UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 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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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
ora	or reverse argument
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Question	Expected answer	Extra guidance	Mark
1 (a)	8 of: *independent variable* 1. ref. to making a range of 0.2, 0.4, 0.6, 0.8, 1.0 mol dm^{-3} sucrose solution / making separate solutions from sucrose and water ; 2. ref. to using distilled / deionised water (for making dilutions) ; 3. ref. to leaving plant tissue for suitable time – minimum of 20 min ; *dependent variable* 4. ref. to using tuber from each region in separate containers of each molar solution ; 5. ref. to weighing before and after immersion in sucrose solutions ; *standardising variables **(max 3)**:* 6 ref. to using same, number / mass / weight /volume, of potato ; 7. ref. to known / same volume of each molar solution ; 8. ref. to same time in solutions ; 9. ref. to blotting tissue dry before reweighing ; 10. ref. to suitable method of keeping temperature constant ; 11. ref to standardising the source of material ; *safety:* 12. ref. to low risk investigation / any suitable safety precaution;	1. allow a general statement of making 5 (min) solutions from 0-1 mol dm^{-3} allow any volumes in correct proportions for making sucrose solutions do not allow if refer to serial dilutions unless it would give the concs. stated by the candidate ignore ref. to 0.0 as a sucrose solution 3. allow in terms of 'long enough for osmotic changes to occur' ignore keeping in water/solution before using 4. look for containers. But give if done for one set 6. 'same size'. Ignore amount. Allow (surface) area / description 7. allow idea of tissue totally immersed 8. can be awarded in the context of mp3 10. e.g. water bath, incubator, temperature controlled room. allow room temperature. ignore air conditioning 11. e.g. same species/variety or clearly same tuber 12. e.g. cutting away from hands / using tile for cutting. e.g. plant allergy gloves or mask etc. ignore gloves for cutting. ignore water and electricity	

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	reliability 13. ref. to minimum of three repeats and a mean ;	13. allow reference to 3 repeats in terms of spotting anomalous results	[8]
(b) (i)	final mass – original mass x 100 ; original mass	allow as a description or difference in mass allow alternatives to multiplication sign	[1]
(ii)	idea of the proportional change from the original mass /allows comparisons to be made if the starting masses are not exactly the same ;	allow: 'easier to compare' , 'takes into account original mass'	[1]
(c) (i)	comparing mean values of (two) sets of data / data is continuous / data has a normal distribution ;	do not allow 'it is a continuous variable' allow: idea that sample is an appropriate size for (*t*-test)	[1]
(ii)	2 of: 1. idea of using a probability table at 0.05 / 5% probability ; 2. to see if the ***t*** -value is higher or lower than the critical value **or** if value of ***t*** is higher than critical value it is significant **ora** ; 3. using 38 degrees of freedom ;	2. allow if refer to 'the right or left of the critical value' or 'above or below'. 2. allow reject null hypothesis **ora** 3. allow if use formula (20-1) +(20-1)	[2]
(d)	*Support:* **2 of:** 1. old tuber at growing shoot equilibrates at the greatest concentration of sugar / sucrose solution (so has lowest water potential) ; 2. old tuber at growing shoot shows greatest change in mass at low concentrations (of sucrose) / less than 0.5 mol dm^{-3} **ora** ; 3. water potential in central old tuber is lower than new suggesting more solutes / sucrose / sugar than in new tuber ; 4. water potential in new tuber is the highest suggesting least number of solutes / sucrose / sugar ; *Against:* **2 of:** 1. evidence shows there is a change in solutes, not which solutes are used / AW ; 2. insufficient data collected / not enough replicates ; 3. insufficient intermediates / too few data points ;	4. allow higher / less 2. allow ref. to no repeats 3. do not allow 'range not wide enough'	[3]

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(e)	ref. to appropriate named tests for starch / sugar / sucrose ; ref. to suitable quantitative / semi-quantitative method ; ref. to testing over time ;	allow idea of finding the 'amount' for starch : allow thiosulfate titration / starch calibration curve iodine test - idea of using colour intensity to find concentration for sugar: allow Benedict's test to estimate precipitate or colour change to find concentration.	[2]
(f)	younger tubers would have high concentrations of inhibitor ; older tubers have low concentrations of inhibitor ;	as the tuber get older the concentration of inhibitor decreases = 2 marks younger tubers have high**er** concentrations = 2 marks ora allow any valid idea e.g. another growth regulator increases and promotes growth	[2]
		Total:	**[20]**

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2 (a)	ref. to idea adding a stain ; ref. to protein or DNA stain ;	ignore practical details that apply to plants, e.g. boiling in alkali/acid allow correct named stain. allow refs to DNA/protein invisible related to stain use	[2]
(b) (i)	*Independent variable* concentration of organo-mercury compound ; *Dependent variable* (frequency of) type of mitosis (observed) ;	do not allow 'amount'	[2]
(ii)	(cells) without any organo-mercury compound ;	allow untreated cells	[1]
(iii)	*x*-axis – independent variable : concentration organo-mercury compounds μm dm^{-3} **and** *y*-axis – dependent variable : frequency of normal mitosis ; correct plots ; appropriate line ;	do not allow if no units on *x*-axis allow if use number of cells instead of frequency no marks if any error (+/- half square) allow best fit or point to point	[3]
(c) (i)	ref. to enzyme inhibitor / inhibits centrioles / inhibitor of microtubule formation / inhibitor of spindle contraction / cycle stops at prophase or metaphase ;	allow if refer to protein precipitation / inhibition do not allow mutation	[1]
(ii)	idea of large number of cells counted for each concentration;	allow wide range of concentrations	[1]
		Total:	**[10]**

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	reliability: 13. ref. to at least 2 / several / many replicates and a mean / average ; 14. ref. to increasing number of intermediates / repeating with more values close to water potential ;	13. allow reference to anomalous results 14. allow figures (e.g.0.6 (mol dm^{-3}) to 0.2 (mol dm^{-3})) allow mp1 if not already given and 5 dilutions are made.	[8]
(b) (i)	mm s^{-1} / mm / s(ec) / mm per s(ec) / millimetres per second ;	allow cm instead of mm for all versions of the units do not allow min(utes) if several are given, all must be correct	[1]
(ii)	(draw (best fit) line through the points to) find intersection with x axis / find the concentration (of sucrose) at which there is little / no movement of the drop ; (this sucrose) concentration / solution is the water potential equivalent of the tissue / cells ;	allow if line is drawn in Fig. 1.2 ignore units / ref. to rates allow - water potential of the tissues / cells is the same as that of this (sucrose) concentration	[2]
(c) (i)	*independent*:concentration / molarity of the sucrose (solutions) ; *dependent*: direction **and** rate of drop / dye moment ;	do not allow amount of sucrose / sugar	[2]
(ii)	2 of: size / volume of droplet ; finding the centre position of the solution or position of drop by eye / ruler measurement ; ref. to tissue varying as cutting may not be exact ; ref. to source of tissue being different ; ref. to removal of pipette ;	ignore temperature and pressure ignore number of drops ref. to parallax error must be in the correct context of finding the position of the drop allow as surface (area) / mass / volume ignore size / amount e.g. from different storage organs e.g. being careful not to mix the solution / moving to the side of the tube	[2]
(iii)	*drop*: idea of: larger drops would move at different rate from smallest (thus give false readings) ; *centre of solution*: idea of: drops have less / more distance to travel so making results inaccurate ;	allow the idea of introducing variables that cannot be measured and this reducing accuracy allow any ref. to under or overestimating related to a specific variable allow ecf for a correct explanation, related to the investigation, for a variable that could have been controlled e.g. temperature	

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<tr><td></td><td>surface / mass / volume / source of tissue:
will change the volume of water movement / density of the solution ;</td><td colspan="3">changes rate of diffusion / osmosis
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2 (a) (i)	to stimulate the growth / development of follicles (containing oocytes);	allow increases follicles / oocytes available allow ref. to injection is only possible in vivo do not allow causes / increases ovulation do not allow increases the production of follicles / oocytes	[1]
(ii)	ref. to idea of all oocytes starting at the same point for investigation ;	e.g. oocytes are all at the same stage of meiosis	[1]
(b)	the closeness of the sample mean to the population mean / the reliability of the estimate of the mean ;	allow ref. to a measure of the accuracy of the calculated mean value do not allow spread of values around the mean or general references to reliability	[1]
(c) (i)	idea of there is no (significant) difference in the stimulation of meiosis by FF-MAS compared to other compounds ;	do not allow the idea of 'does not stimulate meiosis'	[1]
(ii)	(student) *t*-test ; comparing means of (two) populations/ data has a normal distribution / data is continuous ;	do not allow 'it is a continuous variable'	[2]
(iii)	1 of: the activator / FF-MAS is causing a change in the stimulation of meiosis ; there (is less than) 0.05 / 5% chance that the difference (from the control) was caused by chance ;	do not allow 'the null hypothesis is rejected' allow 'there is (more than) 0.95 / 95% chance that the difference is due to other factors other than chance. allow 'it is not due to chance'	[1]
(d) (i)	No, the (known) LXR alpha receptor activators do not stimulate meiosis ;	must have a correct reason for their answer, no without an explanation does not gain credit e.g. because the % FF- MAS is higher than all the others e.g. because none of the others are doing any stimulation	[1]

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(ii)	3 of : 1. FF-MAS above 0.07 at 0.7/at 7.0 μmol dm^{-3}/stimulates meiosis ; 2. increasing the concentration of FF-MAS by x10 (more than) doubles the stimulation of meiosis ; 3. FF-MAS may activate a different receptor / mechanism of action is not known ; 4. none of the other activators / named activator tested stimulate meiosis ; 5. 22R-HC at 7.0 μmol dm^{-3} may inhibit meiosis ; 6. ref. to the reliability of the data sets ;	1. allow general statement 'as the conc. of FF-MAS increases so does stimulation of meiosis' or 'FF-MAS has the greatest effect on meiosis' 3. allow FF-MAS is not stimulating the LXR receptor 4. allow in the context of 'little effect as the error bars overlap' do not allow – the other activators stimulate by the same amount 6. e.g. 0.7 μmol dm^{-3} data set / 25 HC is most reliable as SM has smallest values e.g. FF-MAS data set is least reliable as SM has largest values	[3]
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