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Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2015 series

9700 BIOLOGY

9700/53 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for responses correctly cued by the question, or by extra guidance)
I	ignore
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
mp	marking point (with relevant number)
ecf	error carried forward

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	type of enzyme(s) / amylase(s) **;**	**A** enzyme(s) **A** named list	[1]
(ii)	*method must match the variable stated* 3 of *(for max 1)*: temperature pH concentration / % / dilution of, starch / substrate time for, hydrolysis / incubation / (product) removal / reaction / AW **;** 2 of *(for max 2)*: temperature – use a, water bath / incubator **;** starch / substrate concentration – use, the same (starch) solution / 2% starch solution, for all of the tests **;** time – use a, (stop) clock / (stop) watch / timer / AW **;** pH – use buffer **;**	**A** thermostatically / temperature, controlled room / AW **I** air conditioning **I** time unqualified **A** time stated as 60 minutes / 'the 60 minutes' **I** incubation / incubating **R** *ref. to* volumes of 2% starch **A** named buffer **R** neutral buffer	[max 3]
(iii)	*idea of* boiled / denatured, enzymes **or** (distilled) water **;**	**A** just / only / AW, starch **A** without enzyme **R** if boil / heat mixture (to denature enzyme)	[1]

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Question	Expected answer	Extra guidance	Mark
(b)	**A** *from diagrams where applicable* 8 of: mp1 *idea of* using extracts hydrolysed by, all / each / 3, enzymes **;** mp2 *ref. to* observation / counting, of the number, of spots / products / AW **or** measurement of, distance / length, moved by each spot / product / AW **;** mp3 *ref. to* comparison of the chromatograms **;** mp4 *ref. to* running chromatograms, for same time / to same distance (of solvent front) **;** mp5 *idea of* same number of applications applied (to origin) **;** *procedure:* mp6 *ref to* using capillary or other suitable method of applying a small sample **;** mp7 *ref to* drawing / using, a, line of origin / base line / sample line / starting line / AW **;** mp8 drying between adding drops **or** evaporating the extract (before using) **;** mp9 *idea of* placing in solvent so that level of solvent is below the, origin / line / spot / AW **;**	**I** *descriptions of hydrolysis* **A** any idea that the 3 enzymes have been tested **A** *ref. to* known markers (**not** comparing to R_f values) **A** measure position of spot **I** 'residue' **I** to find R_f unqualified / *ref. to* solvent front **A** if R_f formula given which includes spot / AW distance **A** 'look at differences between' / AW **A** all extracts on the same chromatogram **A** if time stated must be minimum of 5 minutes **A** *idea of* 'almost reach / just before, the highest level ' **I** stopping 'before' unqualified **R** spot reaches the top **I** volumes **A** dabs / dots / AW **A** stated number including 1 e.g. pin head / cocktail stick / tooth pick / Pasteur pipette / AW **I** solvent line if in context of solvent front **R** if line drawn with soluble marker **A** suitable method for TLC *in context of concentrating the extract* **A** drying between every 2nd drop **I** method of evaporating **A** in terms of precise measurements **I** names of solvents	

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Question	Expected answer	Extra guidance	Mark
	mp10 *ref. to* covering to prevent evaporation ;	**A** maintain saturated environment / AW **I** airtight unqualified	
	mp11 *idea of* drying before spraying (with dye) ;	**I** name of dye	
	mp12 *ref. to* running at least 3 chromatograms per extract / AW ;	**R** 'repeat three times' *must refer only to chromatograms if hydrolysis also described*	
	mp13 *ref. to* taking mean of / averaging, distances travelled by each spot / R_f values ;	**R** mean unqualified	
	safety: mp14 1 of: *ref. to* flammable solvents **so** no naked flames ; *ref. to* toxic / flammable solvents or dyes **so** safe disposal ; *ref. to* allergy to dyes / solvents **so** wear gloves ; *ref. to* irritant / corrosive / toxic, solvents or dyes **so** wear gloves / masks / eye protection / use fume cupboard / keep covered ;	**I** goggles for protection against flames **I** *ref. to* enzymes **A** poison	[max 8]
(c) (i)	chromatogram: **A** | **B** | **C** type of amylase: β (amylase) | α (amylase) | γ (amylase) ;		[1]

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Question	Expected answer	Extra guidance	Mark
(ii)	2 of: mp1 *idea that* α (amylase) gives a variety of, products / spots / blobs / stains / AW **;** mp2 *idea that* β (amylase) gives, one product / one spot / maltose **;** mp3 *idea that* γ (amylase) (only breaks 1–6 links so) some products are, large / may be insoluble / will hardly move / AW **;**	**I** *ref. to* heavy and light **I** *ref. to* glucose described a single molecule such as 'produces many glucose molecules' **R** no products **I** no movement **A** *idea that* having identified two amylase types then other must be the third ;	[max 2]
		[Total:16]	

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Question	Expected answer	Extra guidance	Mark
2 (a) (i)	number of rootworms / (insect) larvae ;		[1]
(ii)	3 of: mp1 four replicates for each, treatment / type ; mp2 large numbers of, maize / plants, used ; mp3 *idea of* standardised planting of each plot ; mp4 *idea of* randomising, treatments / plots (to prevent bias) ; mp5 *idea of* randomising (plants) where (soil) samples are collected ; mp6 5 soil samples for each plot / 20 soil samples (for each treatment) ; mp7 same treatment year 1 and 2 ; mp8 spacing of plots / standard gap between plots / AW ;	**I** size of plots **I** equal numbers of plots of each type **A** quoted numbers, 100 per row / 2400 per plot / 9600 per 4 plots **I** large sample size **A** descriptions such as same, density / spacing **A** same number of rows / 24 rows **I** randomising the number of roundworms collected must qualify 'sample' **A** 'around plant' for 'soil' **I** several	[3]
(b) (i)	control(s) / baseline ;	**R** control variable(s)	[1]
(ii)	1 of: mp1 *idea that* used for numerical comparison (via subtraction) ; mp2 comparison qualified ; mp3 *idea o*: finding effectiveness of treatment ;	**I** 'to compare rootworms' unqualified	[max1]

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Question	Expected answer	Extra guidance	Mark
(c)	*assume answers refer to Bt maize unless otherwise specified* 3 of: mp1 the number of rootworms was lower on Bt maize (than, insecticide / NBt + In – (except year1, day1) **; ora** mp2 Bt maize is more effective (than, insecticide / NBt + In in year 1 / year 2 / both years / generally) **; ora** mp3 *idea that* the number of rootworms fluctuated during the investigation (regardless of the control method) **;** mp4 *idea that* (as time increases) there is a decrease in the number of rootworms for both treatments / both treatments are effective **;** mp5 numbers of rootworms (in soil) around control (NBt) plants (also) decreases **;** **or** numbers of rootworms for, treatments (Bt / Nbt +In) lower than control / treatments more effective than control / NBt **;** mp6 *idea that* results for year 2 show smaller numbers of rootworms / greater effectiveness as a treatment **;**	**A** Bt gene / cry gene for Bt maize **I** quoted raw data comparative **A** fewer / less for lower **I** 'very effective' unqualified *idea of* general downward trend **A** general idea or in context of stated year(s) *must be statements related to control* **I** *ref. to* trend	[3]
(d) (i)	there is no **significant** difference in the number of rootworms (in the soil) around plants treated with insecticide / NBt + In plants, and Bt plants **;**	**A** the difference in the number of rootworms (in the soil) around insecticide treated plants / NBt + In plants and Bt plants is **not significant / not significantly different**	[1]
(ii)	*idea of* two samples of 20 and subtracting 1 from each of them ; 38 ;	**A** as a formula (20–1) + (20–1) *if the wrong number of samples allow max 1 for correct use in formula*	[2]

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(e)	there is a, 95% / greater than 95%, chance that the difference is due to chance **;;** *not significant (max1)* *idea that* the results are caused by chance **;** *P < 0.05 (max 1)* *idea that* p< 0.05 means that there is only a, less than 5% / 5% chance / probability, of obtaining results by a factor other than chance **or** greater than 95% / 95% certain / sure, that the results are caused by chance **;**	**I** random error throughout **A** any difference (in the results) is due to chance **I** null hypothesis **A** other numerical methods of processing e.g. 1 in 20 **R** misconceptions such as, 5% of results are due to a factor other than chance / 95% of the results are due to chance	[2]
		[Total:14]	

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