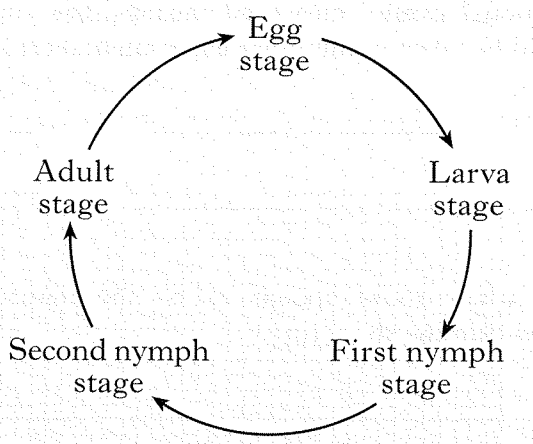
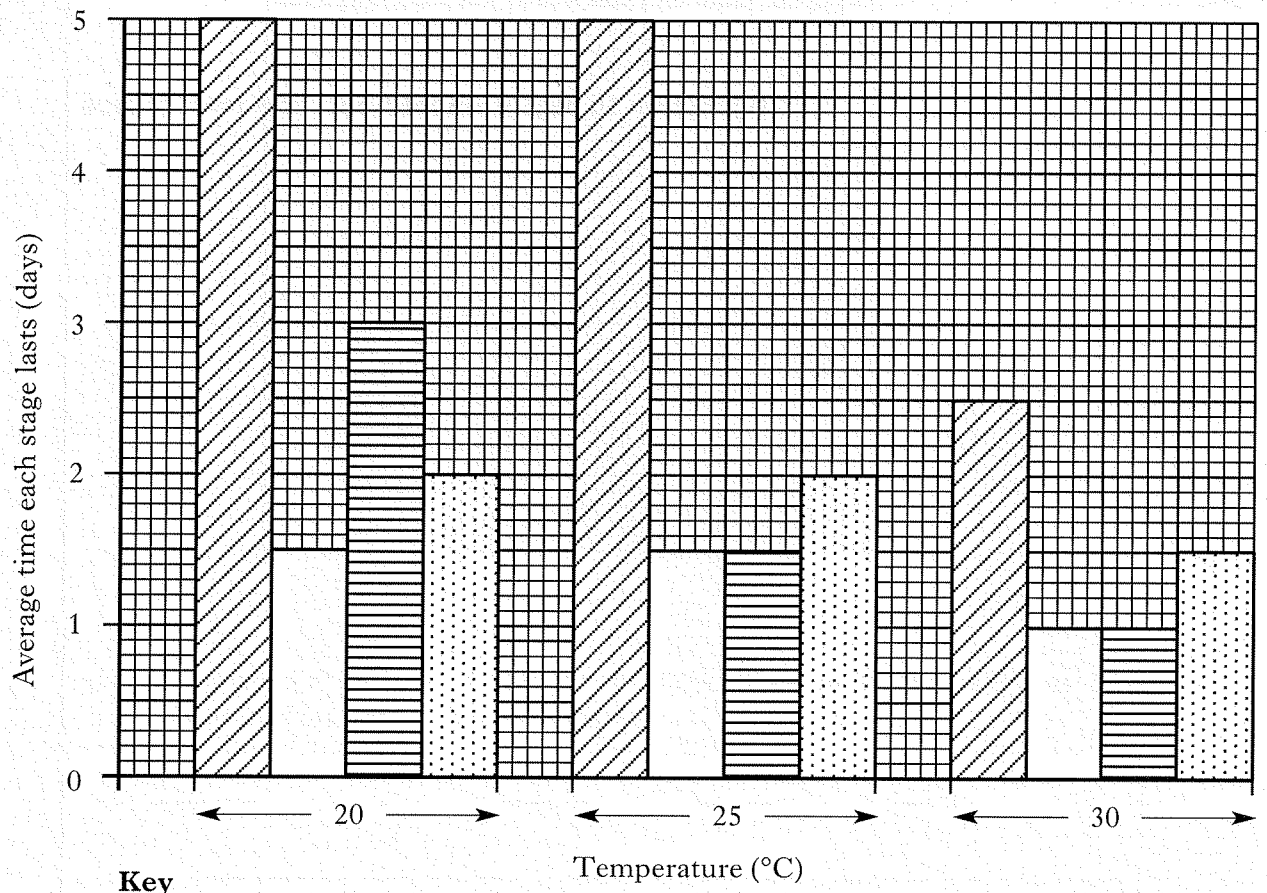
10. The red spider mite is a pest of crop plants. Stages in its life-cycle are shown in the diagram below.



An investigation was carried out into the effects of temperature on the time each of the early stages lasts. The results are shown in the bar graph below.



10. (continued)

Marks

(*a*) From the bar graph, calculate the difference in average time for development through the egg stage to the start of the adult stage at 20 °C and 30 °C.

Space for calculation

Difference _____ days **1**

Table 1 below shows the effect of temperature on features of egg laying in adult red spider mites.

Table 1

Features	*Temperature (°C)*		
	20 °C	*25 °C*	*30 °C*
Average time spent as an adult before first egg laid (days)	2·20	1·60	1·00
Average length of egg laying period (days)	18·40	14·80	10·36
Average number of eggs laid per female during egg laying period	92·00	88·80	62·16

(*b*) From Table 1, describe the relationship between temperature and each feature of egg-laying in adult female red spider mites.

_____

_____

_____

_____

_____ **2**

(*c*) From Table 1, calculate the average number of eggs laid per female per day during the egg laying period at 20 °C.

Space for calculation

Average number of eggs laid per female per day _____ **1**

10. (continued)

Marks

(*d*) From Table 1, calculate the percentage decrease in the average number of eggs laid per female during the egg laying period when the temperature is increased from 25 °C to 30 °C.

Space for calculation

% decrease _____ **1**

(*e*) From the information in the bar graph and Table 1, complete the table below by writing **True** or **False** in each of the spaces provided.

Statement	*True/False*
The time for the length of the first nymph stage is shortest at 30 °C.	
The egg stage lasts twice as long at 30 °C as at 25 °C.	
Only the first nymph stage is affected by a change from 20 °C to 25 °C.	
At 20 °C some adults may take more than 2·2 days to start laying eggs.	

2

(*f*) From the bar graph and Table 1, calculate the average time that it takes for development from the egg stage to the laying of the first egg at 25 °C.

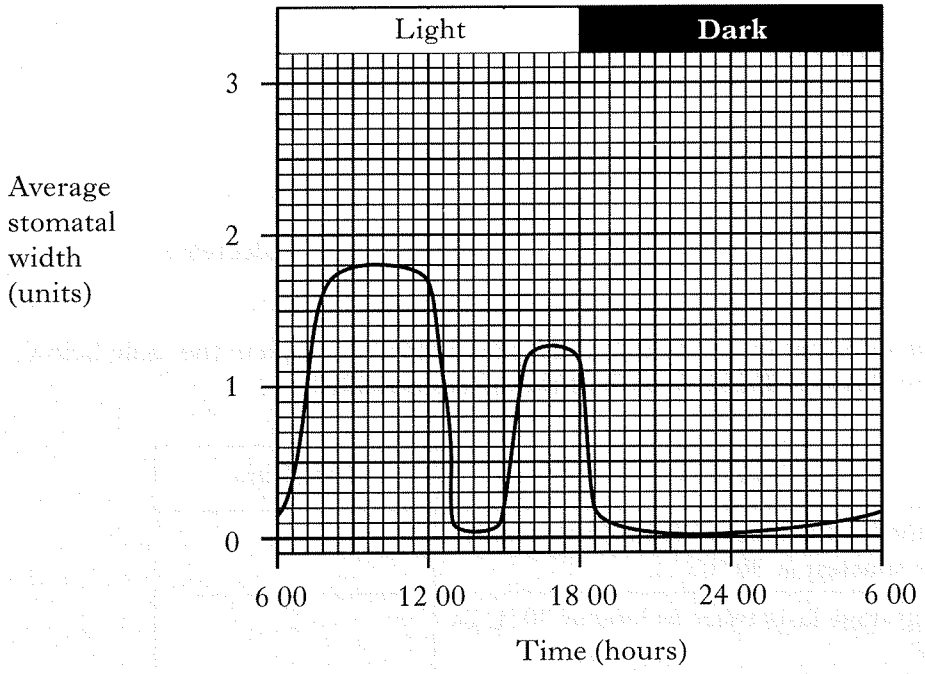
Space for calculation

Average time _____ days **1**

[Turn over

Marks

11. (*a*) The graph below shows changes in stomatal width over a 24-hour period of a plant species that is adapted to live in a hot climate.



(i) State the change in turgor that takes place in the guard cells to cause stomatal closure.

_____ **1**

(ii) 1 Explain how the pattern of change in stomatal width between 11 00 and 16 00 may benefit a plant that lives in a hot climate.

_____

_____

_____ **2**

2 Suggest a possible disadvantage to the plant of this pattern of change in stomatal width.

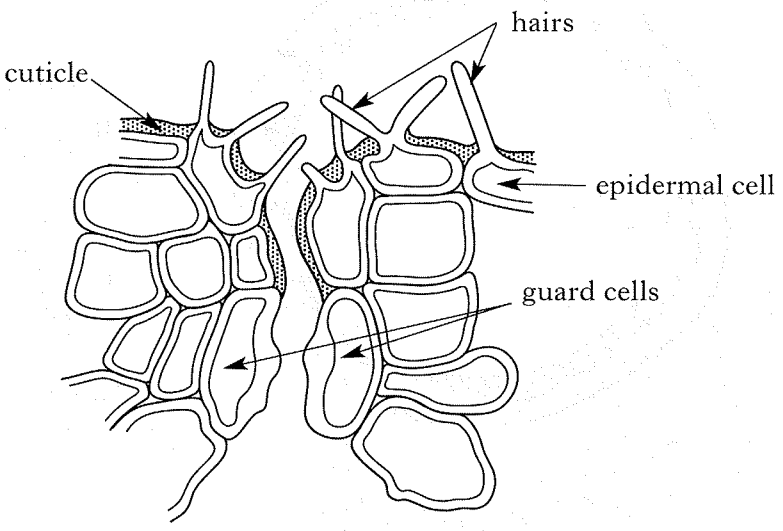
_____

_____ **1**

11. (continued)

Marks

(*b*) Plants that live in desert conditions have adaptations which reduce water loss. The diagram below shows part of a leaf section of a desert plant.



Complete the table below which shows leaf adaptations and explanations of how these reduce water loss.

Description of adaptation	*Explanation for reduction in water loss*
Presence of hairs on the leaf surface	
	Longer distance for water vapour to diffuse out of the leaf.

2

(*c*) Salmon and eels have adaptations associated with migration between freshwater and seawater.

(i) State the change that takes place in the glomerular filtration rate of these fish when they return to the sea.

_____ **1**

(ii) Describe the role of the chloride secretory cells when these fish are in seawater.

_____ **1**

(*d*) Describe **one** behavioural and **one** physiological adaptation shown by the desert rat to reduce water loss.

Behavioural _____

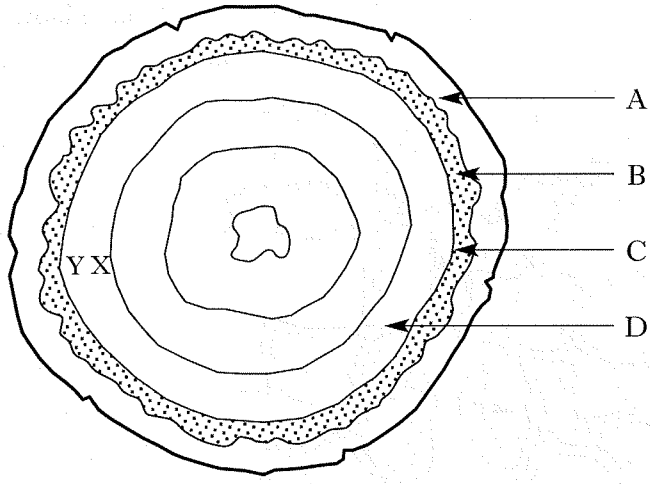
_____ **1**

Physiological _____

_____ **1**

Marks

12. (*a*) The diagram below represents a section through a woody stem.



(i) Name the lateral meristem in a woody stem.

_____ **1**

(ii) Which letter identifies this tissue?

Letter _____ **1**

(*b*) State whether the average diameter of the vessels in area X would be larger or smaller than those in area Y. Give a reason for your choice.

Average diameter of vessels in area X compared to area Y _____

Reason _____

_____ **1**

DO NOT WRITE IN THIS MARGIN

SECTION C

Marks

Both questions in this section should be attempted.

Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.

Supplementary sheets, if required, may be obtained from the invigilator.

Labelled diagrams may be used where appropriate.

1. Answer **either** A **or** B.

A. Write notes on each of the following:

(i) the structure of the plasma membrane; **3**

(ii) the structure and function of the cell wall; **3**

(iii) phagocytosis. **4**

(10)

OR

B. Write notes on each of the following:

(i) mRNA synthesis; **5**

(ii) the role of mRNA in protein synthesis. **5**

(10)

In question 2, ONE mark is available for coherence and ONE mark is available for relevance.

2. Answer **either** A **or** B.

A. Give an account of the Jacob-Monod hypothesis of lactose metabolism in Escherichia coli and the part played by genes in the condition of phenylketonuria. **(10)**

OR

B. Give an account of the effects of IAA on plant growth and the role of gibberellic acid in α-amylase induction in barley grains. **(10)**

[END OF QUESTION PAPER]

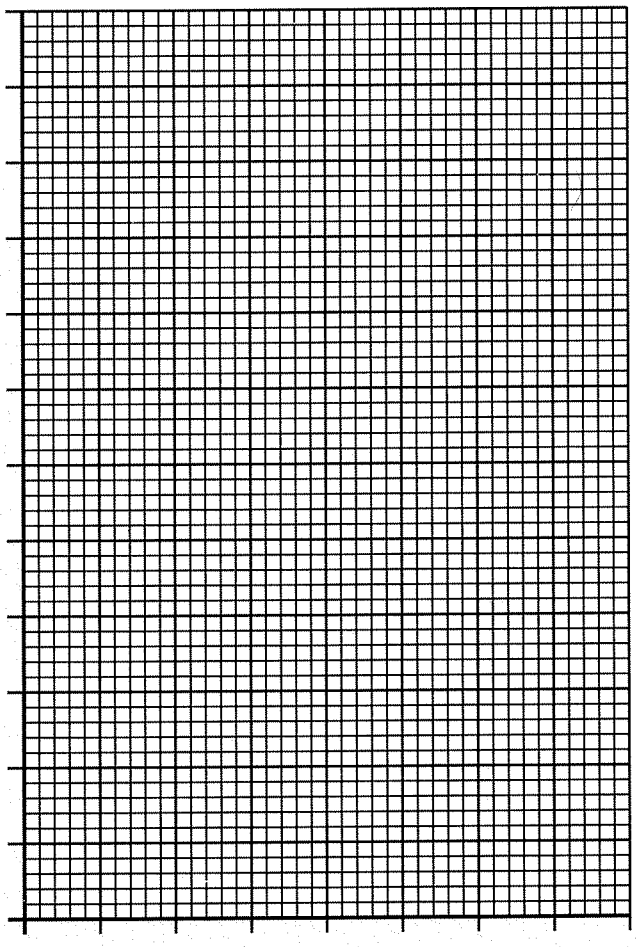
[Turn over

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 9(*a*)



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SPACE FOR ANSWERS