Cambridge International AS & A Level

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BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2016**

MARK SCHEME

Maximum Mark: 30

Published

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A	accept (for answers correctly cued by the question, or extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
ecf	error carried forward
I	ignore
mp	marking point (with relevant number)

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	distance from the pond **;** distribution / abundance / numbers, of (different), species of plant / types of plant / sorts of plant / land plants **;**	**A** position from pond **I** *ref. to* distance from starting point **A** distribution / abundance / numbers, of the plants	[2]
(ii)	*any 8 from:* 1 use a (named) transect **;** 2 method of measuring, transect / line **;** 3 *ref. to* distance / length, of transect **;** 4 *ref. to* selecting where around pond to place the transect(s) **;** 5 *ref. to* suitable sampling technique **;** 6 *ref. to* sampling intervals (in context of transect / line) **;** 7 use of, same / stated size, quadrat / frame / point frame / sample area **;**	 **A** belt (interrupted or continuous) or line transect. **A** description in terms of a line / AW **A** *idea of* use of either one or two measuring tapes, e.g. string with measured marks **A** *idea of* until the plants no longer change **A** stated distance, 10 m minimum e.g. (frame) quadrat / point frame / point quadrat **A** description **A** diagram **I** quadrant / quadrent **I** a square / square shape, unqualified **A** look at / observe, what is touching the line for a line transect **A** continuous sampling **A** (stated) regular intervals for an interrupted transect **I** fixed intervals unless qualified **R** any random placing, e.g. throwing / use of random numbers **A** if size of quadrat / frame / sample area is stated as between 0.25 m^2 – 1 m^2 size **I** controlled size unqualified	

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	8 *ref. to* method to identify (the different) species **;**	e.g. photographs / (dichotomous) key / app / expert / nature guide / book / AW **A** species identified as A, B, C, etc.	
	9 *ref. to* method of estimating abundance / distribution **;**	counting / density / percentage cover / frequency / abundance scale (ACFOR or equivalent) / cover-abundance scale (Braun-Blanquet) / presence or absence / AW	
	10 *ref. to* care taken not to miss, low growing / AW, species **;**		
	11 replicate transect (at least once) **;**	**I** repeat in the same transect **A** repeat, steps / the transect / the experiment at a different (start) point (round the pond)	
	12 sample at different times of, year / seasons **;**		
	13 *safety* *any 1 from:* • *ref. to* injury / getting lost **and** staying with a group **;** • allergy to plants **and** wearing gloves / protective clothing **;** • allergy to pollen / hay fever **and** wearing mask or taking medication **;** • *ref. to* dangerous environment described / hazardous plants / hazardous animals **and** wearing suitable shoes / protective clothing / repellent **;**	*need risk plus precaution* **I** low / high risk	[max 8]

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(b) (i)	$\Sigma D^2 = 317$ **;**	**A** 317.0 / 317.00	[1]
(ii)	$(6 \times \Sigma D^2 =) 1902$ and $(n^3 – n =) 990$ **;** $r_s = (1 – 1.92 =) – 0.92$ **;**	**A** one mark for the formula: $r_s = \frac{1 – 1902}{990}$ **A** –0.9 **or** – 0.921 **R** –.90 *ecf from* ***(b)(i)*** *ecf to max 1 if one or both of calculations* $(6 \times \Sigma D^2 =)$ *and* $(n^3 – n =)$ *are wrong*	[2]
(iii)	there is a negative correlation / as soil water increases the number of species decreases / ora **;**	*ecf from* ***(b)(i)*** **A** correct interpretation of r_s value calculated **A** negative association / inverse relationship / inversely proportional, for correlation **I** significant / not significant **I** qualifications 'strong' or 'weak'	[1]
(c) (i)	evidence that the students used the probability table for 10 pairs of data **;** the r_s value is greater than the critical values at 5% and at 1% / ora **;**	**A** if critical values 0.648 and 0.794 are used **A** r_s value is greater than actual critical values 0.648 and 0.794 **A** ecf for wrong number of pairs **A** r_s value is greater than actual values at p / probability = 0.05 and 0.01 **I** *ref. to* left / right	[2]
(ii)	*idea that* Spearman's rank correlation only shows there is a relationship not a cause / effect **;** *any 1 from*: • sampling / transect(s), may be unrepresentative of the whole area **;** • other (named) biotic / abiotic / environmental	**I** *ref. to* 'not due to chance' *(must have positive idea of correlation / relationship)* **I** do more samples / not enough replicates were taken **I** other factors influence the data *(factor must be qualified)*	

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	factors may be contributing to distribution of plants ;	**A** other environmental / biotic / abiotic / factors influence the data named factors : soil pH, light / light intensity, slope, temperature, (soil) moisture / water, grazing, wind, minerals / ions / mineral salts / salts / humus, soil organisms, pathogens, effluent / herbicide **I** nutrients **I** any *ref. to* stats e.g. need to take account of standard error	[max 2]
		Total:	**[18]**
2 (a) (i)	*any 3 from:* 1 body, mass / weight ; 2 age ; 3 number in each (test) group ; 4 *ref. to* sex (composition of the groups) ; 5 species / variety / type / genetic strain / breed /AW (of rat) ; 6 factor that might affect dopamine secretion ; 7 volume of nicotine used ; 8 concentration of saline ; 9 volume of saline ; 10 volume of topiramate ; 11 each high concentration of topiramate (should be the same concentration) ; 12 time between giving the, treatments / topiramate or	**I** amount *throughout* **I** mass / weight unqualified **A** mass / weight of rats **I** biomass of rats / size of rats **A** all same sex or equal numbers of each sex **A** gender **A** stress / diet / food / water / environmental temperature **I** body temperature **A** each low concentration (Group 2) should be the same for each rat **I** concentration of topiramate unqualified **A** time treatments are given	

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	saline, and nicotine ; 13 time between giving, treatments / nicotine / topiramate / saline, and measuring the concentration of dopamine ; 14 method of administration of, nicotine / topiramate / treatment ;		[max 3]
(ii)	*control groups 1 and 5* to see if / show that / test that, topiramate is, causing the effect / blocking secretion of dopamine / blocking secretion of (pleasure and reward) chemicals ; *control group 4* to show any effect that topiramate has, on its own / without nicotine ;	**A** to show that saline solution on its own does not have an effect on / block secretion of dopamine / (pleasure and reward) chemicals **R** increase in dopamine **A** to see if there is a relationship between topiramate and dopamine secretion **A** *idea of* in context of, rats never given nicotine / 'normal' rats	[2]
(b)	group 5 pre-treatment = 280 (% increase) and group 1 no pre-treatment = 64 (% increase) ; 35:8 ;	**A** figures in a formula **A** 8:35 *if clear which is which* **A** 4.375:1 / 4.38:1 / 4.4:1 / 4:1 **A** quotients 4.375 / 4.38 / 4.4 / 4 **A** fractions 35/8 / 4.375/1 / 4.38/1 / 4.4/1 / 4/1 **R** units or % in final ratio ecf if graph misread *for one mark*	[2]
(c)	*any 3 from:* 1 (topiramate / it), reduces the release of dopamine (from the brain) ; 2 the higher the concentration of topiramate, the greater the reduction / the lower the secretion (of dopamine) ;	**A** inhibits / blocks **A** reduces the (dopamine) response / AW **A** inhibits / blocks	

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	3 (the, percentage) reduction / drop, in dopamine secretion, is lower in the rats pre-treated with nicotine (280% to 120% = 57%) (than in rats not pre-treated with nicotine) (64% to 16% = 75%) ora ; 4 *any 1 from:* • in pre-treated rats / group 6, (high concentration of) the topiramate reduces the response by 160% ; • in rats without pre-treatment / group 2, (low concentration of) the topiramate reduces the response by 40% ; • in rats without pre-treatment / group 3, (high concentration of) the topiramate reduces the response by 48% ;	**A** references to addicted / non-addicted rats **A** by 57% / by approximately half **A** by 63% / by approximately two thirds **A** by 75% / by three quarters	[max 3]
(d)	(topiramate / it) inhibits / reduces / blocks, pleasure / reward / AW, so smokers, gain less from smoking / less enjoyment / become less addicted / likely to smoke fewer cigarettes / AW ; *idea that* topiramate affects, more than one / all / three brain chemicals and so has a cumulative / additive effect (on suppressing the addiction) ;	**A** because it has an effect on more than one chemical it has a, bigger / larger / further / AW, effect	[2]
		Total:	**[12]**

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I	ignore

mp marking point (with relevant number)

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Question	Expected answer	Extra guidance	Mark
1 (a)	number of individuals **or** population of each type of / sort of / species present (in the sample) **;** total number of individuals / all populations (of all species) **;**	**A** count the number in different species **A** in context of any named organisms	[2]
(b)	*any 8 from*: 1 *ref. to* sampling in both areas / grazed and ungrazed **;** 2 any idea of marking out the area to be sampled **;** 3 use a method of generating random numbers (to use co-ordinates) **;** 4 use a (frame or point) quadrat (for individual samples) **;** 5 place (quadrat AW) at coordinates **;** 6 *ref. to* method of identifying **or** distinguishing different species / types / sorts of plant **;** 7 *ref. to* counting / recording of: number of individuals or the population of / each type / sort / species present (in quadrat / plot) **or** the total number of all the plants present (in quadrat / plot) **;** 8 same size quadrat / same quadrat AW **;** 9 same size plot in each area **;** 10 same number of different quadrats / samples per plot **;** 11 replicate the procedure with a different plot in a given area **;** 12 sample at different times of year / seasons **;**	**I** *any ref. to standardising environmental factors.* **I** if listed as the independent **I** *ref. to* transects e.g. tape measures / use string and marker pole / make a grid of plot e.g. random number generator / app / select number from a hat **I** throwing of quadrat *must be clear that the quadrat is the counting frame* *spelling of quadrat must be correct at least once* **A** descriptions, e.g. frame placed on the ground e.g. photographs / key / app / expert / nature guide / AW **A** using letters or numbers for different species **I** percentage cover / abundance scale e.g. 10 quadrats in each plot **I** repeat 3 times and find a mean **A** if only replicate with different plots in one area **I** repeat 3 times and take a mean **I** sampling on same day / next week	

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Question	Expected answer	Extra guidance	Mark
	13 *safety* *any 1 from:* • *ref. to* injury / getting lost **and** staying with group **;** • allergy to plants **and** wearing gloves / protective clothing **;** • allergy to pollen / hay fever **and** wearing mask or taking medication **;** • *ref. to* uneven ground / hazardous plants or animals or environment **and** wearing suitable shoes / protective clothing **;**	**I** low risk **A** any suitable example – thorny / stinging plants, insect bites / stings, snakes, belligerent grazing animals **and** a suitable precaution	[max 8]
(c)	*independent*: grazed and / or ungrazed grassland **and** *dependent*: (mean) height (of plant) **;**	**A** type of grass land **I** extent of grazing	[1]
(d) (i)	mode = 864 **and** median = 864 **;**		[1]
(ii)	S_M grazed = 9.33 **;** S_M ungrazed = 4.97 / 4.96 **;**	*max 1 if answers are to 1 dp or 3 dp* (9.3 / 9.329, 5.0 / 4.965)	[2]
(iii)	860.1 **;** to 879.9 **;**	**A** ecf from **1(d)(ii)**for correct calculation from incorrect S_M	[2]

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Question	Expected answer	Extra guidance	Mark
(iv)	*any 2 from*: 95% confident / sure / certain that the mean lies within these limits **;** shows the reliability of the mean **;** the ungrazed mean is more reliable (because it's smaller) **;** the difference between means is significant because there is no overlap between CI for ungrazed and grazed **;**	*must be a clear statement* **R** if *ref. to* accuracy or results AW ora the grazed is less reliable (because it is bigger)	[max 2]
(e)	*any 2 from:* sample from a large area **;** *idea that* there is a long enough time interval, for marked individuals to mix into the population / between capture and recapture **;** *idea that* the marking technique must not be toxic AW **;** *idea that* the marking technique must not increase / decrease chances of survival **;** marking technique must not fall off / be rubbed off / washed off animal **;** *idea that* time is not so long that migration / life cycle changes (of the species) have occurred **;**	**I** sample size **I** any specified times *need the idea of long enough for dispersal* e.g. increases or decreases chance of predation **A** in terms of inhibiting / changing movement or behaviour	[max 2]
(f)	ungrazed **and** because there are more seeds (to eat) / AW **;**	**A** ungrazed as there will be larger plants and more places for inverts to hide from predators / protection from predators.	[1]
		Total:	**[21]**

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Question	Expected answer	Extra guidance	Mark
2 (a)	*any 3 from*: 1 body mass / weight ; 2 number of volunteers in each group ; 3 age of volunteers ; 4 no factor affecting air flow / lung capacity ; 5 (physical) fitness of volunteers ; 6 (type of) cigarette smoked ; 7 PEFR device / apparatus used ; 8 PEFR test done when volunteers are sitting down / standing up ; 9 time of day the PEFR test performed ; 10 ethnicity / race ;	**I** diet / sex / alcohol consumption / medication / drugs / range of number of packets of cigarettes ; **A** same number in each age group **A** asthma, CF, COPD, TB, lung cancer **A** disease affecting the lungs / breathing **A** living at altitude **A** minimum time since last cigarette **I** passive smoking **A** in terms of nicotine / tar / filter / brand **A** not after exercise / at rest	[max 3]

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Question	Expected answer	Extra guidance	Mark
(b)	*any 3 from:* *support (max 2)* *conclusion 1 (an increase in the number of packets smoked decreases the PEFR measurement)* 1 the mean PFER decreases as the mean number of packets / cigarettes smoked increase **;** 2 compare data from two PEFR and a trend on smoking **or** compare data from two number of packets smoked and a trend in PEFR **;** 3 highest no. of packets / cigarettes smoked has the lowest mean PEFR **;** *conclusion 2 (the number of packets smoked increases with age)* 4 as mean age increases the mean number of packets increases **;** 5 compare data from two age groups and a trend on smoking **or** compare data from two mean number of packets smoked and a trend on age **;** 6 oldest volunteers / group 5 smoked the highest mean number of packets **;**	*answers must either include both 'means' **or** link relevant data for any two groups (age or PEFR and number of packets smoked) from Table 2.1* ***I** comparisons of age with PEFR* *must link PEFR values to the amount smoked / number of packets (not just quote from the table)* e.g. (mean) PEFR decreases from 513.43 to 300.00 with increase in packets / cigarettes smoked e.g. (mean) PEFR decreases as the (mean) number packets increase from 0 to 189.22 **A** non-smokers / group 1 has the highest mean PEFR *must link age values to the amount smoked / number of packets (not just quote from the table)* *must not use group 1 data here (26.42 and 0)* e.g. (mean) number of packets increases from 30.61 to 189.22 with an increase in age e.g. (mean) age increases from 22.82 to 36.22 as the (mean) number of packets smoked increases **A** the youngest smokers / group 2 smoked the least mean number of packets **A** the largest mean number of packets was smoked by the oldest people	

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Question	Expected answer	Extra guidance	Mark
	does not support (max 2) *conclusion 1 (an increase in the number of packets smoked decreases the PEFR measurement)* 7 as the number packets increases **and** the values / range / standard deviation of PEFR of two of the groups overlap **;** *conclusion 2 (the number of packets smoked increases with age)* 8 values / range / standard deviation of the ages (for each group) overlap **or** there are no distinct age groups / age groups overlap **;** 9 group 2 smoke more packets than group 1 but (mean) age is lower **;**	e.g. overlap between: group 1 / non-smokers and group 2 group 1 / non-smokers and group 3 group 2 and group 3 group 4 and group 5 **A** individuals in groups 1, 2, 3 and 4 all have a similar / same age	[max 3]
(c) (i)	there is no <u>significant</u> relationship / correlation between the decrease in the PEFR and the increase in the number of packets of cigarettes smoked **or** there is no <u>significant</u> decrease in the PEFR as the number of packets smoked increases **or** the increase in the number of packets smoked does not <u>significantly</u> decrease the PEFR **;**	**A** there is no <u>significant</u> relationship / correlation between the increase in the number of packets of cigarettes smoked and the decrease in the PEFR	[max 1]
(ii)	*any 2 from*: number of volunteers small (est.) **;** great(est) range in number of packets of cigarettes smoked (151–230) **;** larg(est) standard deviation for number of packets of cigarettes **;**	**A** has a range of 80 instead of 50	[max 2]
		Total:	**[9]**

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	8 *ref. to* method to identify (the different) species **;**	e.g. photographs / (dichotomous) key / app / expert / nature guide / book / AW **A** species identified as A, B, C, etc.	
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	10 *ref. to* care taken not to miss, low growing / AW, species **;**		
	11 replicate transect (at least once) **;**	**I** repeat in the same transect **A** repeat, steps / the transect / the experiment at a different (start) point (round the pond)	
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(b) (i)	$\Sigma D^2 = 317$ **;**	**A** 317.0 / 317.00	[1]
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	factors may be contributing to distribution of plants ;	**A** other environmental / biotic / abiotic / factors influence the data named factors : soil pH, light / light intensity, slope, temperature, (soil) moisture / water, grazing, wind, minerals / ions / mineral salts / salts / humus, soil organisms, pathogens, effluent / herbicide **I** nutrients **I** any *ref. to* stats e.g. need to take account of standard error	[max 2]
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	saline, and nicotine ; 13 time between giving, treatments / nicotine / topiramate / saline, and measuring the concentration of dopamine ; 14 method of administration of, nicotine / topiramate / treatment ;		[max 3]
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(b)	group 5 pre-treatment = 280 (% increase) and group 1 no pre-treatment = 64 (% increase) ; 35:8 ;	**A** figures in a formula **A** 8:35 *if clear which is which* **A** 4.375:1 / 4.38:1 / 4.4:1 / 4:1 **A** quotients 4.375 / 4.38 / 4.4 / 4 **A** fractions 35/8 / 4.375/1 / 4.38/1 / 4.4/1 / 4/1 **R** units or % in final ratio ecf if graph misread *for one mark*	[2]
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	3 (the, percentage) reduction / drop, in dopamine secretion, is lower in the rats pre-treated with nicotine (280% to 120% = 57%) (than in rats not pre-treated with nicotine) (64% to 16% = 75%) ora ; 4 *any 1 from:* • in pre-treated rats / group 6, (high concentration of) the topiramate reduces the response by 160% ; • in rats without pre-treatment / group 2, (low concentration of) the topiramate reduces the response by 40% ; • in rats without pre-treatment / group 3, (high concentration of) the topiramate reduces the response by 48% ;	**A** references to addicted / non-addicted rats **A** by 57% / by approximately half **A** by 63% / by approximately two thirds **A** by 75% / by three quarters	[max 3]
(d)	(topiramate / it) inhibits / reduces / blocks, pleasure / reward / AW, so smokers, gain less from smoking / less enjoyment / become less addicted / likely to smoke fewer cigarettes / AW ; *idea that* topiramate affects, more than one / all / three brain chemicals and so has a cumulative / additive effect (on suppressing the addiction) ;	**A** because it has an effect on more than one chemical it has a, bigger / larger / further / AW, effect	[2]
		Total:	**[12]**

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