
	<i>correct answer with or without working gains 2 marks</i>	
	<i>allow answers in range 0.0005 – 0.0007 inclusive</i>	
(c) (i)	X	1
	because it has the low(est) number of stomata	
	or	
	no stomata on upper surface	
	or	
	<u>only</u> 800 (on lower surface)	1
	which means there will be less transpiration / evaporation / water loss via stomata	1

(ii) it reduces amount of water (vapour)
or
reduces transpiration (from upper surface)

1

because lower surface is cooler

or

in the shade

or

covered by (folded) wilted leaf

1

[18]

