

Questions**Q1.**

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.

(i) Which of the following statements about cellulose molecules is correct?

(1)

- A** they are branched polymers
- B** they contain α -glucose
- C** they are bonded to each other by hydrogen bonds
- D** they contain 1,6 glycosidic bonds

(ii) The following statements relate to calcium pectate:

1. found in the middle lamella
2. cell walls together
3. prevents the movement of water

Which of the following is correct for calcium pectate?

(1)

- A** statement 1 and statement 2
- B** statement 1 and statement 3
- C** statement 2 only
- D** statement 3 only

(Total for question = 2 marks)

Q2.

Mineral ions are needed for plant growth.

A student had a plant that had been kept in the same soil for a long time.

The growth of the plant had slowed down and the leaves were pale green.

The student decided to add fertiliser to the plant and measure the increase in height of the plant.

The student made two predictions:

- the leaves would gradually become greener
- the plant would not start growing until the leaves were greener.

Explain why the student made these predictions.

(3)

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(Total for question = 3 marks)

Q3.

Mineral ions are needed for plant growth.

A student had a plant that had been kept in the same soil for a long time.

The growth of the plant had slowed down and the leaves were pale green.

The student decided to add fertiliser to the plant and measure the increase in height of the plant.

The student made two predictions:

- the leaves would gradually become greener
- the plant would not start growing until the leaves were greener.

The student used a stock fertiliser solution at a concentration of $500 \mu\text{g cm}^{-3}$.

Calculate the volumes of stock fertiliser solution and water that had to be mixed together to produce 100 cm^3 of fertiliser solution at a concentration of $50 \mu\text{g cm}^{-3}$.

(1)

Volume of stock fertiliser solution cm^3

Volume of water cm^3

(Total for question = 1 mark)

Q4.

Mineral ions are needed for plant growth.

A student had a plant that had been kept in the same soil for a long time.

The growth of the plant had slowed down and the leaves were pale green.

The student decided to add fertiliser to the plant and measure the increase in height of the plant.

The student made two predictions:

- the leaves would gradually become greener
- the plant would not start growing until the leaves were greener.

When the fertiliser was added to the plant, the height of the plant was 130 cm.

Six weeks after the fertiliser was added, the plant had grown to a height of 155 cm.

Calculate the mean growth rate for this plant, in centimetres per day, in this six-week period.

(1)

Answer cm day⁻¹

(Total for question = 1 mark)

Q5.

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 .

Transpiration moves water and mineral ions from the roots to the leaves of plants.

Which box in the table shows the mineral ions needed to make an amino acid and which box shows those needed to make DNA?

(2)

Molecule	Mineral ions needed to make the molecule			
	nitrate ions only	phosphate ions only	both nitrate and phosphate ions	neither nitrate nor phosphate ions
amino acid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DNA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(Total for question = 2 marks)

Q6.

White clover plants provide a rich source of nitrogen for cattle when grown with grass plants in fields.

The photograph shows a clover plant growing in a field of grass.



Clover plants have bacteria living in root nodules.

These bacteria convert atmospheric nitrogen (N₂) to ammonia (NH₃) using the enzyme nitrogenase.

- (i) State one organic molecule containing nitrogen atoms which is found in plant cells.

(1)

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- (ii) Nitrogen is a relatively unreactive gas that forms 80% of the atmosphere.

The enzyme nitrogenase catalyses the reaction shown:



The activation energy for this reaction is very high.

Analyse the information to explain how the enzyme nitrogenase is involved in the energy changes required for this reaction.

(4)

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(Total for question = 5 marks)

Q7.

Plants require mineral ions from the soil for healthy growth.

(i) Describe how mineral (inorganic) ions are taken up by active transport.

(3)

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(ii) Describe the function of a named mineral ion that is vital for the growth of plants.

(2)

Mineral ions

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Function

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(Total for question = 5 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>The only correct answer is C (they are bonded to each other by hydrogen bonds)</p> <p>A is not correct because cellulose molecules are not branched polymers</p> <p>B is not correct because cellulose molecules do not contain α - glucose, they contain β - glucose</p> <p>D is not correct because cellulose molecules do not contain 1,6 glycosidic bonds, they contain 1,4 glycosidic bonds</p>		(1)
Question Number	Answer	Additional Guidance	Mark
(ii)	<p>The only correct answer is A (statement 1 and statement 2)</p> <p>B is not correct because calcium pectate does not prevent the movement of water</p> <p>C is not correct because calcium pectate is also found in the middle lamella</p> <p>D is not correct because calcium pectate does not prevent the movement of water</p>		(1)

Q2.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none"> • magnesium ions needed for chlorophyll (1) • nitrate needed for {protein / amino acids} (1) • (leaves gradually become greener) because it takes a while for chlorophyll to be made (1) • (delay in plant growth) because plant needs to photosynthesise before plant can grow (1) 	<p>ACCEPT greener because chlorophyll is made</p> <p>ACCEPT photosynthesis / protein synthesis needed for growth</p>	<p>(3) EXP</p>

Q3.

Question Number	Answer	Additional Guidance	Mark
	<ul style="list-style-type: none"> • 10 cm³ fertiliser + 90 cm³ water 		<p>(1) GRAD</p>

Q4.

Question Number	Answer	Additional Guidance	Mark
	<ul style="list-style-type: none"> • 0.6 (cm day⁻¹) 	<p>ACCEPT 0.595 Do not accept 0.59</p>	<p>(1) CLER</p>

Q5.

Question Number	Answer	Additional Guidance	Mark																			
			(2)																			
	<table border="1"> <thead> <tr> <th rowspan="2">Molecule</th> <th colspan="4">Mineral ions used</th> </tr> <tr> <th>nitrate ions only</th> <th>phosphate ions only</th> <th>both nitrate and phosphate ions</th> <th>neither nitrate nor phosphate ions</th> </tr> </thead> <tbody> <tr> <td>amino acid</td> <td>X</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>DNA</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td>X</td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	Molecule	Mineral ions used				nitrate ions only	phosphate ions only	both nitrate and phosphate ions	neither nitrate nor phosphate ions	amino acid	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DNA	<input type="checkbox"/>	<input type="checkbox"/>	X	<input type="checkbox"/>		
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Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	<p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> (the nitrogen can be incorporated into) protein (1) 	Allow {DNA / RNA / organic base / amino acid / named protein / ATP /chlorophyll}	(1)
(ii)	<p>An explanation that makes reference to the following:</p> <ul style="list-style-type: none"> enzyme lowers the activation energy (for the reaction) (1) a large number of ATP molecules is used (1) because the reaction needs a lot of energy (1) to compensate for nitrogen being unreactive (1) 		(4)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that includes three of the following: <ul style="list-style-type: none"> • moved {across membrane / into cell / into root} by carrier proteins (1) • against a concentration gradient (1) • using ATP (1) 	Accept protein pumps Ignore channel proteins Accept from a low to a high concentration	Exp (3)

Question Number	Answer	Additional Guidance	Mark
(ii)	<ul style="list-style-type: none"> • suitable mineral ion named (1) • appropriate function given (1) 	<p>Mp2 can be given if suitable mineral not named eg nitrogen for nitrate</p> <p>eg</p> <p>nitrate / (ammonium) – formation of amino acids / proteins / enzymes / nucleic acids / nucleotides / DNA / RNA / chlorophyll</p> <p>phosphate – formation of nucleotides / nucleic acids / DNA / RNA / ATP / ADP / amino acids</p> <p>calcium – formation of middle lamella / calcium pectate</p> <p>magnesium – formation of chlorophyll</p> <p>Accept other correct mineral ions with correct functions potassium, sodium, iron etc</p>	Exp (2)