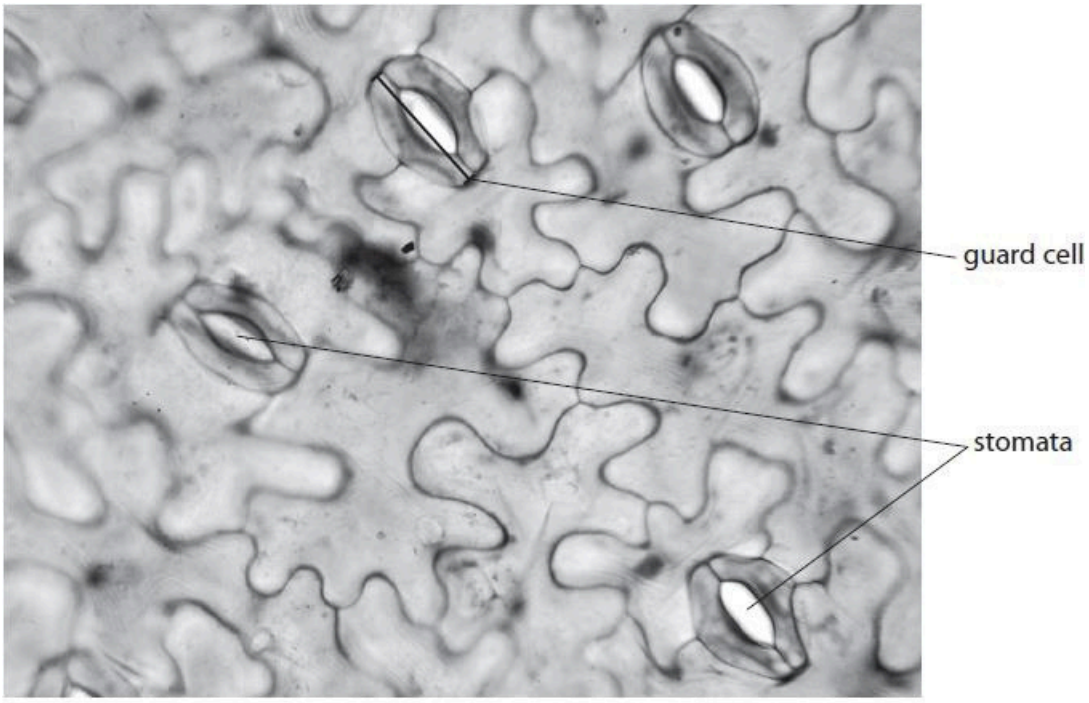
Questions

Q1.

Figure 13 shows guard cells and stomata on the lower surface of a leaf.



(Source: © Rattiya Thongdumhyu/Shutterstock)

Figure 13

Measure the length of the line on the labelled guard cell in mm.

The actual length of the labelled guard cell is 0.05 mm.

Calculate the magnification of this image.

(3)

magnification .....

(Total for question = 3 marks)

Q2.

Pine trees can live in dry soil.

Use words from the box to complete the sentences.

(2)

thickness	water	light
area	chlorophyll	volume

The pine leaf has stomata in pits to reduce the loss of .....

The pine leaf is needle-shaped to reduce the surface .....

(Total for question = 2 marks)

Q3.

* Marram grass is a plant that grows on exposed areas of sand dunes.

Figure 19 shows marram grass growing and a cross section through a leaf of marram grass.

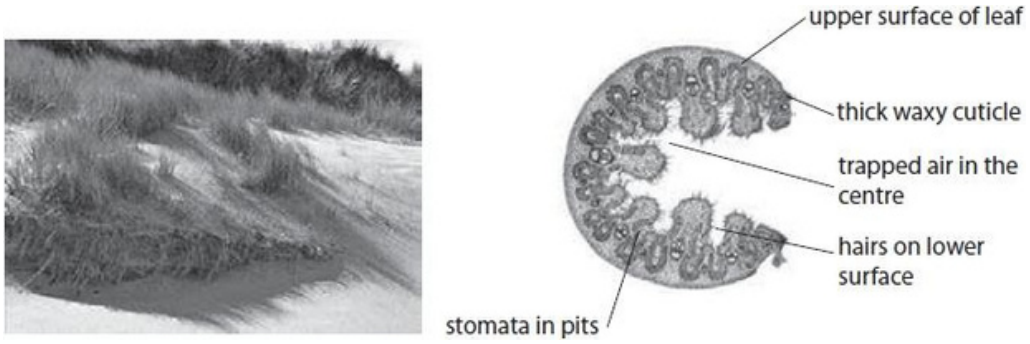


Figure 19

Explain how marram grass is adapted to survive in the hot, windy and dry conditions of a sand dune.

(6)

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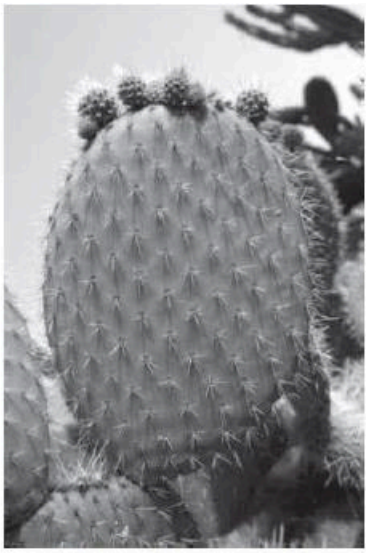
(Total for question = 6 marks)

Q4.

Figure 19 shows examples of two plants growing in a desert environment.

(Source: Steve Allen/Science Photo Library)



(Source: Pascal Goetgheluck/ Science Photo Library)

Figure 19

* Explain the adaptations that desert plants have that allow them to survive in this extreme environment.

(6)

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(Total for question = 6 marks)

Q5.

Figure 14 shows the number of stomata per mm2 on the lower surface of leaves from plants growing in soils with different water content.

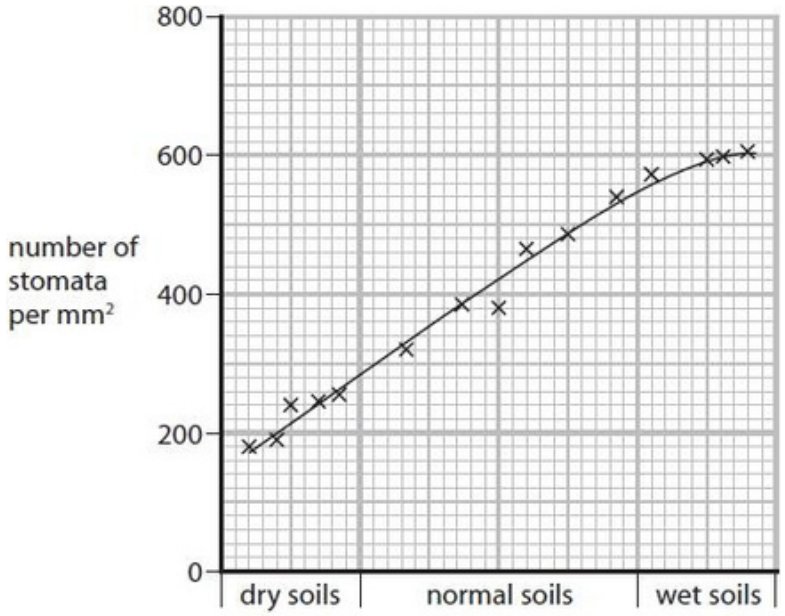

Figure 14

Explain the difference in the number of stomata per mm2 on the leaves of the plants grown in dry and wet soils.

(2)

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(Total for question = 2 marks)

Q6.

Figure 12 shows a cross section through a leaf.

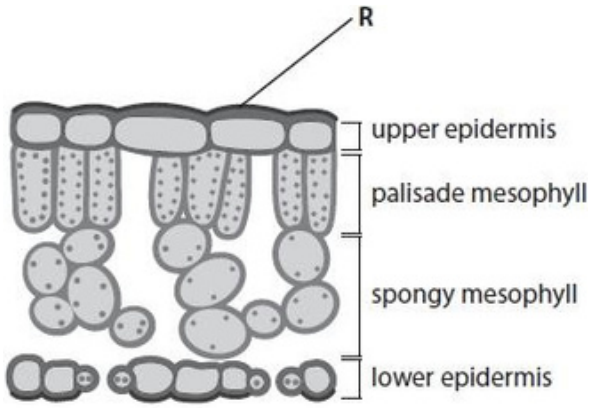

Figure 12

(i) What is the name of the part labelled R in Figure 12?

(1)

- ☒ A cell wall
- ☒ B cytoplasm
- ☒ C stomata
- ☒ D waxy cuticle

(ii) Figure 13 shows the mass of glucose produced in each layer of a leaf per hour.

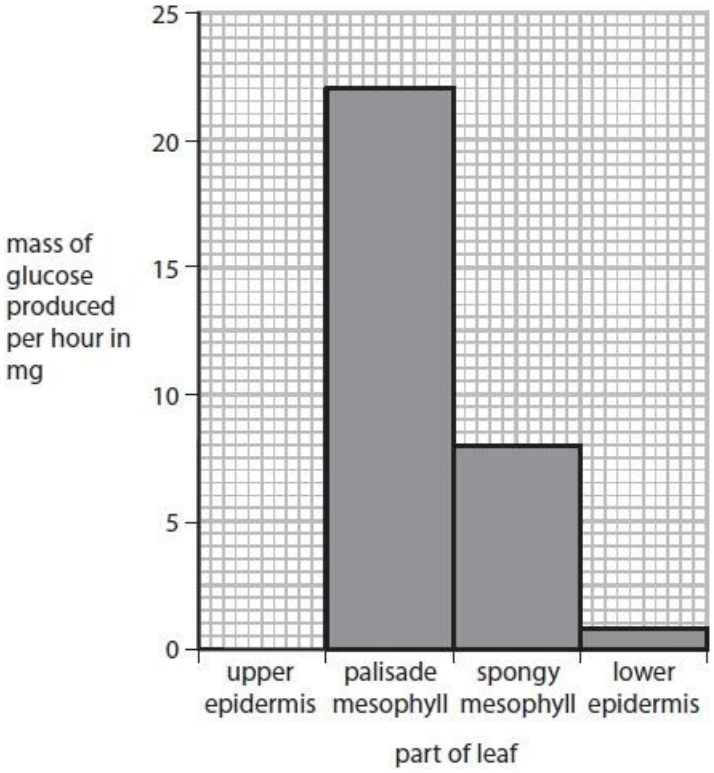

Figure 13

Describe the difference in the mass of glucose produced per hour in the palisade mesophyll and the mass of glucose produced in the spongy mesophyll shown in Figure 13.

(2)

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.....

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.....

(Total for question = 3 marks)

Q7.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 12 shows how the leaves are arranged on a plant.

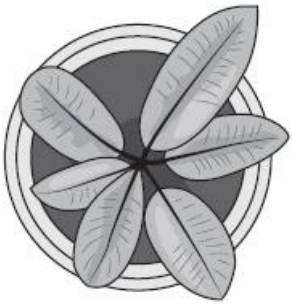

Figure 12

Which reason explains why the leaves are arranged in this way?

(1)

- ☐ A the upper leaves allow more light to reach the lower leaves
- ☐ B the leaves do not need stomata
- ☐ C the phloem in the leaves will absorb more water
- ☐ D more insects will be attracted to the plant to eat the leaves

(Total for question = 1 mark)

Q8.

Figure 1 shows a cross section of a leaf.

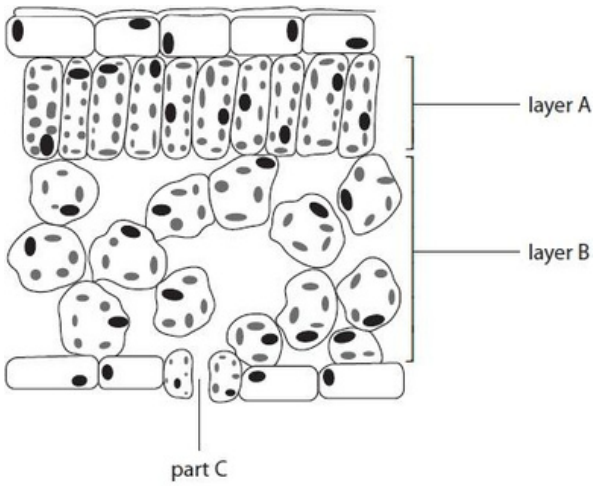

Figure 1

(i) What is the name of layer A?

(1)

- ☒ A spongy mesophyll
- ☒ B palisade mesophyll
- ☒ C upper epidermis
- ☒ D waxy cuticle

(ii) Explain the function of the spaces between the cells in layer B.

(2)

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(iii) Explain the function of part C in Figure 1.

(2)

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(Total for question = 5 marks)

Q9.

A scientist investigated how the flow of air affected the rate of transpiration in a plant.
A fan was used to change the flow of air.
The volume of water taken up by the plant was measured.
Figure 3 shows the results of this investigation.

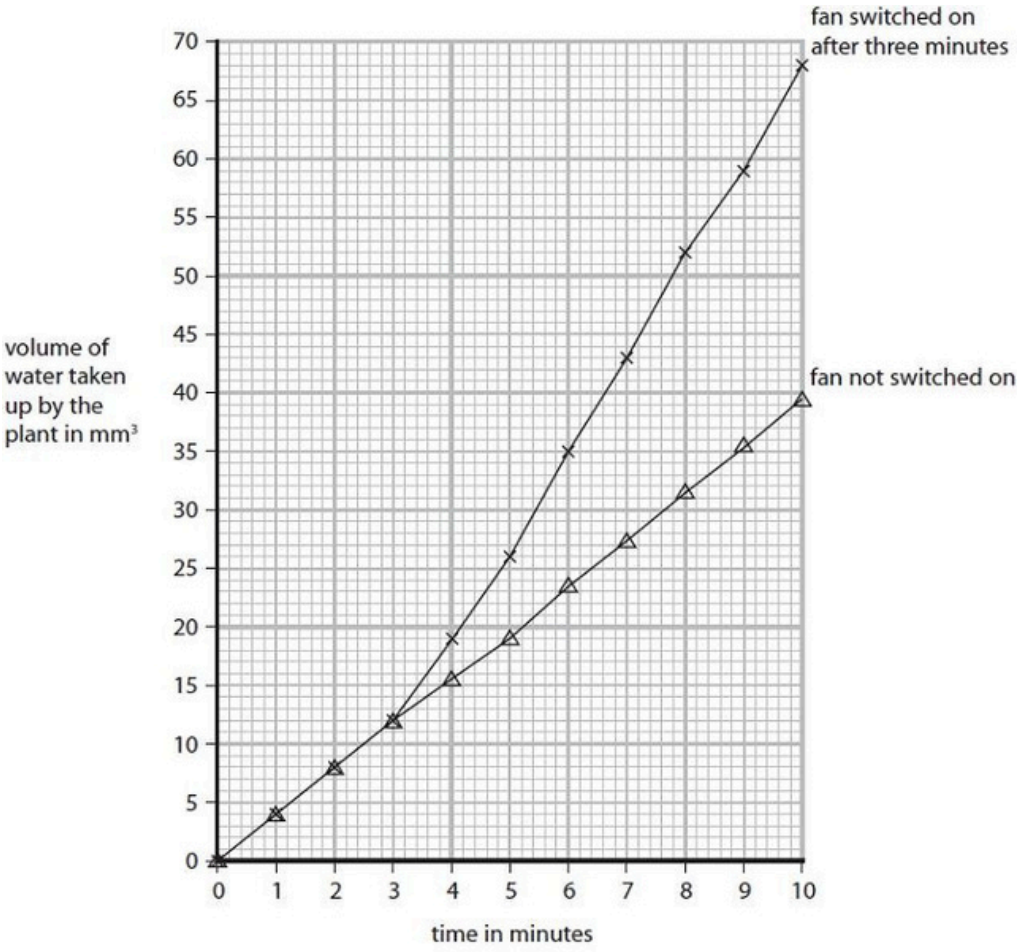

Figure 3

(i) Explain why switching on the fan caused a change in the volume of water taken up by the plant.

(3)

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(ii) Give one reason why the volume of water taken up by the plant was also measured when the fan was not switched on.

(1)

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.....

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(2)

..... mm3 per minute

(Total for question = 6 marks)

Q10.

A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

Figure 19a shows a nettle plant and Figure 19b shows a map of the woodland showing area A and area B.

The woodland caused area A to be in the shade.

(Source: © Alila Medical Media/Shutterstock)

Figure 19a

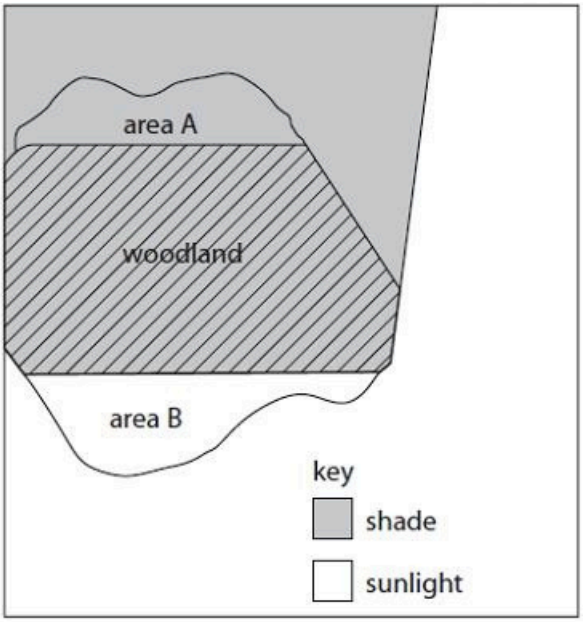

Figure 19b

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

Figure 20 shows the results.

nettle plant	width of the leaf in millimetres (mm)	
	area A	area B
1	45	33
2	50	25
3	48	27
4	52	(48)
5	47	28
mean	48	28

Figure 20

Why did the student not include the circled width when calculating the mean for area B?

(1)

- ☒ A it has not been measured in millimetres
- ☒ B it is an anomalous result
- ☒ C it is a repeat result
- ☒ D it is the mode value

(ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight.

(2)

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.....

(Total for question = 3 marks)

Q11.

Figure 1 shows a cross section of a leaf.

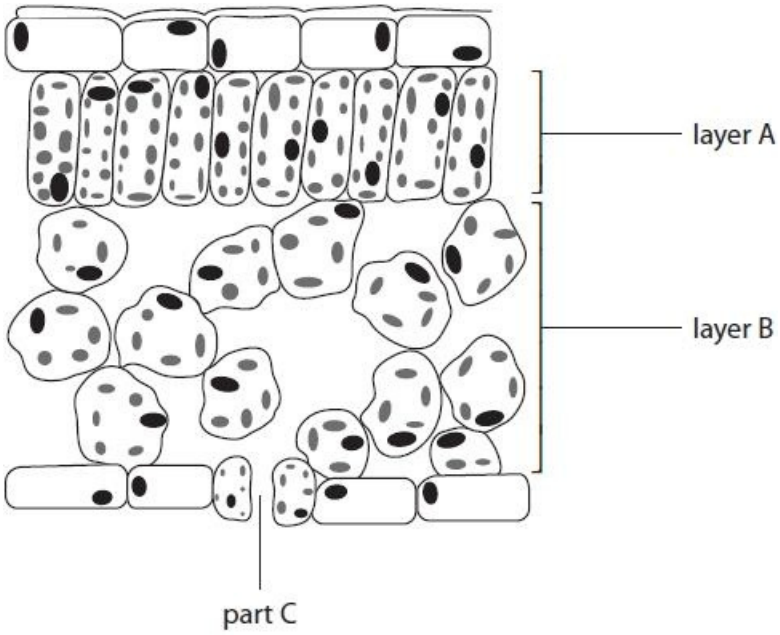

Figure 1

Xerophytes are plants adapted to live in very dry conditions.

State two differences between the leaf structure of a xerophyte and the leaf structure shown in Figure 1.

(2)

1 .....

.....

2 .....

.....

(Total for question = 2 marks)

Q12.

Figure 9 shows a cross section through a pine leaf.

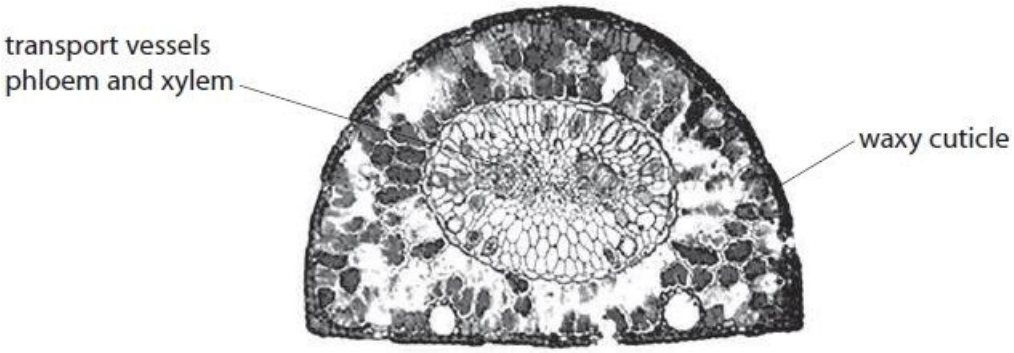

Figure 9

(i) Explain why the waxy cuticle is important for this pine leaf.

(2)

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(ii) The transport vessels are labelled on Figure 9.

Which row of the table is correct for the movement of sucrose through the plant?

(1)

	method of transport of sucrose through the plant	structure through which sucrose is transported
☐ A	transpiration	xylem
☐ B	transpiration	phloem
☐ C	translocation	xylem
☐ D	translocation	phloem

(Total for question = 3 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
	measurement 20 mm (1) substitution 20 ÷ 0.05 (1) evaluation 400 (times)	 accept ± 2 mm accept 18 to 22 ÷ 0.05 accept 360 to 440 (times) award full marks for answer with no working shown	**(3)** **AO2.2**

Q2.

Question number	Answer	Additional guidance	Mark
	water (1) area (1) accept phonetic spellings	Answers must be in the correct order	(2) AO2.1

Q3.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **Plant adaptations** • grass is flexible so does not break in the windy conditions • good root structure to prevent being uprooted in the windy conditions • long thin leaves to reduce wind damage / air resistance **leaf structure** • leaf is rolled to trap air inside • thick waxy cuticle to prevent water loss • by evaporation / transpiration • no stomata on the upper surface to prevent water loss • stomata in pits on the underside of the leaf to retain moist air and reduce water loss • hairs on the lower surface reduce air movement	**(6)** AO 1 1 AO 2 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • Presents an explanation with some structure and coherence.
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. • Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Q4.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2 (6 marks)** Adaptations • these desert plants have: o spines o small leaves o thick waxy cuticles o fleshy/swollen stem plant survival • spines, small leaves o reduced surface area o deter animals from eating for water o less water lost by evaporation o moist air trapped in curled leaves • thick waxy cuticle less water lost by evaporation • stem collects and stores water	**(6)**

Level	Mark	Descriptor
	0	No awardable content
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Q5.

Question Number	Answer	Additional guidance	Mark
	An explanation including • there are fewer stomata in plants in dry soils • (so) less water is lost by plants in dry soils / (because) plants lose water through stomata OR • there are more stomata in plants in wet soils (1) • (as) more water can be lost by plants in wet soils / (because) plants lose water through stomata (1)	 accept as the soils get wetter the number of stomata increases accept as the soils get wetter the number of stomata increases	**(2)** **AO3.1ab**

Q6.

Question number	Answer	Mark
(i)	**D** waxy cuticle **1. The only correct answer is D** ***A*** *is not correct because R is not the cell wall* ***B*** *is not correct because R is not cytoplasm* ***C*** *is not correct because R is not the stomata*	**(1)** AO 2 1

Question number	Answer	Additional guidance	Mark
(ii)	A description including: • more glucose produced in the palisade (mesophyll) layer (1) • correct manipulation of data – e.g. 14 mg more / 2.75 times more (1)	 accept more than double / almost three times more.	**(2)** AO 3 1a AO 3 1b

Q7.

Question Number	Answer	Mark
	A the upper leaves allow more light to reach the lower leaves **The only correct answer is A** ***B*** *is not correct because the arrangement of leaves does not affect the need for stomata.* ***C*** *is not correct because the phloem does not absorb water and would not explain the leaf arrangement.* ***D*** *is not correct because the leaves would not be arranged to increase the amount of leaf eaten by insects.*	**(1)** **AO2.1**

Q8.

Question number	Answer	Mark
(i)	**B palisade mesophyll** **A.** *is not correct because spongy mesophyll is layer B* ***B*** **The only correct answer is B** ***C*** *is not correct because the upper epidermis is at the top of the leaf* ***D*** *is not correct because the waxy cuticle is above the upper epidermis*	**(1)** AO1 1

Question number	Answer	Mark
(ii)	An explanation linking: • gas exchange / diffusion (1) • so {carbon dioxide / oxygen} can enter the cells / so {carbon dioxide / oxygen / water} can leave the cells (1)	**(2)** AO1 1

Question number	Answer	Additional guidance	Mark
(iii)	An explanation linking two from: • part C is stoma (1) • allows gas exchange (1) • allows water (vapour) to leave (1)	 accept stomata accept correct named gases being exchanged	**(2)** AO2 1

Q9.

Question Number	Answer	Mark
(i)	An explanation including **three** from: • fan causes air to move / creates wind / increased air flow (1) • water (vapour) removed (from around leaf) (1) • **increased** {rate of diffusion / evaporation / transpiration} (of water vapour from leaf) (1) • causing the plant to take up more water (1)	**(3)** **AO2** **2**

Question Number	Answer	Additional Guidance	Mark
(ii)	to compare (the effect) / as a control	accept to get a baseline measurement	**(1)** **AO2 2**

Question Number	Answer	Additional guidance	Mark
(iii)	68 – 52 / 16 (1) (16 ÷ 2) 8 (mm^3 per minute)	award full marks for correct answer with no working e.c.f. for incorrect graph readings for 1 mark	**(2)** **AO2 1**

Q10.

Question Number	Answer	Mark
(i)	**B it is an anomalous result** **The only correct answer is B** ***A*** *is not correct because it is measured in millimetres* ***C*** *is not correct because it is not a repeat* ***D*** *is not correct because it is not the mode*	**(1)** **AO3 1a**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer linking: • the leaves in the {shade / area A} are wider (1) • to give a larger surface area / to absorb more light (1)	accept reverse argument	**(2)** **AO3** **2a+2b**

Q11.

Question number	**Answer**	**Additional guidance**	**Mark**
	Any two from: • leaf becomes a spine / reduced surface area (1) • (waxy) cuticle is thicker (1) • stomata are sunk in pits / fewer stomata /smaller stomata (1) • leaf is rolled / curled leaves(1) • guard cells / stomata close during the day (1)	accept leaf becomes narrower / smaller / thicker	**(2)** AO2 1

Q12.

Question number	Answer	Mark
(i)	An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark): • it surrounds the pine leaf (1) • so prevents water loss from the pine leaf/prevents dehydration (1)	(2)

Question number	Answer	Mark
(ii)	D	(1)