15. Control and Coordination

15.2 Control and Coordination in Plants

Paper 4

Marking Scheme

Q1.

(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**

Q2.

(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**

Q3.

(d)(i)	*any **two** from:* 1 0.1, (μmol) increases / gives higher, rate (compared to control / normal) ; 2 1(.0) and 10(.0), (μmol) decrease / give lower, rate (compared to control / normal) ; 3 10(.0) (μmol) rate, stays (approx.) constant / plateaus / does not increase, over, time / (6) days ; 4 data quote comparing rate at two concentrations on one day **or** data quote comparing rate on two different days for 10 μmol ;	**3**
(d)(ii)	1 protons / H^+ (ions) ; 2 cellulose ;	**2**

Q4.

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

(c)	*any **four** from:* *accept distilled water for **A**, 500mg dm^{-3} for **B** and 1000mg dm^{-3} for **C**.* 1 seeds of **B** and **C** germinated before seeds of **A** **or** seeds soaked in gibberellin germinated before seeds soaked in distilled water ; **ora** 2 **rate** of (increase in percentage) germination was, highest in **C** **or** higher in **C** than, **B** / **A** **or** higher as the concentration of gibberellin increases ; **ora** 3 **final** / **day 10** / **maximum** (percentage) germination was, highest in **C** **or** higher in **C** than, **B** / **A** **or** higher as the concentration of gibberellin increases ; **ora** 4 data quote between two groups ; mp1 – **A** by day 6 and **B** and **C** by day 2 mp1 – **A** germinates four days after **B** and **C ora** mp2 – **A** – 2.2 **B** – 5.2 **C** – 9.2, percentage germination day^{-1} mp3 – **A** – 22% **B** – 52% **C** – 92% mp3 – **A** to **C** = 70% more, **A** to **B** = 30% more, **B** to **C** = 40% more 5 percentage germination in **C** levels off after 9 days ; 6 AVP ; e.g. no seeds germinate by day 1	**4**

Q5.

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

(b)(ii)	*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 ;	**4**

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

(c)(i)	*any **three** from:* 1 enzyme, denatured / deactivated / inactivated ; 2 changes, tertiary structure / 3D shape, of amylase ; **A** enzyme 3 changes shape of active site ; 4 active site, no longer complementary / does not bind, to starch / substrate **or** no, ESC / enzyme-substrate complexes, formed ; 5 AVP ; e.g. removes water from embryo for gibberellin synthesis / removes water from endosperm for hydrolytic reactions	**3**
(c)(ii)	*any **one** from:* 1 stops, sugars / glucose, from being used ; **ora** 2 ensures (enough) sugars for beer production ;	**1**

Q6.

(a)	embryo ;	1
(b)(i)	*any **two** from:* 1 as water potential increases the germination index increases ; **ora** 2 water potential in MPa and index figure given for two points ;	2
(b)(ii)	*any **three** from:* 1 low / negative, water potential decreases water, uptake / in, seed ; **ora** 2 water, needed / used, to activate embryo / produce gibberellin ; 3 water, needed / used, for hydrolysis (reactions) ; 4 starch to maltose / maltose to glucose ; 5 water, needed / used, as a medium for reactions ; 6 solutes (lowering water potential) may, be toxic / inhibit enzymes ; 7 AVP ;	3
(c)	*enzyme* amylase / maltase / protease ; *location* aleurone layer ;	2

Q7.

(a)	low, mineral (ions) / named mineral (ion), content of soil ; **A** no minerals insects provide, mineral (ion) / named mineral (ion) / amino acids, for growth ;	2
(b)(i)	(sensory / trigger / receptor) hair ; **Ignore** cells	1
(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

(d)	*any **five** from:* 1 action potential / depolarisation, reaches lobe (of leaf) ; 2 *ref. to* hinge / midrib, cells ; 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) cells, expand / become turgid ; 9 leaves / lobes, become concave ;	5

Q8.

(a)(i)	(auxin) receptor (protein) / auxin binding protein ;	**1**
(a)(ii)	**B** – proton / H^+ / hydrogen ion, pump ; **C** – potassium / K^+ / ion, channel / pore ; **D** – aquaporin ;	**3**
(b)	*any **three** from:* 1 (cell wall) pH decreases / becomes more acidic ; 2 expansins ; 3 break / loosen, non-covalent, bonds / cross-links ; 4 between cellulose and, hemicellulose / matrix / calcium pectate **or** between cellulose microfibrils ; 5 cell wall, expands / stretches **OR** microfibrils move past each other ; 6 due to turgor pressure (on wall) ;	**3**
(c)	*any **two** from:* 1 water potential, decreases / becomes more negative ; 2 water moves into cell, by osmosis / down water potential gradient ; 3 cell, expands / increases in volume / elongates ;	**2**