PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 9: CONTROL SYSTEMS

CHEMICAL CONTROL IN PLANTS

SCORE	PERCENTAGE
/89	%

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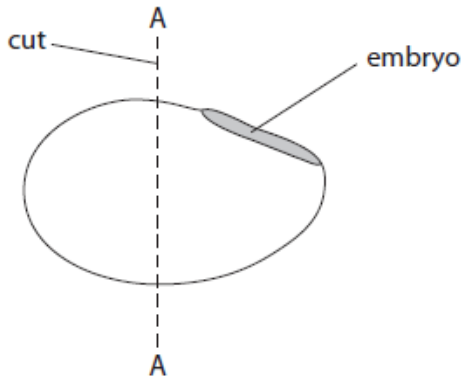
Q1.

Gibberellin stimulates amylase activity. Amylase converts insoluble starch into maltose.

A student suggested that developing embryos in seeds produce gibberellin.

To test this idea, the student carried out two experiments.

In each experiment barley seeds were cut as shown in the diagram.



The seed halves were sterilised by washing in bleach.

In the first experiment, seed halves that contained an embryo were placed on sterile starch agar.

Seed halves without an embryo were placed on sterile starch agar and on sterile starch agar containing gibberellin.

The seed halves were incubated for 48 hours at 25°C. Iodine solution was then poured over the agar.

The table shows the results of the student's first experiment.

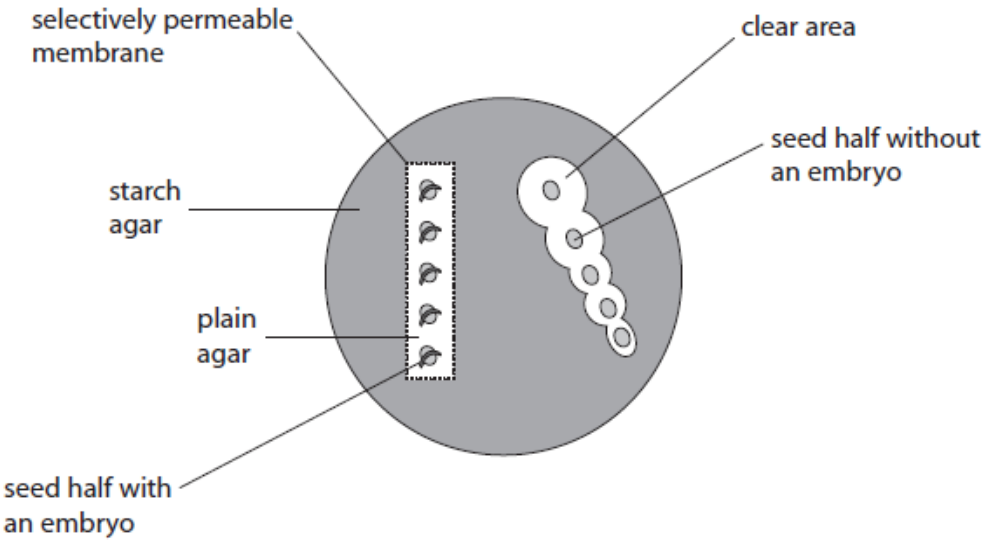
Agar	Seed halves	Result
starch	with an embryo	clear area around seed halves
starch	without an embryo	no clear area around seed halves
starch + gibberellin	without an embryo	clear area around seed halves

In the second experiment, seed halves containing an embryo were placed onto plain agar in a "boat" made from a selectively permeable membrane.

This boat was embedded in starch agar.

These seed halves were also incubated for 48 hours at 25 °C. Iodine solution was then poured over the agar.

The diagram shows the results from the second experiment.



(a) Explain why sterile conditions were maintained.

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*(b) Analyse the data from these two experiments to explain the results obtained by the student.

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(Total for question = 8 marks)

Q2.

Auxins and cytokinins are plant growth regulators that control apical dominance and cell elongation.

Explain how auxins and cytokinins control the growth of lateral buds.

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(Total for question = 3 marks)

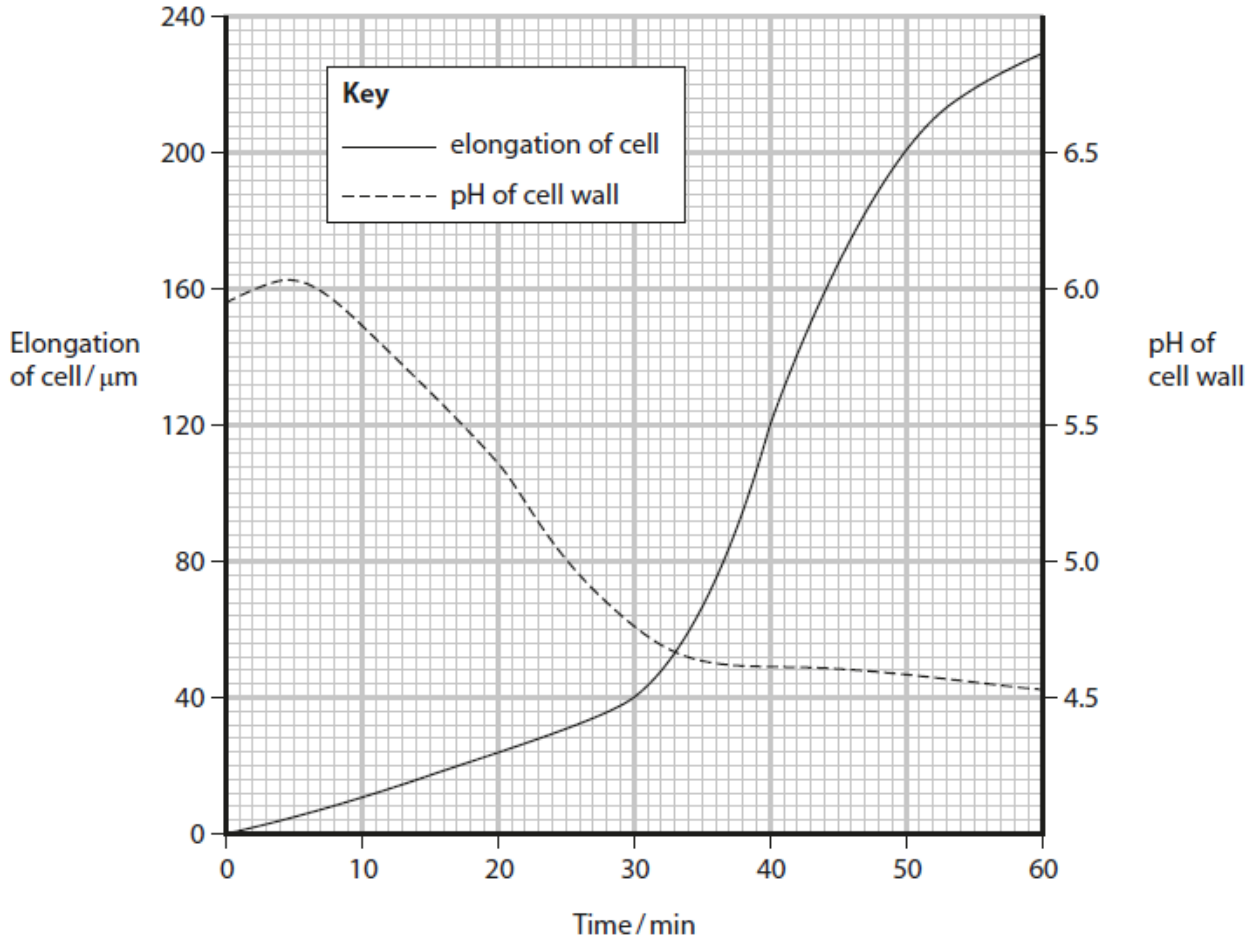
Q3.

Auxins and cytokinins are plant growth regulators that control apical dominance and cell elongation.

When auxin enters a cell, it causes hydrogen ions to be pumped out of the cell into the cell wall.

The effect of auxin on the pH of the cell wall and cell elongation was investigated. Auxin was added to plant cells. The pH of the cell wall and cell elongation were measured over a period of 60 minutes.

The results are shown in the graph.



(i) Calculate the maximum rate of elongation of the cell.

(2)

Answer .....

(ii) Expansin is a protein located in cell walls.

Expansin disrupts hydrogen bonds and ionic bonds of molecules in the cell wall.

Deduce a mechanism by which auxin and expansin cause cells to elongate.

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(Total for question = 5 marks)

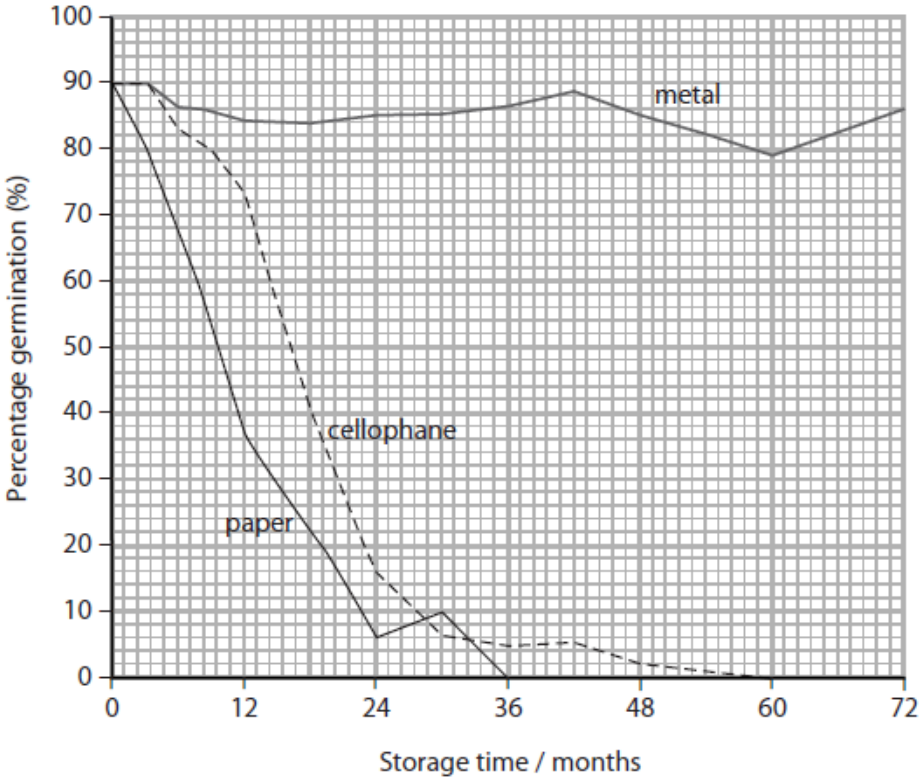
Q4.

Seed banks store seeds for future use. Seeds can be stored for a long time if the seeds are kept dry with a moisture content of less than 8%.

The seeds are stored in closed containers. The percentage germination of the seeds is measured to test their viability during storage.

At the Millennium Seed Bank, the seeds are stored in closed glass containers at 15% relative humidity at a temperature of –20°C.

The graph shows the percentage germination of seeds kept in three different closed containers: metal, cellophane and paper. They were kept for 72 months at a temperature of –20°C.



(a) Analyse the data to explain why seeds are stored in glass containers in the Millennium Seed Bank.

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(b) Each time the seeds are tested for viability, 50 seeds are used.

State why 50 seeds are used.

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(c) Calculate the rate of change in viability of the seeds stored in a cellophane container for the first two years.

(2)

Answer .....

(d) Seeds from other parts of the world are stored in seed banks.

(i) Explain how the viability test would be different for these seeds from other parts of the world.

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(ii) Explain why plants grown from these germinating seeds may not flower at the same time of year as they would have done in their country of origin.

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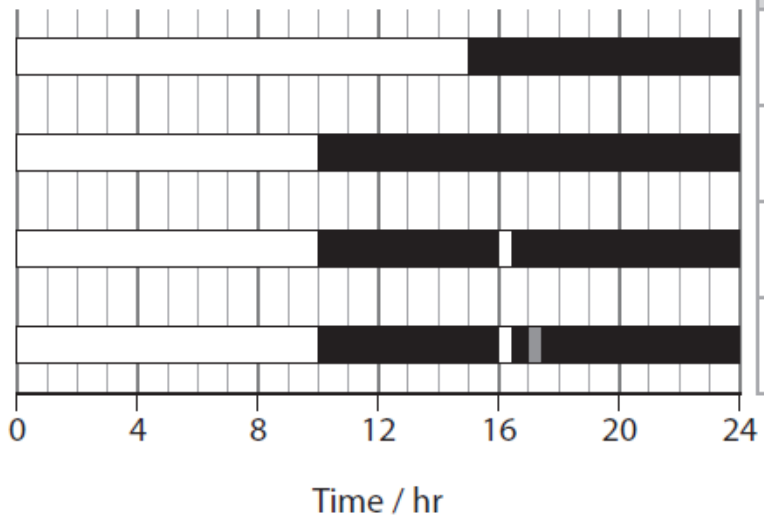
(Total for question = 12 marks)

Q5.

* The effect of day length on flowering in two species of plants, *Kalanchoe* and *Sedum*, was investigated.

The effect of different periods of light and darkness and the effects of exposure to far red light were investigated.

The diagram shows the results of this investigation.



Kalanchoe	*Sedum*
no flowers	flowers
flowers	no flowers
no flowers	flowers
flowers	no flowers

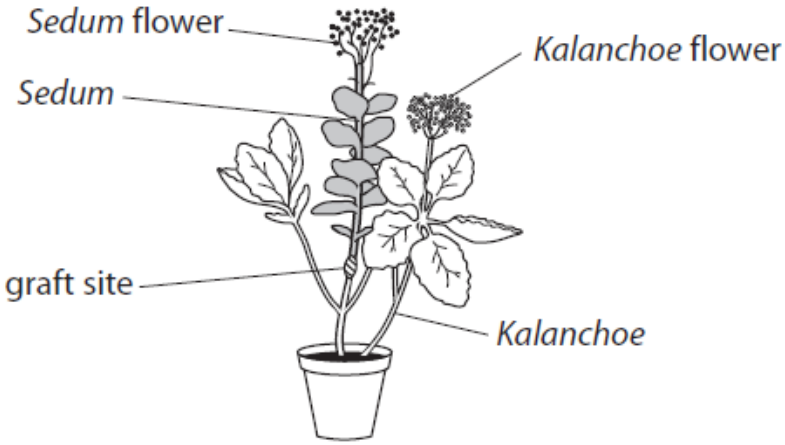
Key

- light
- dark
- far red light

In another investigation, a piece of *Sedum* was grafted onto the stem of a *Kalanchoe* plant.

This plant and graft were exposed to 10 hours of light followed by 14 hours of darkness.

The *Kalanchoe* and the *Sedum* graft both produced flowers, as shown in the diagram.



Analyse the data to explain the effects of different light periods and far red light on flowering in *Kalanchoe* and *Sedum*.

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(Total for question = 6 marks)

Q6.

Chemical control in plants involves plant growth substances.

Which of the following effects are caused by auxin?

(1)

1 cell elongation

2 suppression of lateral bud growth

3 photomorphogenesis

☒ **A** 1 and 2

☒ **B** 1 and 3

☒ **C** 2 and 3

☒ **D** 1, 2 and 3

(Total for question = 1 mark)

Q7. The scientific article you have studied is adapted from several sources.

Use the information from the article and your own knowledge to answer the following questions.

(a) The sweet potato eaten by naked mole rats (paragraph 3) is very rich in starch. Starch can be a combination of amylose and amylopectin.

Give **two** structural differences between amylose and amylopectin.

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(b) Explain why a colony of naked mole rats is considered 'a eusocial society' (paragraph 4).

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(c) Naked mole rats show evidence of poikilothermy (paragraph 5).

(i) Explain what is meant by the term **poikilothermic**.

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(ii) Suggest how each of the following 'contribute to poikilothermic responses to changing temperature of this mammal'.

(2)

'Lack of an insulating layer'

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'A marked reduction in sweat glands'

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(d) Suggest a mechanism that could have been used to genetically modify cells from mice with cancer-causing genes (paragraph 13).

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*(e) Whilst naked mole rats are 'impervious to chemical pain' they do feel 'acute pain such as cuts and burns' (paragraph 31).

Touching something hot, which could lead to a burn, can cause nerve impulses to travel along myelinated sensory neurones very rapidly.

Explain how myelination increases the speed of transmission of nerve impulses in a sensory neurone.

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(f) Explain how a heart attack can temporarily reduce the oxygen concentration in brain tissue (paragraph 36).

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(g) Using the information in paragraph 48, name **one** hormone **and** state its function.

(1)

Hormone:

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Function:

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(h) Suggest how a change in the mid region of the sperm may make it non-motile (paragraph 48).

(2)

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(i) Disperser naked mole rats 'are laden with fat' (paragraph 50).

Suggest why it may be advantageous for disperser naked mole rats to have high levels of fat.

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(j) Explain the statement that 'a preference by reproductively active females for unfamiliar males is interpreted as inbreeding avoidance' (paragraph 52).

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(k) 'The naked mole rat hasn't yet had its genome sequenced' (paragraph 53).

Explain what is meant by the term **genome sequenced**.

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(l) 'With so much to offer science, it is no surprise that naked mole rats are becoming more common in labs' (paragraph 53).

Using information from the article, describe **two** adaptations of naked mole rats. For each adaptation, explain why it could be of interest in a medical research laboratory.

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(Total for Question = 30 marks)

Q8.

Light is involved in the germination of lettuce seeds. This is an example of photomorphogenesis.

The germination is affected by the wavelength of light the seeds receive.

The table below shows the percentage germination of lettuce seeds when exposed to light of different wavelengths.

Wavelength of light	Percentage germination (%)
red only	97
far red only	4
period of red followed by a period of far red	4
period of far red followed by a period of red	96

Explain how red and far red light affects the germination of lettuce seeds.

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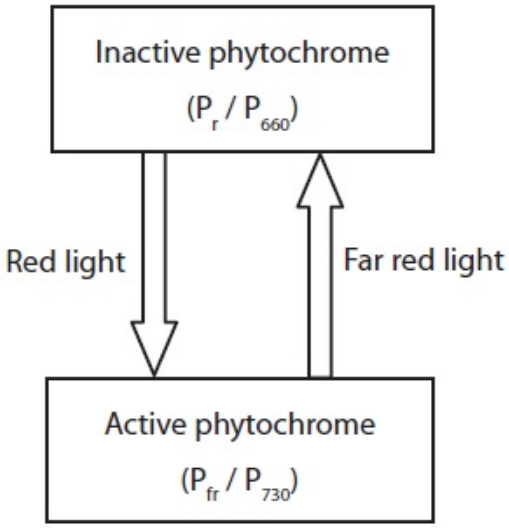
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(Total for question = 4 marks)

Q9.

Phytochromes are photoreceptors found in many plants.

(a) The diagram below shows the interconversion of inactive phytochrome (P_r / P_{660}) and active phytochrome (P_{fr} / P_{730}).



State **one** way in which the active form of phytochrome can be converted back to the inactive form, other than by exposing it to far red light.

(1)

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(b) A study was carried out to investigate the effect of red light and far red light on sunflower plants.



A sunflower

Magnification × 0.5

One group of sunflower seedlings, group A, was grown under a lamp that emitted red light and far red light of the same intensity.

Another group of sunflower seedlings, group B, was grown in the same way, except that the lamp emitted a lower intensity of red light. The intensity of far red light was unchanged.

When the plants were fully grown, the mean dry mass of the flowers produced and the mean length of the plant stems were recorded.

This study was repeated using new groups of sunflower seedlings.

The results are shown in the table below.

Study	Mean dry mass of the flowers / g		Mean stem length / cm	
	Group A	Group B	Group A	Group B
Original	58	45	125	148
Repeat	43	38	124	142

(i) Using the mean dry mass of the flowers shown in the table, compare the results of group A with group B for both the original and repeat studies.

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(ii)The light conditions experienced by group B were similar to those found near ground level in woodland.

Using the mean stem lengths shown in the table, suggest the importance of these light conditions for a young seedling in the woodland.

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(iii) A statistical analysis of the data for mean stem length was carried out.

The analysis showed that there was a significant difference between the mean stem length data for groups A and B. However, there was no significant difference between the data from the original study and the repeat study.

Suggest a conclusion for the effect of light on mean stem length and use the results of this statistical analysis to comment on the reliability of the data.

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(Total for question = 10 marks)

Q10.

Plant growth substances and phytochromes are chemicals that affect the growth of plants.

Phytochrome is involved in the germination of seeds.

The effect of red (R) light and far-red (FR) light on the germination of lettuce seeds was investigated.

A scientist exposed five groups of 50 seeds to red light for one minute.

The seeds were planted and the mean number that germinated was calculated.

Another five groups each of 50 seeds were then exposed to red light for one minute, followed by far-red light for four minutes.

These seeds were planted and the mean number that germinated was calculated.

The experiment was repeated with different combinations of red light and far-red light.

The results are shown in the table.

Sequence of red (R) and far-red (FR) light	Mean number of seeds that germinated	Standard deviation (SD)
R	45	±4
R, FR	5	±2
R, FR, R	45	±5
R, FR, R, FR	10	±4
R, FR, R, FR, R	40	±9

Analyse the data to comment on the effect of red (R) and far-red (FR) light on the germination of lettuce seeds.

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(Total for question = 4 marks)

Q11.

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 ☒.

Plant growth substances and phytochromes are chemicals that affect the growth of plants.

(i) Which row of the table shows the concentrations required for the fastest growth of lateral buds?

		Auxin concentration	Cytokinin concentration
☒	**A**	high	high
☒	**B**	high	low
☒	**C**	low	high
☒	**D**	low	low

(ii) Some types of auxin affect the activity of cells in the same way as hormones such as oestrogen affect human cells.

These auxins pass through the cell membrane and affect the synthesis of enzymes.

Explain how these auxins affect the synthesis of enzymes.

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(Total for question = 3 marks)

Q12.

Chemical control in plants is brought about by plant growth substances such as auxins.

Auxins cause elongation of cells.

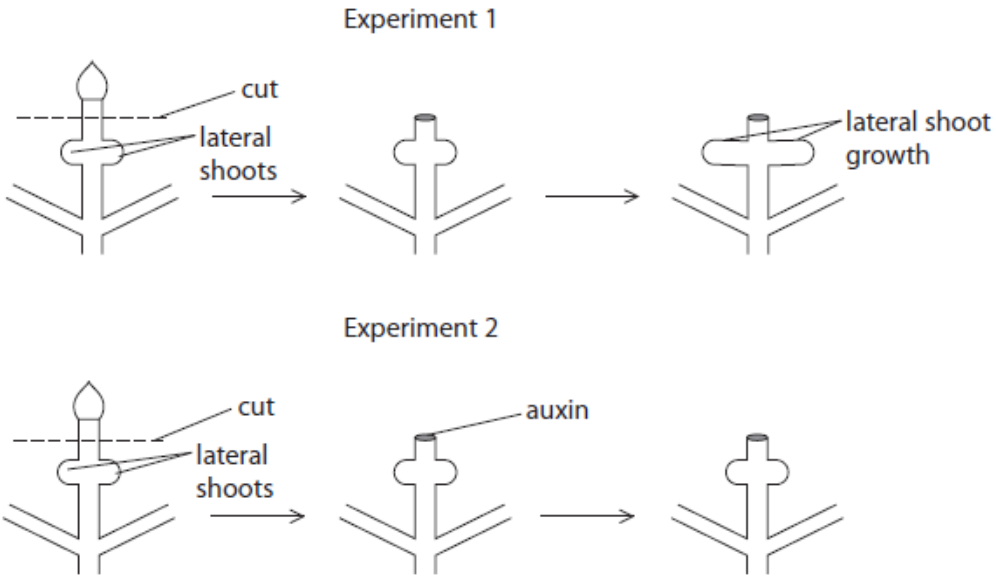
Auxins weaken the bonds between molecules found in cell walls. Molecules found in cell walls include cellulose and hemicellulose.

A scientist investigated apical dominance in plants.

In experiment 1, the shoot tips were cut off and the growth of lateral shoots assessed.

This was repeated in experiment 2, but auxin was placed over the cut end of the tips and the growth of lateral shoots was assessed.

The results are shown in the diagrams.



Explain how the interaction between auxins and cytokinins could have produced the results shown in the diagram.

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(Total for question = 3 marks)