CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9700 BIOLOGY

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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Mark schemes abbreviations:

;	separates marking points
/	alternatives answers for the same point
R	do not allow
A	allow (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

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Question	Expected answer	Extra guidance	Mark	AO
1 (a) (i)	*independent*: concentration of GA **;** *dependent: ref. to* the starch free, area / zone (around grains) **;**	*ignore* amount / quantity **A** diameter / radius / size **A** clear zone / brown zone / digested starch *ignore* ref. to amylase activity	[2]	P
(ii)	8 of: *independent variable* 1. *ref. to* method of diluting the ($3\,mmol\,dm^{-3}$) GA to give a minimum of (any) 5 dilutions **;** 2. *ref. to* concentrations (other than 0) that fall in the range $3\,mmol\,dm^{-3}$ to any value above zero with units **;** 3. *ref. to* soaking grains in GA solutions for, min 24 hours / max 72 hours **;** 4. *ref. to* a **control** using (distilled / deionised) water **;** 5. *ref. to* stated incubation temperature **;**	***A** seed / fruit / maize for any mark point in **(a)*** *ignore any ref. to time between soaking and putting maize onto agar plate* 1. **A** series / serial / proportional / simple, dilution as method **or** description of method 2. minimum is 2 values that are not higher than $3\,mmol\,dm^{-3}$ and are above zero $1\,mmol\,dm^{-3} = 1000\,\mu mol\,dm^{-3}$ $1\,\mu mol\,dm^{-3} = 0.001\,mmol\,dm^{-3}$ 3. *ignore* if the range of GA is incorporated into agar plates If pre-soaked in water for 24h and then in GA, must be **minimum** of 1 hour GA 4. **A** description – 'to allow comparison' / AW 5. e.g. any one temp in the range 15–35°C. **A** room temperature. **R** body temperature / 37°C		

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Question	Expected answer	Extra guidance	Mark	AO
	dependent variable 6. *ref. to* a suitable method of measuring the starch free area around the grains **;** *standardising variables* **(max 4)**: 7. *ref. to* using, same / stated number of, grains / halves, for each concentration **;** 8. *ref. to*, stated / same, volume of each soaking solution / GA **;** 9. *ref. to* method of keeping same incubation temperature **;** 10. *ref. to* one stated time for incubation (of enzyme) **;** 11. *ref. to*, same / stated, concentration of starch in agar **;** 12. *ref. to* same, volume / depth, of agar (in the Petri dishes) **;** 13. covering to prevent, evaporation / contamination **;**	6. e.g. trace outline onto a grid / transparent grid / photograph and put on grid / cut out clear zone and put on grid, **and** count squares. **OR** use suitable apparatus to measure, diameter / radius, directly **or** from a grid **and** calculate area using πr^2 *ignore* metre ruler. **A** e.g. ruler / callipers / micrometer / eyepiece graticule 7. **A** 'one / a' as same number *ignore* 'same size of grains / same amount of grains. **A** quantity for number 8. **A** *idea* of: all, submerged / covered 9. e.g. water bath / incubator / temperature controlled room / thermostatically controlled environment / environmental chamber / propagator / thermostat *ignore* air conditioning 10. **A** any value in the range 24–72 hours. Actual value must be stated **A** left on, plate / agar as AW for incubate 11. **A** 'known' time		

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Question	Expected answer	Extra guidance	Mark	AO
	safety: 14. *ref. to*, low risk investigation / any suitable safety precaution **;** *reliability*: 15. *ref. to* replicates, **and** mean / to identify or eliminate anomalies **;**	14. e.g. cutting away from hands / using tile for cutting. *ignore* gloves for cutting. ref. to allergy / irritation, and, gloves / mask / eye protection **R** no risk 15. must be a minimum of 3 (data sets), allow as, original and 2 more / several **A** outliers for anomalies **A** average for mean	[8]	M
(b)	*x-axis*: concentration of GA **and** mmol dm^{-3} **or** μmol dm^{-3} **;** *y-axis*: (mean) area of, clear zone / starch digested **and** mm^2 **;**	**A** mmol **or** μmol, per dm^3 **or** mmol / dm^3 **or** μmol / dm^3 **A** (mean) diameter of clear zone / mm **A** cm^2 / cm **A** activity of amylase **and** arbitrary units / au labels correct – no / incorrect, unit(s) = 1 max axes reversed, correct for labels **and** units = 1 max	[2]	D
(c) (i)	3 of: 1. *idea of* areas irregular in shape **;** 2. *idea of* edges of areas difficult to see **;** 3. not sure how much GA embryo is also producing **;** 4. may be other, enzymes / chemicals, that hydrolyse the starch **;**	*ignore ref. to replicates / repeats* 1. **A** in terms of different diameters **A** in general terms like 'difficult to tell actual size' 2. **A** in terms of edges overlapping or edges blurred / brown merging into blue / AW 3. **A** grain / fruit / seed for embryo		

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Question	Expected answer	Extra guidance	Mark	AO
	5. *idea of:* no way of quantifying amylase (leaving grain) **;**	5. **A** in terms of, not diffusing out / used inside / ref. to different surface area of (cut) grain / size of grain only in context of amylase not leaving grain or having different amounts of amylase		
	6. amylase / enzyme, may come from contamination **;**	6. **A** coming from fungi / bacteria / coat of grain		
	7. *idea of:* no method of quantifying the starch disappearance **;**	7. *idea of*: do not know of the number of molecules of starch broken down. Look in context of the test being qualitative rather than quantitative. NOT rate ideas		
	8. pH may vary / AW **;**		[3]	E
(ii)	*method:* any 1 × 2 of: 1. stated better method of measuring, (area / diameter) **;** some brief detail of stated method **;** 2. *if overlap:* separate plates / fewer grains per plate / larger plates **;** able to distinguish edges more clearly / AW **;** *if 'blur':* really cannot be improved = 2 marks **;;** **or** do large sample **;** minimises, effect / error / AW **;** 3. *idea of:* separating the embryo from the grains (after soaking) **;** *idea of:* measure area, without embryo present / with embryo on its own **;** 4. *idea of:* extracting the amylase (from grain) **;** *idea of:* repeat with just the extract and compare **;**	1. e.g. use graticule on low power of microscope = 2 marks		

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Question	Expected answer	Extra guidance	Mark	AO
	5. *if in term of how much out / used up*: *idea of:* extracting the amylase (from grain) **;** *idea of:* repeat with just the extract and compare ; *if in terms of different surface areas:* *idea of:* measuring (surface) area **;** *idea of:* either finding similar area or calculating per unit area **;** 6. *idea of:* sterilising / disinfecting (grain / agar / dish /AW) **;** detail of possible method **;** 7. *idea of:* putting known concentrations of amylase on starch agar **;** producing a calibration curve from areas measured **;** 8. use a buffer **;** to make up the agar (plates) **;**	5. **A** remove endosperm repeat using embryo / AW 6. detail e.g. (named) disinfectant **or** sterile technique to, make plates / make up agar / handle grains **or** keep plate covered.	[2]	M
		Total:	**[17]**	

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Question	Expected answer	Extra guidance	Mark	AO
2 (a)	3 of: 1. anaerobic bacteria increase with depth **and** aerobic bacteria decrease with depth ; 2. below 1.5–2.0 m aerobic stay approximately the same **and** anaerobic continues to increase(slowly) **;** 3. *idea of:* oxygen content of soil decreases with depth **;** 4. *idea that:* anaerobic bacteria replace the aerobic bacteria as oxygen reduces / (most) aerobic unable to survive in low oxygen **;**	1. A general point – but must relate to idea of depth 3. **A** oxygen content decreases with time 4. **A** replacement in terms of succession / competition	[3]	C
(b) (i)	less activity of, dehydrogenase / enzyme **;**	**A** less <u>aerobic</u> respiration **R** less dehydrogenase	[1]	E
(ii)	2 of: 1. temperature **;** 2. pH **;** 3. *idea of:* time that determination was run for **;** 4. (soil) moisture / water **;** 5. substrate (in soil) **;**	*ignore* ref. to oxygen 5. **A** (named) nutrients (in soil)	[2]	P
(iii)	*idea of*: (soil) without, (active) bacteria / active enzyme **;**	**A** heated / boiled / disinfected / sterilised / irradiated / AW, soil **A** (soil) with, dead / killed bacteria / denatured enzyme / enzyme removed **A** ref. to add an enzyme inhibitor **A** remove the bacteria from soil **R** killed enzyme / replace with (named) inert material	[1]	P

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Question	Expected answer	Extra guidance	Mark	AO
(c) (i)	*ref. to* wide / long / big / AW, error bars, that indicate results are, less / not, reliable **;** *ref. to* data **;**	**A** reverse argument **A** suitable AW for wide e.g. 6 years least reliable **or** 6 months / 3 years most reliable **or** more reliable in **B** than **A** at 6 years	[2]	D
(ii)	6 months and 3 year , 6 months and 6 years **both** underlined / ringed **;** error bars do not overlap **;**	**A** error bars do not cross / AW	[2]	D
(d)	*idea of*: graph of, dehydrogenase / enzyme, activity, against number of bacteria per gram (plotted) **;** *idea of:* dehydrogenase / enzyme, activity located on graph and number of bacteria read from scale **;**	*ignore* orientation of graph. **A** if shown on a graph for 2 marks **A** *idea of:* comparing data against table to look for 'closest approximation' = 1 mark max *ignore* compare unqualified	[2]	D
		Total:	**[13]**	

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