CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 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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Mark scheme abbreviations:

;	separates marking points
/	alternatives answers for the same point
R	reject
A	accept (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
efc	error carried forward
mp	marking point (with relevant number)
ora	or reverse argument

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	*independent* : (sodium) nitrate concentration *dependent* : number of, cells / *Chlorella* **;**	**R** amount / frequency for number **Ignore** growth / population growth	[1]
(ii)	2 of: 1 source of, *Chlorella* culture / *Chlorella* / culture ; 2 time (of investigation) / time (of sampling) / AW ; 3 volume of growth medium ; 4 volume of (*Chlorella*) culture (added to growth medium / in haemocytometer) ; 5 size of flask ;	*Mark first two suggestions* 1 **A** age. **A** species of *Chlorella* 2 AW = e.g. intervals, etc 3 or 4 **Ignore** amount / quantity **A** if volumes stated Accept: 6 **A** (room) temperature 7 **A** (sun)light	[max1]

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	2 × 2 of: 1 volume of (sodium) nitrate added to growth medium ; ref. to using a (graduated) pipette / burette / measuring cylinder ; 2 method of counting cells; descriptions of any method of systematic counting using haemocytometer ; 3 light (intensity / wave length / duration) ; ref. to a method of giving standard, intensity / wave length / time of illumination per day ; 4 temperature; ref. to a suitable method of maintaining temperature ; 5 pH ; buffer ; 6 aeration / oxygen (concentration of water) ; ref. to a method of supplying air / oxygen ; 7 carbon dioxide (concentration) ; method of supplying carbon dioxide ; 8 nitrate concentration in each culture should be kept constant; ref. to replacing / adding, new solution, daily / regularly; 9 *idea of* even density of *Chlorella* in culture added ; stir / swirl / agitate / AW, culture before adding ;	*Only give mps 3 or 4 if factors not mentioned in (a)(ii) Read the whole. Identifying a variable must be free standing, method must be linked to the variable* 1 **Ignore** amount **A** graduated, beaker / flask. **A** volumetric flask 3 e.g. lamp at fixed distance / same wattage bulb / filter of known wave length **A** stated fixed duration **A** fixed voltage for intensity 4 e.g. temperature controlled room / AW **A** thermostatically controlled water bath **A** incubator 5 **R** phosphate buffer / add H^+ /add OH^- 6 e.g. pump / oxygen cylinder / bubbler / diffuser /air lift **A** bubbling of air /oxygen 7 e.g. (sodium)<u>hydrogen</u> carbonate / CO_2 gas from a cylinder **A** bicarbonate **R** carbonate 8 **A** stated time interval up to 48 hours / 2 days 9 **R** ideas on same, mass / density	[max 4]

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Question	Expected answer	Extra guidance	Mark
(b) (i)	1 ref. to (weighing), 0.025 of molecular mass in g / 2.125 g ; 2 ref. to adding 1 dm^3 (deionised) water ; 3 ref. to using deionised / distilled water ; 4 ref. to adding different proportions of nitrate solution and water ; 5 ref. making suitable dilutions to give range of dilutions in Fig. 1.2; (allow in a table) 6 ref. to stirring / swirling / AW, solution ;	1 **A** if weigh 85 g and make 1 M solution then must dilute by factor of 0.025 or 25 × 10^{-3} **A** rounding of decimal places 3 **A** pure / sterile, water. 4 **A** formula $c_1 / m_1 . v_1 = c_2 / m_2 . v_2$ **Ignore** serial dilution 5 look for a description of measuring known volumes of 25 $mmoldm^{-3}$ and adding water to make a dilution. (4:1, 3:2, 2:3, 1:4 ratio for the sequence in Fig. 1.2). <u>All</u> must be correct 6 **A** mix, thoroughly / with a glass rod / AW **R** 'mix' unqualified	[max 4]
(ii)	(a flask containing) only growth medium and water or (a flask with) water added in place of (sodium) nitrate (solution);	*idea that* nitrate is being replaced by water	[1]
(c) (i)	1 find / calculate, means of cultures; 2 find the, difference / increase, between the new count and original count; 3 divide (the difference) by the original count and multiply by 100;	1 **A** average for mean 2 and 3 **A** as a formula. <u>(mean of) new sample – (mean of) original</u> × 100 (mean of) original subtraction must be correct way round if shown **A** original described in terms of the control 3 Apply **ecf**	[3]
(ii)	idea of: (easier) to make comparisons between different samples / different starting numbers;	**A** differences easier to see / cell numbers harder to compare	[1]

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(d)	3 of: 1 (for all concentrations of nitrate) the number of cells / *Chlorella* / population, increases compared to, control / 0 mmol dm^{-3} ; 2 for concentrations up to 15 / 20 mmol dm^{-3} number of cells / Chlorella / population, increases (proportional to nitrate concentration) ; 3 from 15 / 20 – 25 mmol dm^{-3} the rate of increase in, number of cells / Chlorella / population, is slower ; 4 optimum nitrate concentration is between 10 – 20 mmol dm^{-3} ; If no mention of figures for nitrate concentration **Allow Max 1** for a general statement giving idea that as nitrate increases the cell % increase increases up to a point above which the rate decreases.	*Ignore references to individual data* *Units not needed, if used must be correct. Wrong units – penalise once then ecf here and part (e)* mp 1,2,3 **A** in terms of growth 2 Look for the idea of an increase in numbers / AW with concentration (of nitrate) 3 Look for the idea that the increase in numbers / AW starts to decrease Can accept: **A** 5 increase in nitrate allows more growth as more, protein / DNA can be synthesised ; **A** 6 high levels of nitrate, reduce / inhibit growth **or** decrease the water potential of the solution **or** cause the cells to lose water ;	[max 3]
(e)	*idea of*: using, more concentrations / concentrations with smaller intervals, within the range 10– 20 mmol dm^{-3};	**A** if whole range used at smaller intervals **A** answers in a table / actual values quoted	[1]
(f)	*y*-axis: *Chlorella* / cells / population / growth / % increase, *x*-axis: phosphate (concentration) / time ; line shows a correlation between population increase and concentration **OR** population increase and then starting to plateau /decrease ;	units not needed **Do not allow** lines that start at 0 if raw numbers given on *y*-axis if more than one line drawn they should be labelled with days if phosphate is *x*-axis. if time is the *x*-axis at least 2 lines must be shown and labelled with appropriate phosphate concentrations	[2]
		Total:	**[21]**

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Question	Expected answer	Extra guidance	Mark
2 (a)	ref. to (obtaining) a suitable sample ; *idea of* using test strips to measure urea level with reference to colour change / AW ;	e.g. a dialysis fluid sample after use (by the patient); e.g. blood sample before and after dialysis / AW ; **A** urine sample before and after dialysis / AW *idea of* comparison to standard / change of colour related to urea level	[2]
(b) (i)	idea of: measures the reliability (of the estimate) of a mean ; the larger the standard error the less reliable ; ora	**A** how close a sample mean is to the, actual / population mean **R** 'spread from mean'	[2]
(ii)	the data is continuous / comparing <u>means</u>;	**A** normal distribution **A** not discrete	[1]
(iii)	*idea that* the, means / data (of the patients), before treatment /in test A, <u>do not</u> overlap with the means of test B / test C for, iron / haemoglobin;	**Ignore** comparisons between **B** and **C** **A** one correct comparison between **A** and **B** / **C** **A** no overlap between **A** and **C** for ferritin **A** only **A** and **B** for ferritin does overlap **A** most do not overlap between **A** and **B** / **C**	[1]

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(c) (i)	2 of: 1 haemoglobin / iron / ferritin / all, increase more, if given by injection / in treatment **C** ; ora 2 any comparative data quote which compares, provision by injection and mouth / treatments **C** and **B** ; 3 *idea of:* provision by injection increases, haemoglobin / iron, to within the normal range ; **ora**	*Can allow both marks in (ii) if only 1 mark awarded in part (i)* 1 only one needed but must be comparative 2 e.g. results with injected iron increase haemoglobin 40 (g dm^{-3})but only 10 (g dm^{-3}) by mouth / (30 g dm^{-3}) more in injected than by mouth **A** pairs of suitable raw figures e.g. for haemoglobin 100 (g dm^{-3}) v 130 (g dm^{-3}) **A** processed data e.g. % differences *units not needed but if given must be correct need to indicate to which substance the data refers*	
(ii)	2 of: 1 small sample size / 14 people ; 2 limited age range ; 3 gender bias / 10 men to 4 women ; 4 treatment with iron by mouth may influence results for injected iron;	*Ignore other suggestions and look for two acceptable ones* 2 **A** mean age 63 3 **A** more men / AW	[max 3]
		Total:	**[9]**

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