Control and Coordination in Plants (15.2): Cambridge (CIE) A Level Biology 9700 Exam Questions by Topic

22 questions · 58 marks · about 70 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · information from earlier in the question

7 **(a)** The Venus fly trap, *Dionaea muscipula*, is a plant that can capture insects. Each leaf of a Venus fly trap is modified to form 2 lobes.

Fig. 7.1 shows how the leaf of a Venus fly trap appears folded (closed) when an insect has been captured.



Fig. 7.1

Question 1 · Paper 4 · October/November 2025 (42) · Q7(a)(iv) · 1 mark

(iv) When an insect has been trapped, the leaves have to remain closed for a number of days.

Suggest why this needs to happen.

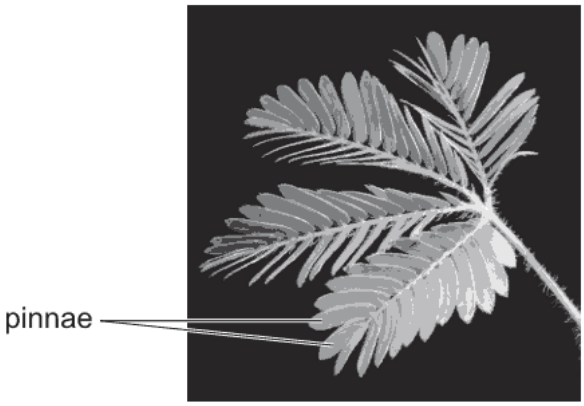
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4 The leaves of *Mimosa pudica* plants are made of a number of structures known as pinnae. The pinnae fold when the leaf is touched. This closes the leaf.

Fig. 4.1 shows an open leaf of *M. pudica* before it is touched. Fig. 4.2 shows the same leaf that has closed after being touched.



A open (not touched)

Fig. 4.1



B closed (touched)

Fig. 4.2

(a) A touch stimulus to an *M. pudica* leaf causes an action potential to be generated.

The action potential results in changes in cells, which cause the leaf to close.

Fig. 4.3 shows the mechanism in *M. pudica* cells that causes the leaf to close.

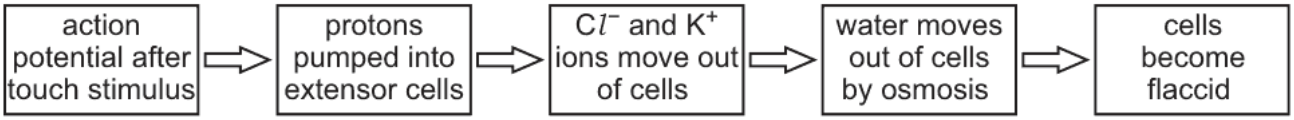


Fig. 4.3

The leaves of *M. pudica* and the leaves of Venus fly traps move in response to touch stimuli, but the mechanisms that cause the responses are different.

Describe the differences between the mechanism shown in Fig. 4.3 and the mechanism that causes the closure of the modified leaves in Venus fly traps.

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Question 3 · Paper 4 · February/March 2021 (42) · Q5(b)(i) · 1 mark

(b) The Venus fly trap is a plant that is able to capture and digest insects. It has modified leaves, which have sensory hairs that respond to touch. When an insect comes into contact with the hairs, receptor potentials are generated.

(i) Name the ion that moves into the cells at the base of the sensory hairs to generate receptor potentials.

Question 4 · Paper 4 · February/March 2021 (42) · Q5(b)(ii) · 1 mark

(ii) If two or more of these hairs are stimulated within a period of 20–35 seconds, action potentials are generated, causing the leaf to close quickly and trap the insect.

Suggest why it is beneficial to the plant for stimulation of two or more hairs to be necessary before the leaf will close.

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Question 5 · information from earlier in the question

7 The Venus fly trap, *Dionaea muscipula*, is a carnivorous plant, native to wetlands of the East Coast of the USA. Mineral ions from decayed organisms are often washed away in these wetlands.

Fig. 7.1 shows a Venus fly trap leaf.

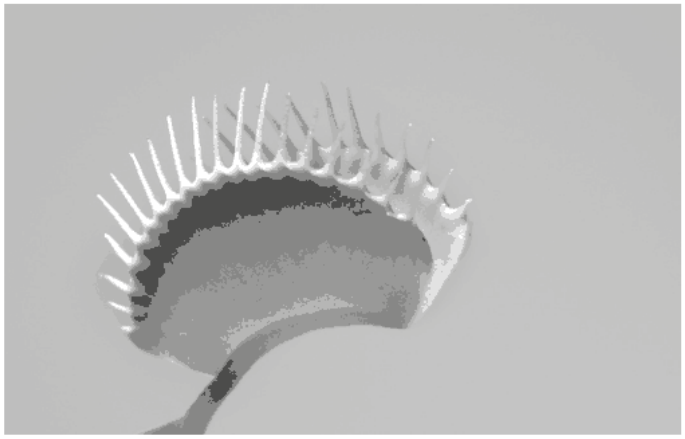


Fig. 7.1

Question 5 · Paper 4 · October/November 2019 (42) · Q7(b)(i) · 1 mark

(b) (i) The leaves of the Venus fly trap will close if stimulated by an insect.

State which part of the leaf detects the stimulus.

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Question 6 · Paper 4 · October/November 2019 (42) · Q7(b)(ii) · 1 mark

(ii) Explain how the plant does not waste energy by closing when it does not need to, such as when a large drop of rain touches the receptor.

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Question 7 · Paper 4 · October/November 2019 (42) · Q7(d) · 5 marks

(d) Describe how the production of action potentials in the leaf cells of the Venus fly trap can result in the leaves closing and trapping an insect.

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Question 8 · Paper 4 · February/March 2024 (42) · Q9(b) · 7 marks

(b) After germination, auxin is important in the growth of barley plants.

Describe **and** explain the role of auxin in cell elongation.

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Question 9 · Paper 4 · October/November 2023 (41) · Q3(d)(ii) · 2 marks

(ii) The passage outlines the role of auxin in elongation growth in plants.

Complete the passage by using the most appropriate scientific terms.

The binding of auxin to receptors causes ..... to be pumped into cell walls.

This activates proteins called expansins, which disrupt the links between

..... microfibrils. The cell walls are then able to expand.

[2]

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Question 10 · Paper 4 · May/June 2023 (41) · Q3(a)(iv) · 3 marks

(iv) Auxin is a plant growth hormone that affects the growth of rice stems.

Explain how auxin affects the growth of rice stems.

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(b) Growth in plants occurs in areas such as shoot and root tips. Growth occurs by cell division and cell elongation.

Fig. 3.2 shows the effect of the plant growth regulator auxin on mean cell length in the shoot tips of wheat seedlings.

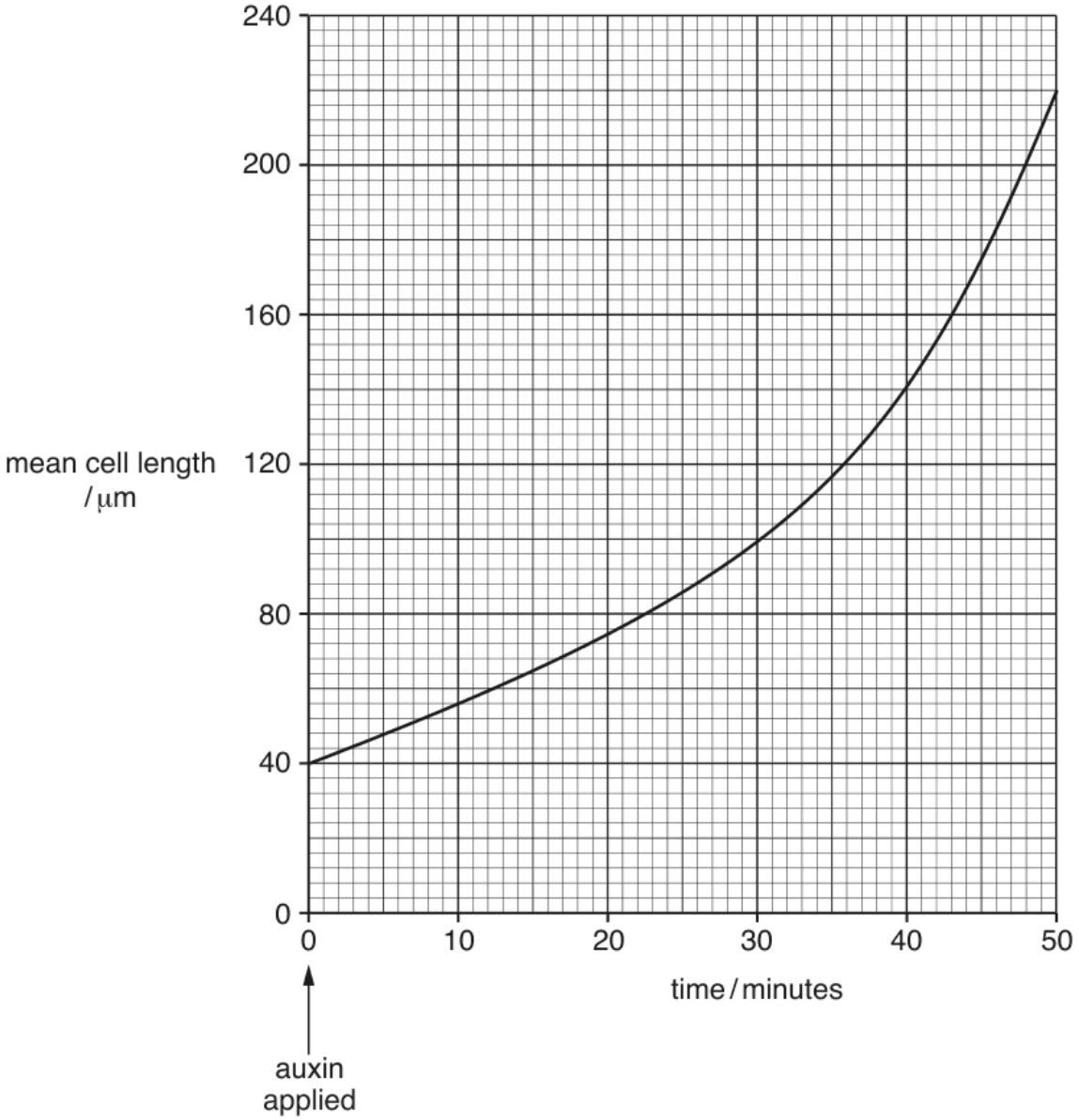


Fig. 3.2

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Question 11 · Paper 4 · February/March 2017 (42) · Q3(b)(ii) · 2 marks

(ii) The pH of the cell walls decreased after the application of auxin.

Outline the events that occurred to cause this decrease in pH.

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Question 12 · Paper 4 · February/March 2017 (42) · Q3(b)(iii) · 3 marks

(iii) Explain the increase in the length of the cells following the decrease in pH of the cell walls.

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Question 13 · Paper 4 · May/June 2022 (42) · Q6(a) · 2 marks

6 (a) Gibberellin is a plant hormone that has an important role in seed germination.

Fig. 6.1 is a diagram of a section through a barley seed (grain).

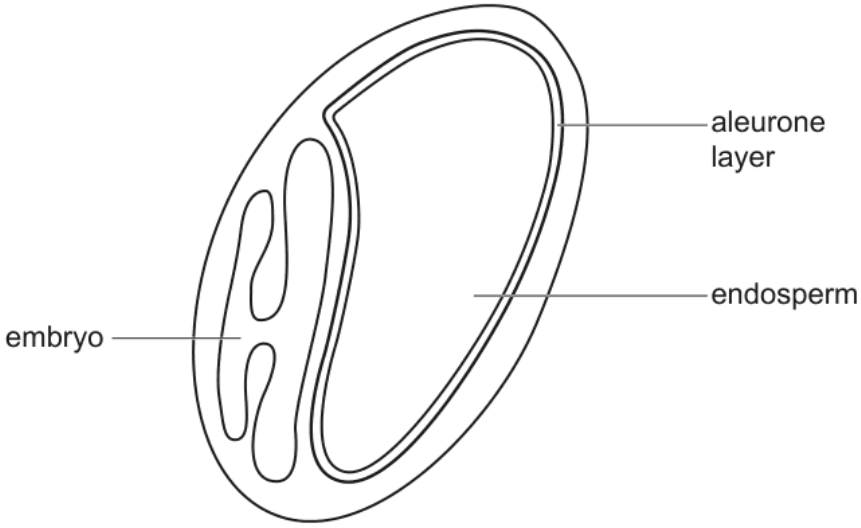


Fig. 6.1

On Fig. 6.1:

- Draw **one** arrow, labelled **G**, to show the movement of gibberellin during germination.
- Draw **one** arrow, labelled **A**, to show the movement of amylase during germination.

[2]

Question 14 · Paper 4 · May/June 2022 (42) · Q6(b) · 3 marks

(b) Outline the role of amylase in seed germination.

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Question 15 · Paper 4 · October/November 2021 (42) · Q3(a) · 3 marks

3 During the germination of barley seeds, amylase is produced.

(a) Describe the sequence of events that lead to the production of amylase during germination of barley seeds.

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Question 16 · Paper 4 · October/November 2021 (42) · Q3(b)(i) · 1 mark

(b) Malting is a process involved in the production of a drink called beer. During malting, barley seed germination is controlled so that the sugars produced during germination can be used in the production of beer.

Fig. 3.1 shows two features of a germinating barley seed during the first five days of malting:

- activity of the amylase enzyme
- the percentage of starch reserves remaining in the barley seed.

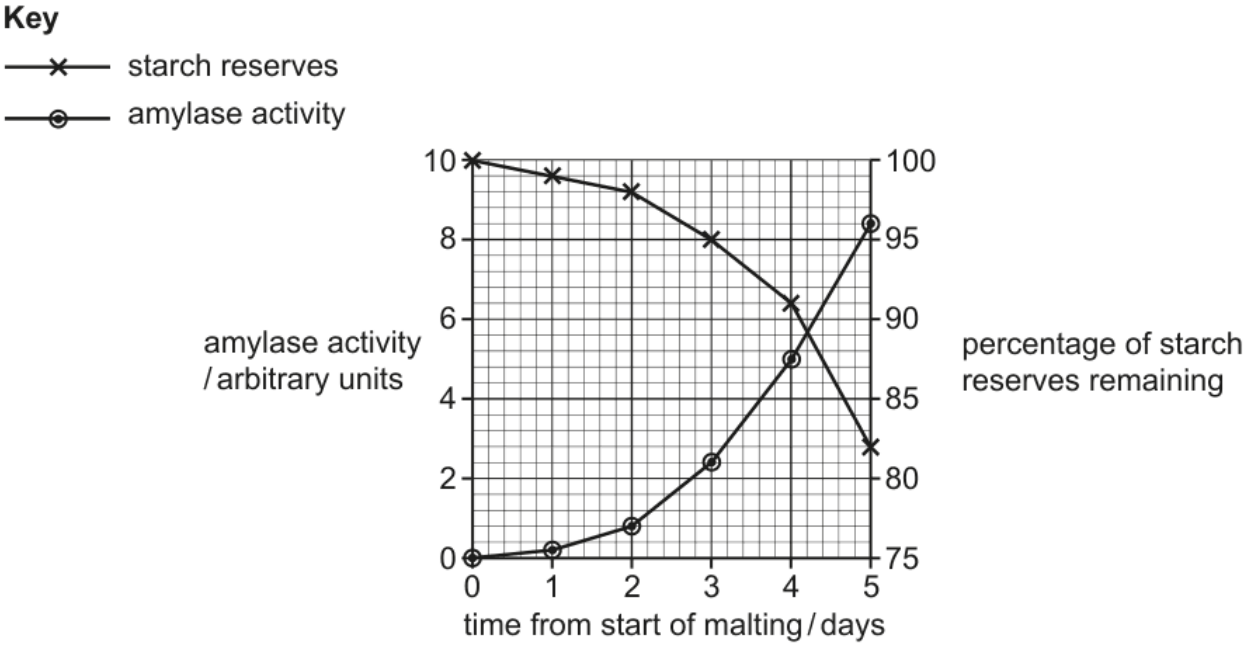


Fig. 3.1

(i) State the precise location of the starch reserves in the barley seed.

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Question 17 · Paper 4 · October/November 2021 (42) · Q3(b)(ii) · 4 marks

(ii) With reference to Fig. 3.1, describe **and** explain the effect of malting on amylase activity and the percentage of starch reserves remaining in the germinated barley seed.

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Question 18 · information from earlier in the question

(c) In the malting process, germination is stopped before the concentration of sugars in the germinating barley seeds exceeds a concentration that causes shoot or root growth.

Drying the germinating barley seeds at 50 °C is one method used to stop malting.

Question 18 · Paper 4 · October/November 2021 (42) · Q3(c)(ii) · 1 mark

(ii) Suggest why malting is stopped before shoot or root growth occurs.

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Question 19 · information from earlier in the question

8 Gibberellin is a plant growth hormone that has a role in germination and in stem elongation.

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Question 19 · Paper 4 · October/November 2018 (42) · Q8(b) · 4 marks

(b) Outline the role played by gibberellin in the germination of wheat seeds.

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3 One example of chemical control and co-ordination in plants is in the breakdown of food reserves during the germination of cereal grains, such as wheat.

(a) Fig. 3.1 is a diagram of a grain of wheat.

The numbered arrows indicate the sequence of events that occurs after the uptake of water by the grain of wheat.

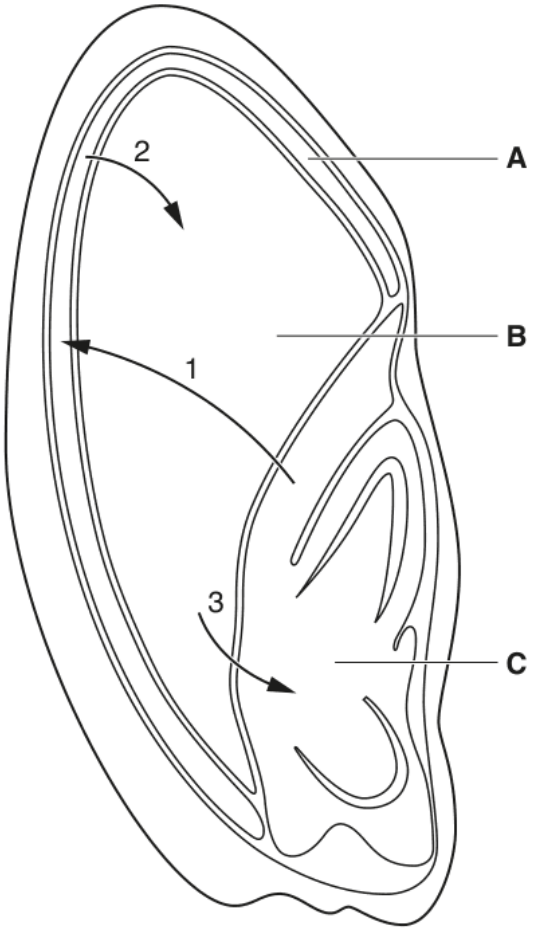


Fig. 3.1

(i) Name structures **A**, **B** and **C**, shown in Fig. 3.1.

A .....

B .....

C .....

[3]

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Question 21 · Paper 4 · February/March 2017 (42) · Q3(a)(ii) · 6 marks

(ii) With reference to the three numbered arrows in Fig. 3.1, describe the sequence of events that follows the uptake of water by the grain of wheat.

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Question 22 · Paper 4 · October/November 2016 (42) · Q8(a) · 1 mark

8 **(a)** When a dormant seed absorbs water it will start to germinate and its rate of respiration will increase.

Name the plant growth regulator involved in the initiation of germination of seeds.

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Mark schemes

Question 1 · Paper 4 · October/November 2025 (42) · Q7(a)(iv) · 1 mark

7(a)(iv)	(time) for, digestion / enzyme action / absorption / assimilation ;	1

Question 2 · Paper 4 · October/November 2024 (41) · Q4(a) · 3 marks

4(a)	*any **three** from:* *in Venus fly traps* **1** touch two (sensory hairs) ; **2** protons, leave hinge cells / enter hinge cell walls ; **3** Ca^{2+} ions move into (hinge) cells ; **4** water moves into (hinge) cells ; **5** (hinge) cells, become turgid / swell / increase in volume / expand ;	3

Question 3 · Paper 4 · February/March 2021 (42) · Q5(b)(i) · 1 mark

5(b)(i)	Ca^{2+} / calcium ions ;	1

Question 4 · Paper 4 · February/March 2021 (42) · Q5(b)(ii) · 1 mark

5(b)(ii)	to avoid wasting <u>energy</u> **or** *idea of* avoid closing, due to a single contact / by an object such as water drop ;	1

Question 5 · Paper 4 · October/November 2019 (42) · Q7(b)(i) · 1 mark

7(b)(i)	(sensory / trigger / receptor) <u>hair</u> ; **Ignore** cells	1

Question 6 · Paper 4 · October/November 2019 (42) · Q7(b)(ii) · 1 mark

7(b)(ii)	at least two hairs must be touched within, 35 seconds / short time period / at same time **or** one hair touched twice, within, 35 seconds / short time period ;	1

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Question 7 · Paper 4 · October/November 2019 (42) · Q7(d) · 5 marks

7(d)	*any **five** from:*	**5**
	1 action potential / depolarisation, reaches lobe (of leaf) ;	
	2 *ref. to* hinge / midrib, <u>cells</u> ;	
	3 H^+, pumped out of cells / pumped into cell walls ;	
	4 cell wall, loosens / cross-links broken / AW ;	
	5 calcium pectate, dissolves / breaks down (in middle lamella) ;	
	6 Ca^{2+} (ions) enter cells ;	
	7 water enters, by osmosis / down water potential gradient ;	
	8 (hinge / midrib) <u>cells</u>, expand / become turgid ;	
	9 leaves / lobes, become concave ;	

Question 8 · Paper 4 · February/March 2024 (42) · Q9(b) · 7 marks

9(b)	*any **seven** from:*	**7**
	1 auxin binds to receptor on the cell surface membrane ;	
	2 stimulates proton pumps ;	
	3 protons move from, cytoplasm / cell, to cell wall ;	
	4 pH of cell wall decreases ;	
	5 expansins activated ;	
	6 loosens linkage between cellulose microfibrils ;	
	7 by breaking hydrogen bonds ; **Ignore** weakening bonds	
	8 K^+ channels open ;	
	9 K^+ diffuse into, cytoplasm / cell ;	
	10 water potential (of cytoplasm / cell) decreases ;	
	11 water enters by osmosis ;	
	12 increase in turgor pressure / volume of cell increases ;	

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Question 9 · Paper 4 · October/November 2023 (41) · Q3(d)(ii) · 2 marks

3(d)(ii)	1 protons / H^+ (ions) ; 2 cellulose ;	**2**

Question 10 · Paper 4 · May/June 2023 (41) · Q3(a)(iv) · 3 marks

3(a)(iv)	*any **three** from*: **1** auxin increases stem, growth / length / height ; **2** protons / hydrogen ions / H^+, move / pumped, into cell wall(s) ; **3** (expansins) break, links / (H) bonds, between cellulose, molecules / microfibrils ; **4** water enters cell(s) by osmosis ; **5** cells, elongate / expand / increase in volume / swell ;	**3**

Question 11 · Paper 4 · February/March 2017 (42) · Q3(b)(ii) · 2 marks

3(b)(ii)	*two from:* 1 auxin binds with receptor (on cell surface membrane) ; 2 proton pumps activated ; 3 H^+ pumped into cell wall ;	**2 max**

Question 12 · Paper 4 · February/March 2017 (42) · Q3(b)(iii) · 3 marks

3(b)(iii)	*three from:* 1 expansins activated / AW ; **A** optimum pH for expansins 2 loosens bonds in cellulose microfibrils ; 3 K^+ ions enter cells (lower water potential) ; 4 (so) cells take in water by osmosis / AW ; 5 (increase in turgor causes) cell walls to stretch ;	**3 max**

Question 13 · Paper 4 · May/June 2022 (42) · Q6(a) · 2 marks

6(a)	**G** – embryo to aleurone layer ; **A** – aleurone layer to endosperm ;	**2**

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Question 14 · Paper 4 · May/June 2022 (42) · Q6(b) · 3 marks

6(b)	*any **three** from:* 1 hydrolyses / breaks down / digests / converts, starch / amylose ; 2 in endosperm ; 3 to, maltose / glucose ; 4 (glucose) used by embryo ; 5 (glucose used) for, respiration / growth ;	**3**

Question 15 · Paper 4 · October/November 2021 (42) · Q3(a) · 3 marks

3(a)	*any **three** from:* 1 seed / embryo, absorbs water ; 2 (stimulates) embryo to produce gibberellin ; 3 gibberellin moves to aleurone layer ; 4 gene coding for amylase, expressed / transcribed ; 5 translation of mRNA (to produce amylase) ; 6 AVP ; e.g. gibberellin binds to receptor / ref. destruction of DELLA protein	**3**

Question 16 · Paper 4 · October/November 2021 (42) · Q3(b)(i) · 1 mark

3(b)(i)	endosperm ;	**1**

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Question 17 · Paper 4 · October/November 2021 (42) · Q3(b)(ii) · 4 marks

3(b)(ii) — **4**

*any **four** from:*

1 amylase activity increases ;

2 as (seeds) produce **more** amylase ;

3 percentage of starch decreases ;

4 amylase, hydrolyses / breaks down, starch ;

5 *idea of* a change at an increasing rate (for either) ; **A** exponential change

6 data quote: amylase **or** starch at two different days ;

time / days	amylase activity / au	percentage of starch remaining
0	0.0	100
1	0.2	99
2	0.8	98
3	2.4	95
4	5.0	91
5	8.4	82

accept manipulated data

Question 18 · Paper 4 · October/November 2021 (42) · Q3(c)(ii) · 1 mark

3(c)(ii) — **1**

*any **one** from:*

1 stops, sugars / glucose, from being used ; **ora**

2 ensures (enough) sugars for beer production ;

Question 19 · Paper 4 · October/November 2018 (42) · Q8(b) · 4 marks

8(b) — **4**

any four from

1 seed absorbs water ;
2 embryo produces gibberellin ;
3 gibberellin, moves to / acts on / stimulates, aleurone layer ;
4 (where) production of amylase occurs ;
5 amylase, hydrolyses / breaks down, starch in endosperm ;
6 to, maltose / glucose ;
7 embryo uses sugars for, respiration / growth ;
8 AVP ; e.g. gibberellins affect, gene / synthesis of mRNA, coding for amylase

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Question 20 · Paper 4 · February/March 2017 (42) · Q3(a)(i) · 3 marks

3(a)(i)	**A** – aleurone layer ; **B** – endosperm ; **C** – embryo ;	**3**

Question 21 · Paper 4 · February/March 2017 (42) · Q3(a)(ii) · 6 marks

3(a)(ii)	*six from:* 1 embryo / **C**, produces / releases, gibberellin ; 2 (arrow 1) gibberellin moves into, aleurone layer / **A** ; 3 gibberellin stimulates production of amylase ; 4 (arrow 2) amylase moves into, endosperm / **B** 5 hydrolyses / breakdown, starch to maltose ; 6 (arrow 3) maltose / glucose, moves into, embryo / **C** ; 7 for respiration / to release energy / for ATP production ; 8 for, germination / growth ;	**6 max**

Question 22 · Paper 4 · October/November 2016 (42) · Q8(a) · 1 mark

8(a)	gibberellin ;	**1**

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