PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 9: CONTROL SYSTEMS

CHEMICAL CONTROL IN PLANTS

SCORE	PERCENTAGE
/89	%

STEMUP

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Mark Scheme

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	An explanation that makes reference to the following: (1) • to prevent growth of { bacteria / fungi } which would produce amylase (1) • to prevent { bacteria / fungi } from decomposing the seeds		**(2)**

Question Number	Indicative content
(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • seed half with embryo does have amylase activity • seed half without embryo has no amylase activity • seed half without embryo and with the gibberellin does have amylase activity • this suggests gibberellin is needed for amylase { synthesis / activity } • selectively permeable membrane shows that the active agent / gibberellins is a small molecule • amylase is not diffusing through the membrane

Level	Mark	Descriptor
	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

Q2.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three from: • auxin is released from the terminal bud (1) • and (diffuses down the stem) to inhibit cytokinin action / inhibit lateral shoot growth (1) • cytokinin stimulates lateral shoot growth (1) • and is produced from base of shoot (1)	Allow one mark for antagonistic effectif no MP1 or MP3?	3

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	• correct calculation of increase of elongation from graph from tangent (1) • increase in elongation divided by timetaken (1)	ecf for mp2 **Allow** answer between 9.5 and 12.8 μm min^{-1} one mark for correct answer with no units a correct answer gains full credit	2
(ii)	An answer that makes reference to three from: • as pH falls / at lower pH, elongation increases (1) • because expansin is activated by lower pH (1) • weakening (intermolecular) bonds between cellulose molecules / calcium pectate / hemicelluloses (1) • cell takes in water causing it to expand (1)	**Allow** converse for increase in pH forall MPs **Allow** low pH / hydrogen ions changeshape of expansin so it can weakencell walls	3

Q4.

Question Number	Answer	Additional Guidance	Mark
(a)	An explanation that makes reference to four of the following: • {seed viability / germination} high in metal containers (1) • glass containers have similar properties to metal containers (1) • because {metal / glass} containers keep {air / moisture} out (1) • therefore seed water content is kept below 8% (1) • can see through glass without removing lid (1)	**Accept** converse for paper / cellophane	**(4)**

Question Number	Answer	Additional Guidance	Mark
(b)	• to produce valid (measure of seed viability / results / data)	**Accept** allows identification of anomalous result **Do not accept** if in list	**(1)**

Question Number	Answer	Additional Guidance	Mark
(c)	• difference calculated • how many times better calculated with units	<u>Example of calculation:</u> 90 – 16 = 74 74 ÷ 2 = 37 % year^{-1} or 74 ÷ 24 = 3.08 % month^{-1} / 3.1 % month^{-1} / 3 % month^{-1}	**(2)**

Question Number	Answer	Additional Guidance	Mark
(d)(i)	An explanation that makes reference to the following: • {viability test / germination} requires similar conditions as the country (1) • because germination is affected by {temperature / pH / light intensity / wavelength / humidity / vernalisation} (1) • if correct conditions not used seeds would not germinate even if viable (1)	**Accept** other relevant abiotic factor	(3)

Question Number	Answer	Additional Guidance	Mark
(d)(ii)	An explanation that makes reference to the following: • because flowering is affected by {day length / photoperiod / light and dark period} (1) • because flowering involves {phytochrome / P_R / P_{FR}} (1)	**Accept** florigen	(2)

Q5.

Question Number	Indicative content
*	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content Level 1 Descriptions (D) • Sedum flowers with long period of light / short period of dark • Kalanchoe flowers with short period of light / long period of dark • Kalanchoe is a short day plant / Sedum is a long day plant • light during dark period means Sedum flowers / Kalanchoe does not flower • light then far red during dark period means Sedum does not flower / Kalanchoe flowers Level 2 Phytochrome (P) • phytochrome converted between P_R and P_{FR} • light converts P_R to P_{FR} • dark converts P_{FR} to P_R • far red converts P_{FR} to P_R • far red converts P_{FR} to P_R rapidly • short light exposure during dark period converts P_R to P_{FR} • Sedum needs (high) P_{FR} / (low) P_R to flower / Kalanchoe needs (high) P_R / (low) P_{FR} to flower Level 3 Explanation (E) • experiment 2 Kalanchoe should flower • experiment 2 Sedum should not flower but does because Kalanchoe produces florigen / growth factor / diffusible substance / FT mRNA • florigen / growth factor is transported between the two plants • florigen / growth factor activates genes • florigen / growth factor triggers flowering in both plants

Level	Marks	
0	0	No awardable content
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context. **D only or P only**
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure. **2 D and 1 P or 1 E**
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. **2 D, 2 P and 1E**

Q6.

Question Number	Answer	Mark
(i)	The only correct answer is A 1 and 2 *B is incorrect because photomorphogenesis is incorrect* *C is incorrect because photomorphogenesis is incorrect* *D is incorrect because photomorphogenesis is incorrect*	**1**

Q7.

Question Number	Answer	Additional Comments	Mark
(a)	1. only (alpha) 1-4 glycosidic bonds in amylose / (alpha) 1-6 only found in amylopectin ; 2. only amylopectin has side branches / only amylose is {coiled / eq} ; 3. Amylopectin is a {larger / eq} molecule than amylose ;	**1. ACCEPT** 1-6 and 1-4 in amylopectin	**(2)**

Question Number	Answer	Additional Comments	Mark
(b)	1. Different individuals in the {colony / eq} take on specific {roles / jobs / eq} ; 2. Example given e.g. queen produces offspring ;	**1. Accept** division of labour **2. Accept** dominance by queen, {few of the males / kings} involved in breeding	**(2)**

Question Number	Answer	Additional Comments	Mark
(c) (i)	Idea that body temperature of animal mimics the ambient temperature ;	**Accept** body temp follows environmental temperature	**(1)**

Question Number	Answer	Additional Comments	Mark
(c) (ii)	1. Lack of insulating layer: Idea that does not impede transfer of heat energy / allows exchange of heat energy more easily ; 2. A marked reduction in sweat glands: Idea that they do not need to cool down OR less water lost ;	**1. Accept** enables heat transfer between environment and NMR	**(2)**

Question Number	Answer	Additional Comments	Mark
(d)	1. (Cancer causing) gene identified / eq ; 2. Gene {cut / isolated / eq} from DNA / eq ; 3. Using a {restriction / eq} enzyme / eq ; 4. Gene in {vector / named vector} ; 5. Mechanism for getting {gene/vector} into host cells (of mice) / eq ;	**1. Accept** screen for the gene **2. Accept** extracted **3. Accept** correctly named restriction enzyme e.g. EcoR1 **4. Accept** Named egs – retrovirus, virus, liposome, plasmid, bacteria **5. Accept** reference to (micro)injection, microprojectiles, electroporation, gene gun, inhaler, transduction	**(3)**

Question Number	Answer	Additional Comments	Mark
* (e)	QWC – Spelling of technical terms (*shown in italics*) must be correct and the answer must be organised in a logical sequence 1. {*neurone* (cell) surface membrane exposed / no *myelination* / eq} at nodes of *Ranvier* ; 2. Nodes are the site of clusters of {*sodium-gated channel proteins / potassium channels*} ; 3. Which {open / close} when *impulse* arrives / eq ; 4. Allowing *depolarisation* at nodes / eq ; 5. idea that *myelin*/eq acts as an (electrical) *insulator* (on *neurone* surface between nodes) ; 6. reference to *Schwann* cell ; 7. idea that *impulse/depolarisation* 'jumps' to next node ; 8. Reference to this being *saltatory conduction* ; 9. idea that this happens between the *myelin* layers of the *Schwann* cell ;	**QWC emphasis on spelling** **3. Accept** influx of sodium ions	**(5)**

Question Number	Answer	Additional Comments	Mark
(f)	1. idea of heart working less efficiently ; 2. idea of less oxygen absorbed at lungs / eq ; 3. less blood pumped to brain ; 4. concentration gradient (for oxygen) at brain reduced / eq ; 5. less oxygen in blood (in brain) diffuses into brain tissue / eq ; 6. idea of less oxygen in brain tissue due to continual (aerobic) respiration ;		**(3)**

Question Number	Answer	Additional Comments	Mark
(g)	gonadotrophin-releasing (hormone) stimulates gonadotrophin release / gonadotrophin stimulates ovulation / testosterone stimulates {sperm production / (male) secondary sexual characteristics / other named example} ;		**(1)**

Question Number	Answer	Additional Comments	Mark
(h)	1. Idea of effect on mitochondria ; 2. (therefore) reduced {energy / ATP / eq} for flagellum movement ;	**1. Accept** less efficient / fewer / none **2. Accept** tail for flagellum	**(2)**

Question Number	Answer	Additional Comments	Mark
(i)	1. idea that fat is an energy store ; 2. reduces dependence on external food source / eq ; 3. enables disperser to travel / eq ; 4. (metabolic) water is released (on oxidation) / eq ; 5. acts as a thermal insulator / eq ;	**Accept** energy-rich	(3)

Question Number	Answer	Additional Comments	Mark
(j)	1. idea that unfamiliar males are likely to be genetically different ; 2. idea that this is outbreeding ; 3. idea that this increases genetic diversity ;	**3. Accept** producing offspring that are genetically different	(2)

Question Number	Answer	Additional Comments	Mark
(k)	the order of the {bases / genes and non-coding sequences / eq} in the DNA (of the naked mole rats) is found / eq ;	**Accept** exons and introns **Ignore** genes unqualified	(1)

Question Number	Answer	Additional Comments	Mark
(l)	Paired responses: 1. reduced sensitivity to chemical pain / disconnection of 'pain nerves' ; 2. Idea of pain relief e.g. dealing with post traumatic pain, post surgical pain, joint pain after a knee operation ; 3. haemoglobin has higher affinity for oxygen ; 4. Idea of dealing with reduced oxygen situations such as due to a heart attack or stroke ; 5. Naked mole rat {incisors / eq } grow through skin (of lip) without damage ; 6. Idea of better prosthesis e.g. new {coatings / permanent seal} at {skin / bone / metal} interface, soft tissue not damaged, avoid infection ; 7. High protein stability / does not (easily) lose 3D shape ; 8. (so) reduced effect of oxidative {damage / stress} / reduced effect of oxygen-containing free radicals / live healthily into old age ; 9. Cell overcrowding early warning gene / ref. to two tiered contact inhibition / presence of gene p16 ; 10.Idea of cancer prevention e.g. cancer resistance, future cancer therapy ; 11.Naked mole rat neurones display immature {characteristics / physiological properties} / brain cells that cope with {low oxygen / hypoxia} ; 12.To treat people with temporary loss of oxygen to brain e.g. heart attack, stroke, drowning / to prevent permanent brain damage ; 13.High levels of oxytocin receptors in {brain / nucleus accumbens}; 14.Idea of links to autism ; 15.Naked mole rats do not experience menopause ; 16.Ref to osteoporosis {treatment / prevention} (without side effects) ; 17.circadian rhythms / sleep patterns of naked mole rats ; 18.Idea that may help with sleep disorders ;	**9. Accept** anticancer mechanism	

Q8.

Question Number	Correct Answer	Additional guidance	Mark
	An explanation that makes reference to four of the following: • red stimulates by converting P_R to P_{FR} (1) • far red inhibits by converting P_{FR} to P_R (1) • the last wavelength received determines the form of phytochrome present because the process is reversible (1) • P_{FR} is the active phytochrome (1) • genes involved in germination are switched on (1) • enzymes involved in germination are synthesised (1)		**(4)**

Q9.

Question Number	Answer	Mark
(a)	(leave it) in the dark / eq ;	**(1)**

Question Number	Answer	Mark
(b)(i)	1. mass higher in A (compared with B) for both studies ; 2. the difference is less in repeat study ; 3. comparative manipulation of data e.g. 13g decrease for A to B for original and 5 g for repeat ; 4. mass lower in repeats (of both A and B) / eq ;	**(3)**

Question Number	Answer	Mark
(b)(ii)	1. { increase / eq} in stem length ; 2. correct manipulation of the data e.g. by 23cm / 18.4% ; 3. reference to {taller / faster growing / eq} seedling ; 4. to receive {more light / higher red light / eq} / to maximize photosynthesis / eq ; 5. idea of allows {active phytochrome / eq} to be made ;	**(3)**

Question Number	Answer	Mark
(b)(iii)	1. less red light {increases / eq} mean stem length / more far red light increases stem length / eq ; 2. the (significant) difference in mean stem length is not due to {chance / eq} / eq ; 3. the mean length for repeat was close to the original ; 4. suggesting it is likely to be reliable ;	**(3)**

Q10.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four of the following points: • **more** seeds germinate when last colour is red (1) • number of exposures to light makes no difference (1) • significant difference when last colours are different as standard deviations do not overlap (1) • red light converts P_R into P_{FR} / far red light converts P_{FR} into P_R (1) • {P_{FR} stimulates/ P_R inhibits} {germination / gibberellin release / activation of amylase / abscisic acid}	**Allow** converse for FR light **Accept** no significant difference when last colours are same as standard deviations overlap (1) **Accept** P725 or P730 for P_{FR} / P665 or P660 for P_R **Accept** high P_{FR} : low P_R ratio stimulates germination	**4 exp**

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	The only correct answer is: **C** low auxin, high cytokinin *A is incorrect as high auxin inhibits lateral shoots* *B is incorrect as high auxin inhibits lateral shoots* *D is incorrect as low cytokinin inhibits lateral shoots*		**1 comp**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following points: • auxin binds with {receptor / transcription factor} (inside cell / in cytoplasm / in nucleus) (1) • transcription factor becomes active / is activated (1) • transcription factor binds to {DNA / promoter} (1) • switches on / causes {transcription / production of RNA} (1)	**Accept** forms auxin-receptor complex **Accept** forms hormone-receptor complex **Do not accept** if receptor on cell membrane **Accept** transcription factor changes shape **Accept** auxin-receptor complex becomes a transcription factor **Accept** auxin-receptor complex binds to DNA / promoter (1)	**3 exp**

Q12.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • {removing tip / removing meristem / absence of auxin} results in lateral shoot growth (1) • because auxin inhibits lateral shoot growth (1) • cytokinin stimulates lateral bud growth (1) • auxin {represses / inhibits / is dominant over} cytokinin action (1)	**Accept** if auxin is higher than cytokinin, lateral shoot growth stops **Accept** if cytokinin is higher than auxin, lateral shoot growth occurs	**(3)**