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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/51 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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Mark schemes abbreviations:

; separates marking points

/ alternative answers for the same point

R reject

A accept (for answers correctly cued by the question, or guidance on the mark scheme)

AW alternative wording (where responses vary more than usual)

underline actual word given must be used by the 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
1 (a) (i)	light + intensity / exposure;	do not allow light unqualified or position in shade / sun	[1]
(ii)	8 of: *independent variable:* 1. ref. to a systematic way of obtaining leaves; *dependent variables:* 2. ref. to a **method** of measuring surface area; 3. ref. to how surface area is calculated; 4. ref. to idea of both sides needed to get total surface area; 5. ref. to a method of measuring mass; 6. ref. to finding dry mass; 7. ref. to a method of measuring internode length either on the plant or a cut section from a plant; 8. ref. to a method of measuring water loss; 9. ref. method of using the transpiration apparatus; 10. ref. to keeping constant environment when measuring water loss; (max. 6) *safety*: 11. ref. to low risk investigation; *reliability* 12. ref. to mean values of the whole sample; 13. ref. to method of working out SA : mass ratio; 14. ref. to calculating standard deviation;	*ignore any reference to planting seeds / potted plants* 1. e.g. 3rd leaf from the apex / different heights / all from the same height / equal light exposure 2. e.g. draw round each leaf on grid or use transparent grid over leaf / measure **diameter(s)** of leaf 3. count squares / use formula πr^2 5. e.g. digital balance / scales 6. e.g. sample leaves dried in oven until mass constant 7. by holding against a ruler / use string or cotton to mark distance measure with ruler 8. e.g. use a potometer / weigh leaf / place leaf inside a plastic bag (to collect water) 9. measure distance moved by water / weigh at hourly intervals / weigh bag or leaf after a stated time 11. e.g. ref. heat and suitable precaution if use dry mass / leaf allergy 12. do not allow 'mean of three idea' 14. ignore formula	[8]

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(b) (i)	t = **23 – 15** ; $\sqrt{\frac{4^2}{30}} +$ **$\frac{3^2}{30}$** ; $\frac{(8)}{(0.9)}$ = **8.9**;	ignore any working in the answer allow 9 / 8.89 and 8.88 $\dot{8}$ allow ecf for incorrect figure from subtraction	[3]
(ii)	total number of measurements –1 **for each set of measurement /** (30 – 1) + (30 – 1) = 58;	allow 2n – 2 / (n – 1) + (n – 1) 60 – 2 = 58	[1]
(iii)	ref. (both) calculated / t values are greater than the critical value / 0.2; both results are significant / not due to chance / caused by another factor / light exposure;	if the calculation is omitted from **(b)(i)** both marks are still available allow ecf from **(b)(i)** ignore null hypothesis unless explained	[2]
(c) (i)	ref. to counting the number of eye piece graticule units; ref. to idea of finding the value of an eyepiece unit with a stage micrometer	 allow descriptions / ref. to a standard graticule unit value	[2]

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(ii)	*Marks are for conclusions about the adaptations shown by the plants. Do not allow marks for answers that restate the data in table 1.1* 3 of: **EITHER** for shade leaves: 1. thinner cuticle increases light penetration; 2. thinner leaf / shorter palisade cells increases light penetration (to inner parts of leaf); 3. spongy mesophyll has more chloroplasts to increase light absorption; 4. cells less densely packed / larger air spaces for better gas diffusion; 5. larger surface area to absorb limited light / enables more photosynthesis with less light availability; **OR** for sun / exposed leaves: 1. thicker cuticle limits water loss; 2. (large / long palisade cells) contain more chloroplasts to absorb maximum light; 3. fewer chloroplasts in spongy mesophyll as little light penetrates / palisade is light saturated; 4. densely packed cells / smaller air spaces reduce water loss; 5. smaller surface area reduces water loss;	*Look for the understanding that shade leaves have adaptations that maximise photosynthesis and sun leaves have adaptations to minimise water loss.* allow mix and match for sun and shade leaves but take care not to give the same mark twice. candidates should make it clear which type of leaf they are referring to. ignore anything related to growth ignore any references to internodes ignore any references to stomata	[3]
			[Total: 20]

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2 (a) (i)	2 of: length of organism; time for adjustment (to temperature); time of measurement;	do not allow size	[2]
(ii)	1 of: activity / age / sex / mass of organism; source / type / pH / volume of water; oxygen supply;	do not allow microscope lamp / light	[1]
(iii)	1 of: counting high rates is error prone; changes in temperature; activity / stress affect heart rate;	allow oxygen content if not in **(ii)** e.g. light from microscope / cooling	[1]
(iv)	idea of sufficient measurements for reliability / to remove anomalous results;	do not allow accurate ignore reduce error / fair test	[1]
(b) (i)	allows for different starting points between individuals / can see the changes more clearly;	looking for the idea that 'it is easier to see what is happening / make comparisons'	[1]
(ii)	$\frac{\text{rate at 30 °C} - \text{rate at 25 °C / difference in rate at 30 °C and 25 °C}}{\text{rate at 25 °C}}$ × 100;	allow correct use of any figures from the table e.g. $\frac{165 - 132}{132} \times 100$	[1]
(iii)	decrease (by at least 50%) / falls to a very low value / may stop;		[1]
(c)	*support*: 5 °C – 15 °C / 15 °C – 25 °C / 10 °C – 20 °C (as rate approx. doubles with10 °C increase); *does not support:* 20 °C – 30 °C increases but does not double / 25 °C – 35 °C decreases / above 30 °C rapidly decreases with temperature increase;	allow 'below 30 °C' / 'up to 25 °C' allow above 30 °C – 35 °C rapidly decreases with temperature increase;	[2]
			[Total: 10]

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(b) (i)	t = **23 – 15** ; $\sqrt{\frac{4^2}{30}} + \frac{\mathbf{3^2}}{\mathbf{30}}$; $\frac{(8)}{(0.9)}$ = **8.9**;	ignore any working in the answer allow 9 / 8.89 and 8.88 $\dot{8}$ allow ecf for incorrect figure from subtraction	[3]
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(iii)	ref. (both) calculated / t values are greater than the critical value / 0.2; both results are significant / not due to chance / caused by another factor / light exposure;	if the calculation is omitted from **(b)(i)** both marks are still available allow ecf from **(b)(i)** ignore null hypothesis unless explained	[2]
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2 (a) (i)	2 of: length of organism; time for adjustment (to temperature); time of measurement;	do not allow size	[2]
(ii)	1 of: activity / age / sex / mass of organism; source / type / pH / volume of water; oxygen supply;	do not allow microscope lamp / light	[1]
(iii)	1 of: counting high rates is error prone; changes in temperature; activity / stress affect heart rate;	allow oxygen content if not in **(ii)** e.g. light from microscope / cooling	[1]
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(ii)	$\frac{\text{rate at 30 °C} - \text{rate at 25 °C / difference in rate at 30 °C and 25 °C}}{\text{rate at 25 °C}}$ × 100;	allow correct use of any figures from the table e.g. $\frac{165 - 132}{132} \times 100$	[1]
(iii)	decrease (by at least 50%) / falls to a very low value / may stop;		[1]
(c)	*support*: 5 °C – 15 °C / 15 °C – 25 °C / 10 °C – 20 °C (as rate approx. doubles with10 °C increase); *does not support:* 20 °C – 30 °C increases but does not double / 25 °C – 35 °C decreases / above 30 °C rapidly decreases with temperature increase;	allow 'below 30 °C' / 'up to 25 °C' allow above 30 °C – 35 °C rapidly decreases with temperature increase;	[2]
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AW alternative wording (where responses vary more than usual)

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max indicates the maximum number of marks that can be given

ora or reverse argument

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	time taken for blue colour to become colourless / AW ;	**A** time to change colour / AW	[1]
(ii)	to prevent oxygen entering / prevent re-oxidation of methylene blue ;	**A** the idea of it allows the methylene blue to work as a hydrogen acceptor **Ignore** air, carbon dioxide, gas exchange	[1]
(iii)	7 of: *independent variable:* 1. ref. to water-baths at different temperatures ; 2. at least 5 different temperatures ; 3. ref. to suitable range ; 4. ref. to retesting within the approximate optimum zone ; *dependent variable* 5. ref. to fastest time until blue disappears is optimum ; 6. ref. to colour comparison / control without methylene blue added ; *control variables* 7. ref. to standard volume of yeast / suspension (in tube) ; 8. ref. to adding standard volume methylene blue ; *procedure* 9. ref. inverting / stirring (to mix indicator and yeast) ; 10. ref. to repeats / replicates – min 3 **and** mean value to remove anomalies ; *safety:* 11. ref. to a low risk experiment ;	1. allow other suitable means of maintaining constant temperature 3. e.g. 0 °C – 70 °C. Any range in this but at least one below 30 °C and one above 5. **A** ...becomes colourless 7. **R** amount unqualified **A** known mass / weight for (dried) yeast provided some water added **Ignore** glucose 8. **R** amount /drop(s) **A** inject known volume of methylene blue through the oil layer 11. **A** ref. to possible toxicity of methylene blue / allergy to yeast / hot water **and** tongs, etc.	[7]

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(b)	3 of: 1. (yeast) can use / respire/ metabolise fructose, glucose sucrose and maltose ; 2. (yeast) has enzyme(s) to use above sugar(s) ; **ora** 3. (yeast) uses / takes up, fructose preferentially, as highest rate / AW ; 4. sucrose has a high rate as a source of fructose / AW ; 5. maltose / sucrose are larger so take longer to take up / AW ; 6. disaccharides / named disaccharide have to be hydrolysed / AW ;	1. little / no, use with galactose and lactose 3. **A** refs. to respiration as idea of uses	[3]
(c) (i)	$\frac{\mathbf{4}}{\sqrt{12}}$; = 1.16 / 1.15; = 1 cell;	**A** 4 / 3 **A** 1.2 (1.33 /1.3 if use 4 / 3) allow ecf if any value other than √12 used	[3]
(ii)	ref. to spread of data from the mean value / AW; ref. to larger value the less reliable the results / AW ;	**A** with reference to data in question **R** if accurate mentioned as well as reliable	[2]
(iii)	axes correct and labelled ; correctly plotted bar chart ; error bars correct using S_M values; (*plus and minus 2 and 1)*	*y* – mean, no. cells per mm^3 / population size per mm^3 *x* – each block labelled with correct sugar / key **R** histogram / line graph **A** sd values (plus and minus 8 and 4)	[3]
(iv)	1 of: yes: difference in mean number of cells / AW ; yes: standard error does not give overlap in populations; no: some raw data overlaps / standard deviation overlaps ; inconclusive: as no statistics tests carried out ;	reason must be consistent with their choice ignore qualifications like large / significant **A** 'no' if no statistics done	[1]
			[Total: 21]

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2 (a) (i)	independent – nicotine ; dependent – reaction time ;	**A** cigarette. **Ignore** 'amount' etc. **A** description of reaction time	[2]
(ii)	2 × 2 of: memory test time (for exposure to letters) ; constant time for which stimuli shown / 250 ms ; time between stimuli and test ; constant time / 1000 ms ; non smoking time prior to start of test ; constant time / 12 hours ; nicotine content of cigarette for each test; fixed mass in each cigarette; test group / AW ; same group used ; number of tests / single letters tested ; 50 / same ; difficulty of memory test ; varying the number of letters used (to randomise the test) ;	 **A** amount / figures quoted 0.05mg / 1.1mg **R** 'all regular smokers'	[4]
(b)	3 of: *support:* reaction time decreases with nicotine / higher nicotine (1.1mg) greatest decrease ; 1.1 mg (nicotine) increases number of letters correct / improves accuracy ; *against:* 0.05 mg (nicotine) decreases accuracy / decreases number of letters correct / small differences in number of letters correct ; ref. to error bar overlap in, accuracy data / reaction time between no smoking and 0.05 mg ;		[3]
			[Total: 9]

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