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BIOLOGY

9700/53

Paper 5 Planning, Analysis and Evaluation

October/November 2016

MARK SCHEME

Maximum Mark: 30

Published

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Page 2	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark	Additional Guidance
1(a)(i)	<i>independent:</i> <u>concentration</u> of calcium chloride / CaCl_2 ; <i>dependent:</i> number of stomata closed / open ;	2	A closing / opening <i>for closed / open</i> I percentage
1(a)(ii)	serial dilution ;	1	A description I simple / standard dilution, or description of I proportional dilution
1(b)(i)	<i>idea of</i> the higher the concentration (of, calcium chloride / CaCl_2), the greater the, number / percentage / proportion, of stomata that are closed / ora ;	1	<i>hypothesis must be testable and not repeat information given in question</i> A <i>idea that</i> , the number / proportion / percentage of closed stomata is (directly) proportional to the conc. of CaCl_2 A as CaCl_2 concentration increases more stomata close ora A a null hypothesis: different / changing concentrations of CaCl_2 have no (significant) effect on the number / proportion / percentage of, closed / open, stomata

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Question	Answer	Mark	Additional Guidance
1(b)(ii)	<i>five from</i> <i>ref. to putting (epidermal) strip(s) in the (different) solutions in appropriate containers ;</i> <i>ref. to keeping in the light (for the investigation) ;</i> <i>ref. to using a (light) microscope (to observe the stomata) ;</i> <i>count/record, (the number of/how many), closed/open stomata ;</i> <i>ref. to standardising the counting ;</i> <i>ref. to making several counts on at least one epidermal strip and taking a mean/to identify anomalies ;</i> <i>max 2 for control variables (mps 7–9)</i> <i>ref. to using suitable equipment for cutting and measuring strips (to same size) ;</i> <i>ref. to method achieving constant temperature ;</i> <i>ref. to method of preventing evaporation ;</i> <i>one of</i> <i>ref. to low risk ;</i> allergy to leaves/plants and wearing gloves/goggles ; CaCl₂ irritant and avoid swallowing/wearing gloves/goggles ; care when cutting with scalpel and cut on tile and away from, hand/body ;	5	A named solutions A e.g. beakers, watch glasses, Petri dishes, test tubes, boiling tubes, measuring cylinders, (microscope) slide/cavity slide I <i>ref. to</i> volume of solution I <i>ref. to</i> time A in dark room with fixed light R electron / electronic microscope I calculate / observe if a number of counts is given it must be a minimum of 3 I average A mean average I repeat / replicate, the experiment <i>unqualified</i> e.g. scalpel or scissors and ruler / calipers I metre ruler e.g. incubator, temperature controlled room, water bath to keep temperature constant e.g. lid / film / coverslip (if slide) AW R no risk I allergy to CaCl₂ I scissors

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Question	Answer	Mark	Additional Guidance
1(c)(i)	<i>two (for 1 mark) from</i> (same calibrated eyepiece) graticule used ; (same) microscope ; (same) magnification ;	1	A same calibration for measuring I stage micrometer I same apparatus / method of measuring I random selection of stomata
1(c)(ii)	$0.75 / 7.5 \times 10^{-1} (\mu\text{m})$;	1	I $\frac{3}{4}$

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Question	Answer	Mark	Additional Guidance
1(d)(i)	<i>one from</i> 1 up to/at, $0.001 \mu\text{mol dm}^{-3}$ ABA/initially/at first, upper epidermis mean has increased/not changed, lower epidermis has decreased ; 2 lower epidermis responds at $0.001 \mu\text{mol dm}^{-3}$, ABA upper epidermis responds at $0.01 \mu\text{mol dm}^{-3}$ ABA ; 3 confidence intervals/error bars, do not overlap (until $1.00 \mu\text{mol dm}^{-3}$ ABA) ; 4 stomata on upper epidermis have wider aperture at, all/increasing, concentrations of ABA (until $1.00 \mu\text{mol dm}^{-3}$ ABA) ;	1	<i>idea that</i> upper epidermis at $0.001 \mu\text{mol dm}^{-3}$ has not decreased while lower epidermis has decreased lower epidermis (starts to) responds at lower concentrations of ABA ; I standard deviation/standard error I <i>ref. to</i> one stated ABA concentration I <i>ref. to</i> one stated ABA concentration I longer/shorter/higher, aperture/stomata A longer/shorter, diameter/width
1(d)(ii)	<i>one from</i> <i>definition:</i> e.g. the confidence limits are, the range/interval, in which the true value of the mean lies, with 95% probability/chance ; <i>idea of</i> the true/AW, mean, lies within, $\pm 2 \times S_M/SE$, with 95% probability/chance ; <i>idea of</i> the (calculated) mean is close to the true/actual mean ; shows the reliability of the (calculated) mean ; (the confidence intervals are small) so data is reliable ; (the confidence limits do not overlap) so data is reliable ;	1	<i>this must be a clear statement</i> A 95% confident/sure/certain, that the true/actual/population mean lies within this range I ora for 5% I 95% reliable

Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark	Additional Guidance
1(d)(iii)	t-test ; data has a normal distribution / comparing the <u>means</u> of two samples ;	2	<i>if test not correct allow reason if correct for stated test and t-test e.g. Pearson's linear correlation because gave normal distribution</i> A comparing two means / comparing a pair of means / to see if two means are different A data is continuous / not discrete I continuous variation
1(e)	<i>four from:</i> 1 large number of stomata / 50 stomata (from each epidermal surface) (for each ABA concentration) ; 2 (left for) the same time / left for <u>2 hours</u> ; 3 same age of leaf / young leaves used ; 4 describe how one (stated) environmental condition <u>is</u> controlled ; 5 <i>ref. to</i> how one stated method of measurement has been standardised ; 6 random selection of stomata (to avoid bias) ;	4	I <i>ref. to</i> confidence intervals I large sample size unqualified A 10 stomata from each (epidermal) strip I time unqualified A seedling leaf / leaves just expanded either carbon dioxide-free air or pH by buffer I 'ensure no carbon dioxide in environment' calibrated, eye piece / graticule or same microscope or same magnification
	Total:	19	

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Question	Answer	Mark	Additional Guidance
2(a)(i)	<i>four from either</i> <i>idea of</i> making extracts of couch grass roots, of different ages / grown for different times / 14 days old / old(er) root(s) ; - grow barley (grains / young plants), supplied with (water containing) extract / has extract added ; - grow (another) set of barley (grains / young plants), (supplied with water) without extract ; or - grow couch grass for different times / to different ages / to 14 days / until older, and remove couch grass / cut off grass shoots ; - grow barley (grains / young plants) where couch grass has been previously grown and removed / where couch grass shoots had been cut off leaving roots ; - grow (another) set of barley (grains / young plants) on its own / where couch grass has not been grown ; then <i>ref. to</i> at least one standardised (environmental) condition ; - measure / record, length / (dry) mass, of barley roots ; <i>idea of</i> compare / analyse statistically, the length / (dry) mass / growth, of the barley roots ;	4	I where barley / couch grass is grown, e.g. field, green house, plot, pot, paper in petri dish etc. A extracts from separately sown couch grass or from couch grass from original experiment 2 A experiment 4 acts as / is, a control A idea of repeating experiment 2 but removing couch grass before barley is planted A idea of growing barley where only the roots are left A experiment 4 acts as / is, a control A e.g. same watering / temperature / light / humidity / time / nutrients / minerals I growth <i>unqualified</i> I measurement before investigation I compare growth of barley <i>unqualified</i> I chi squared test <i>must be clear that they have at least two treatments / values to compare</i>

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Question	Answer	Mark	Additional Guidance
2(a)(ii)	<i>one from</i> <i>idea that</i> established / older couch grass, is (better) competitor than barley for stated resources (light / minerals / water / space) / ora ; <i>idea that</i> by the time barley is grown couch grass has depleted stated soil resources (light / minerals / water / space) ora ; <i>idea of</i> older couch spreads a, disease / herbivore, to barley ; <i>idea of</i> older couch produces a substance that inhibits / slows the germination of barley ; <i>idea of</i> older couch grass changes the pH of the soil ;	1	A nutrients I nutrition I resources <i>unqualified</i> A nutrients I nutrition I resources <i>unqualified</i> A something that eats barley lives, in / on, older couch grass
2(a)(iii)	there is no significant difference between yield of barley grown with couch grass and, barley grown without couch grass ;	1	A there is no significant difference between yield of, barley grown with couch grass / experiment(s) 1 / 2 / 3, and, (the yield of) the control / experiment 4 A no significant decrease / increase in yield when couch grass is present compared to when couch grass is not present

Page 9	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark	Additional Guidance										
2(b)(i)	correct calculation for both ground beetles ; <table><tr><td>ground beetles</td><td>20</td><td><u>0.181</u></td><td>45</td><td><u>0.012</u></td></tr></table> correct addition of both columns in table 2 ; <table><tr><td>total</td><td>47</td><td>0.300</td><td>414</td><td>0.188</td></tr></table> correct values for both values of <i>D</i> with pesticides <i>D</i>=0.700 and without pesticides <i>D</i>=<u>0.812</u> ;	ground beetles	20	<u>0.181</u>	45	<u>0.012</u>	total	47	0.300	414	0.188	3	<i>ecf for wrong values for ground beetles</i> A 0.7 / 0.70 <i>ecf from wrong totals</i>
ground beetles	20	<u>0.181</u>	45	<u>0.012</u>									
total	47	0.300	414	0.188									

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Question	Answer	Mark	Additional Guidance																		
2(b)(ii)	two from 1 the use of pesticides reduces the numbers of all, the organisms/individuals/plants and animals ; 2 either the, biodiversity/ species diversity, is reduced or idea that <i>D</i>/diversity index/biodiversity/species diversity, does not appear to be much affected/only changed by 0.112 ; 3 either use of processed data to describe percentage decrease in any one group or idea of beetles are less affected/have a much lower percentage decrease ; 4 bees (appear to have been) completely lost ; 5 idea that data collected is grouped, so cannot tell if any specific species has been lost ; 6 idea of reason for decline in, birds/small mammals , due to effect on food chain / non-specific nature of pesticides / herbicides ;	2	<i>must be in terms of effect of pesticides causing the decrease</i> A pesticides decrease the number of organisms I ora e.g. number of individuals in fields without pesticides is higher A species richness I diversity / <i>D</i>/, is reduced for either I diversity for or <table><thead><tr><th>organism</th><th>percentage drop</th></tr></thead><tbody><tr><td>dicot</td><td>95</td></tr><tr><td>monocot</td><td>88</td></tr><tr><td>beetles</td><td>56</td></tr><tr><td>butterflies and moths</td><td>89</td></tr><tr><td>bees</td><td>100</td></tr><tr><td>mammals</td><td>87</td></tr><tr><td>birds</td><td>94</td></tr><tr><td>total</td><td>89</td></tr></tbody></table>	organism	percentage drop	dicot	95	monocot	88	beetles	56	butterflies and moths	89	bees	100	mammals	87	birds	94	total	89
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