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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9700 BIOLOGY

9700/51 Paper 51 (Practical 2), 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.

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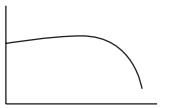
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Mark schemes abbreviations:

- **;** separates marking points
- **/** alternative answers for the same point
- **R** reject
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- **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)	2 of; axes correctly oriented and labelled; appropriate values and curve shown; 1/time or Rate of light dependent reaction  temperature ºC	Allow as minimum: rate on y axis and temp on x axis. Allow time^{-1} and ºC. Do not allow rate of photosynthesis.	[2]	P
(ii)	*For each factor, allow both marks anywhere in the answer. If two factors given in one answer, mark the first unless there is nothing written in no.2* *For 1 and 2 – ignore amount/quantity for the variable, but not for the method of control.* 2 × 2 of: 1. light <u>intensity</u>; use light of (same wattage) at same distance; 2. light <u>wave length</u>; use a known filter / coloured filter / coloured light bulb; 3. (quantity o)f chloroplasts; chloroplasts - using same mass / volume of chloroplast; suspension; 4. (quantity) of indicator / (electron) acceptor; indicator – same concentration/volume of indicator / (electron) acceptor;	Ignore carbon dioxide concentration and pH. Allow a light in a dark room. Do not allow from the same plant.	[2] [2]	P M
(iii)	*Take care that the question is not being repeated for 'expose to light'.* idea of: keeping covered / not adding acceptor (until ready to measure), (using stop watch) find time for colour to disappear/ change from blue to colourless; divide 1 / time to find rate;	 Allow any idea that the light is not switched on until measuring is carried out. Allow a formula.	[1] [1]	M D

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Question	Expected answer	Extra guidance	Mark	AO
(b)	idea of: (ADP and inorganic phosphate) will increase the rate (of the light dependent reaction);	Ignore photosynthesis.	[1]	P
		Total:	**[9]**	P5 M3 D1
2 (a)	(distilled) water; idea of: to show that the hormone / solution Y causes extra population growth / to show how much population growth occurs without hormone;	Allow if the answer implies that any effect on population / cells is due to solution Y / hormone.	[2]	M
(ii)	2 of: 1. ref. to adding sample to slide; 2. ref. to idea the sample is uniform; 3. ref. counting cells; 4. ref. to any detail of counting e.g. exclusions / number of squares; 2 of: 5. ref. to grid volume 0.2 mm × 0.2 mm × 0.1 mm = 0.004 mm^3; 6. ref. to factor × 250 to estimate number of cells per mm^3 / dividing by the grid volume (0.004 mm^3); 7. ref. to counting min.3 areas / slides and taking mean;	3. Allow reference to number of cells. 4. Allow any recognised systematic method of measuring. 5. Allow any other sizes identified from diagram e.g. 0.1 × 0.1 × 0.1. 6. Allow marks from a formula.	[2] [2]	M D
(c) (i)	mean = 6.2;		[1]	D
(ii)	$\frac{(6.2-3.0)}{3}\times 100 = 107(\%)$;	Do not allow fraction / decimal answers. Allow 106 if calculation shows 6.18 being used to find the percentage. Allow ecf for wrong mean in **(c) (i)**.	[1]	D

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Question	Expected answer	Extra guidance	Mark	AO
(d)	*Must have at least one answer in each section and any 2 others* *support:* 1. mean value of experimental cell culture is higher (than control); 2. percentage increase in greater in experimental culture; 3. bottom of range higher / top of range higher, in experimental cell culture (than control) / AW; *does not support* 4. range overlaps / ref. to specific examples of control and experimental samples which are the same ; e.g. control 6 and experimental 8 which are both 6.5 / some control samples have same value as experimental mean *allow any refs. to limitations of procedure:* 5. ref. to insufficient replication (for such variable data); 6. no statistical test of difference carried out / do not know if the difference is significant / no chi squared test / no t-test / no standard error calculated; 7. only one concentration tested / ref. limited range / AW;	Do not allow isolated examples of comparisons between specific samples any where in the answer. 3. Idea that the figures at the lower end of the range are all higher in the experimental culture / ora OR the figures at the top end of the range are all higher for the experimental culture / ora.	[4]	E
		Total:	**[12]**	M4 D4 E4
3 (a) (i)	3 of: ref. to weighing / finding mass of the fish; ref. to suitable method of measuring testis e.g. mass / volume / length; ref to suitable units for chosen method e.g. g / kg / cm^3 / cm; ref. to a sample of 3 or more and taking a mean; ref. to proportion calculated by, mass / volume / length testis divided by mass of body;	Allow measurement of volume or length. Allow several / many / a number. Allow as a formula. Allow ecf from a fish mass without testis. Do not allow ref. 'find the ratio' unqualified.	[3]	M

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Question	Expected answer	Extra guidance	Mark	AO
(ii)	t-test; data is a continuous / shows a normal distribution / comparing differences in means;	Allow ref. to lack of overlap of error bars.	[2]	D
(iii)	1 of: fewer seminiferous tubules / fewer spermatogonia / less sperm produced; fewer endocrine / Leydig cells / less hormones (so fail to mature);		[1]	C
(b)	1.ref. to values between 60–120 (ng per g lipid)show greatest increase in damage / fragmentation; 2. ref. to values above 120–180 (ng per g lipid) show that increase in (CB-153) concentration has little effect ; 3. ref. to no overlap in error bars between values at 60 and 120 (ng per g lipid) indicates the difference (in damage) is likely to be significant; 4. ref. to above 120–180 (ng per g lipid) error bars have a lot of overlap so (increase in damage) not likely to be significant;	1. Allow higher concentration (of CB-153) causes more(DNA) damage. 2. Allow ref. to non-linear relationship / seems to be threshold / shows a plateau.	[3]	C
		Total:	**[9]**	3 M 3 D 3 C

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9700/52 Paper 52 (Practical 2), maximum raw mark 30

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Question	Expected answer	Extra guidance	Mark	AO
1 (a)	*For each factor, allow both marks anywhere in the answer. If two factors given in one answer, mark the first unless nothing is written in no.2.* *For 1 and 2 – ignore amount for the variable, but not for the method of control* 2 × 2 of: 1. ref. to nutrient / substrate; ref. to suitable context e.g. concentration / volume / flow rate / composition; 2. ref. to bacteria culture added; ref. to suitable context e.g. volume or mass of (immobilised) cells / volume of culture; 3. pH; use buffer / named buffer; 4. ref. to anaerobic conditions; ref. to a suitable method of providing condition in a fermenter; e.g. nitrogen / carbon dioxide, atmosphere;	Ignore type of fermentation system unless qualifications apply only to batch culture. Reject food as variable, but allow method if reference to concentration or mass in solution. Ignore mass of nutrient unless in terms of making up solutions. Allow ref. to, oxygen / air supply / aerobic bubbling air/oxygen / use of sparger / air lift.	[2] [2]	P M
(b)	*Assume that the answer is about immobilised cells unless the answers says otherwise. Allow marking points expressed as figures in the correct context.* 3 of: 1. immobilised cells have lower survival rates than control cells on day 3; 2. immobilised cells have higher survival rates in gastric juice than in intestinal juice; 3. (immobilised cells) survival increases with time of fermentation; 4. decrease in temperature increases survival ; 5. not all cells survive / some die ; 6. allow: idea that survival in intestinal juice and gastric juice become almost the same by day 12 / 15 ;	1. Allow reverse argument. 2. Survival rate in gastric juice in control cells is lower than in intestinal juice; 3. Allow day 3 is the lowest / 15 days max. 4. Allow temperature has little effect on the increase in survival.	[3]	C

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Question	Expected answer	Extra guidance	Mark	AO
(c)	idea of: number of samples (for each condition tested); mean value (for each condition tested);	Allow any word that implies samples e.g. readings / values / repeats / sample size. Do not allow number of cells surviving. Allow marks on a labelled formula. Ignore any other ref. to figures / measurements / undefined symbols.	[2]	D
		Total:	**[9]**	P2 M2 D2 C3

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Question	Expected answer	Extra guidance	Mark	AO
2 (a)	*If carried out in Glasshouse / room do not award. points 9,10 and 11* 8 of: *independent variable* 1. ref. to exposing slide / apparatus for period of time in different light intensities to include dark (zero intensity) / to light and dark conditions; *dependent variable* 2. ref. to counting pollen in field of view; 3. ref. to counting at least 3 areas of the slide; 4. ref. measuring diameter of field of view using graticule; 5. ref. to calculating area of field of view (using formula πr^2) ; *control variables – max 4* 6. ref. time of exposure constant; 7. ref. same location for all readings; 8. ref. to removing any pollen on opening between each slide ; 9. ref. to outside location; 10. detail of location; e.g. no walls/hedges/trees in the way / facing wind; 11. ref. to an attempt to control environmental factors / some environmental variable cannot be controlled ; *reliability* 12. ref. to repeating the whole investigation on 3 different days and taking mean; *safety: max 1* 13. low risk investigation ; pollen allergy and use of mask; electrical safety and ref. to water ;	1. Allow ref to range of times covering light and dark periods. 3. Allow using 3 traps (at the same time) and taking counts. 7. Room / Glasshouse – need precise ref. to same location. 10. Allow specified place – on roof, wall, field. 11. Ignore wind speed if related to pump. 12. Allow if take 3 repeats on the same day plus mean. Several = 3 or more.	[8]	M

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Question	Expected answer	Extra guidance	Mark	AO
(b) (i)	*If the total number of pollen grains is correct and the volume of air is correct from a calculation, give both marks. Allow any method of calculation that give the expected values.* *Calculations of values e.g.* total pollen collected = number of pollen per mm^2 × surface area collection strip (1/0.25 × 6 = 24) × 420 (10 × 42) = 10080; volume of air m^3 in 6 hours = volume per min × min in 1hour × no. hours ÷ 1000 (10 dm^3 × 60x 6 ÷ 1000 = 3.6 m^3); *Use of calculated values:* pollen in 1 m^3 = $\frac{10080}{3.6} = 2800$;	*allow marks either for words or figures* *allow 'back' calculations* *allow other calculations e.g.* $\frac{420}{0.25}$ = *1680 × 6 = 10080* $\frac{10080}{60 \times 6}$ = 28 pollen per minute 28 × 100 or $\frac{28}{10}$ × 1000 = 2800 in 1 m^3 Allow ecf if either of the values calculated incorrectly, but used correctly in the formula.	[3]	D
(c) (i)	there is no difference in the number of pollen grains in (hot)dry air and (hot)wet air ; humidity / dryness / wetness does not affect the number of pollen grains;	do not allow alternative hypothesis do not allow if differences in light given	[1]	D
(ii)	ref. to the data being categoric / discrete;	Allow discontinuous, but NOT discontinuous variation. Allow expressed as ref. to significance between observed and expected data.	[1]	D
(iii)	there are two conditions counted, so 2-1= 1	Allow 2 sets of data or two conditions sampled. Reject 2 – 1 = 1 unqualified	[1]	D
		Total:	**[14]**	M8 D6

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<table>
<tr><th>Question</th><th>Expected answer</th><th>Extra guidance</th><th>Mark</th><th>AO</th></tr>
<tr><td>3 (a) (i)</td><td>ethanol concentration;
temperature;</td><td>Allow alcohol concentration.</td><td>[2]</td><td>P</td></tr>
<tr><td>(ii)</td><td>pigment released / light absorbance;</td><td>Ignore membrane permeability.</td><td>[1]</td><td>P</td></tr>
<tr><td>(b) (i)</td><td>2 of:
<table>
<tr><td></td><td colspan="6">absorbance at each ethanol concentration / %</td></tr>
<tr><td></td><td>0</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td></tr>
<tr><td>student 1</td><td>0</td><td>0.12</td><td>0.21</td><td>0.35</td><td>0.65</td><td>0.70</td></tr>
<tr><td>student 2</td><td>0.10</td><td>0.10</td><td>0.22</td><td>0.32</td><td>0.60</td><td>0.75</td></tr>
<tr><td>student 3</td><td>0</td><td>0.18</td><td>0.20</td><td>0.38</td><td>0.59</td><td>0.72</td></tr>
<tr><td>student 4</td><td>0</td><td>0.18</td><td>0.35</td><td>0.35</td><td>0.65</td><td>0.76</td></tr>
<tr><td>student 5</td><td>0.15</td><td>0.10</td><td>0.18</td><td>0.34</td><td>0.62</td><td>0.75</td></tr>
</table></td><td>If more than 2 given – allow marks if all correct, lose 1 for every incorrect.</td><td>[2]</td><td>E</td></tr>
<tr><td>(ii)</td><td>2 of:
ref. to insufficient data:
ref. to idea that cannot make comparisons between ethanol and temperature;
ref. to needing all the temperature and ethanol concentrations;</td><td>allow if refers to comparing like with like
allow if refers to only 0% ethanol and 30^{o}C being comparable</td><td>[2]</td><td>E</td></tr>
<tr><td></td><td></td><td>Total:</td><td>[7]</td><td>3P
4E</td></tr>
</table>

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