UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

9700 BIOLOGY

9700/51 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 must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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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
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point (examples given as guidance)

Question	Expected answer	Extra guidance	Ma
1 (a) (i)	oxygen production / concentration; (light) transmission / absorbance;	**A** amount **R** oxygen unqualified **A** descriptions e.g. reduction in light passing through **R** light intensity.	[2]
(ii)	2 of: light intensity; carbon dioxide concentration; speed of stirrer; mass of alga (suspension); volume of alga(suspension); distance of light meter from the alga suspension; position of oxygen probe;	**A** light in terms of distance from lamp / same (wattage) bulb ignore size of container / references to quantities of liquid or water **A** weight ignore number of cells ignore amount / concentration / quantity for mass or volume	[max 2]
(b) (i)	subtract the transmission (for each wave length) from 100;	**A** as a formula 100 – transmission (for each wave length) **A** subtracting the transmission from the transmission without any algae / just water **R** subtracting the wave length	[1]
(ii)	oxygen concentration;	*if more than one given, mark the first* **A** production / volume / amount / quantity / meter reading (ignore rate) **R** bubbles	[1]
(c)	2 of: 1. ref. to idea of different movement / spread / partitioning in different solvents ; 2. ref. to idea that some pigments are not soluble / less soluble in some solvents ; 3. ref. to the idea that some pigments have the same solubility in solvent 1 ; 4. ref. to second solvent separates pigments that are not separated by solvent 1 ;	***A** marks on Fig. 1.3* 1. **A** if it is clear that the pigments have not been separated by solvent 1 / clump together 2. **A** if refer to pigments 1 and 6 or 4 and 5 3. **A** if refer to 'not knowing' if all the pigments have been found 4. **A** some pigments are separated more easily in one solvent and others by a different solvent	[max 2]

Question	Expected answer	Extra guidance	Ma
(d)	8 of: *independent variable:* 1. ref. to using (a sample) from each type of alga ; 2. ref. to same quantity / amount (of each) ; *dependent variables:* 3. ref. to observing / measuring / marking / finding the position of the pigments / colours (on the chromatogram) ; *procedure:* 4. ref. to a method of extracting pigments (from the algae) ; 5. ref. to filtering / centrifuging to remove debris / obtain pigments ; 6. ref. to method of concentrating the extract; 7. ref. to a method of applying sample; 8. ref. to suitable placing in the solvent; 9. ref. to running to a set distance of run; 10. ref. to drying before using second solvent; 11. ref. to running in second solvent at 90° to first run; 12. ref. to covering container (to prevent evaporation);	*Ignore reference to leaves for any mp.* 1. need idea of water plant / alga 2. **A** in terms of mass / volume of suspension (of algae) not number 3. **A** results / pattern / ref. to Rf values ignore ref. to locating agents, e.g. ninhydrin 4. **A** any idea of grinding / crushing algae (separately or with solvent / use a blender **A** crushing onto one corner of the paper **A** boiling / heating with ethanol / solvent 5. **A** extract / supernatant for pigments 6. **A** any method, e.g. evaporating, heating, partitioning with different solvents or (many) spots at the same point / crushing several lots of algae in the same spot 7. e.g. capillary tube / fine or small dropper / fine or small paint brush / pin head **A** ref. to a small spot **R** a line or several spots 8. e.g. solvent level below sample / origin. Ignore names of solvent 9. e.g. before solvent front reaches the end / pre-marked line **A** 'same time' for 2 chromatograms, one for each of the strains of alga. Ignore any specific times 11. ignore diagrams with incorrect orientation 12. **A** air tight container	

Question	Expected answer	Extra guidance	Ma
	reliability: 13. ref. to repeating to compare (chromatograms) / to find anomalies; *safety (max 1):* 14. ref. to solvents / algae + suitable precaution; 15. ref. to safe disposal of solvent;	13. ignore ref. to means unqualified **A** finding means of Rf values / AW 14. e.g. flammable – no naked flames / AW toxic – in fume cupboard / ventilated space / covered containers / gloves / goggles corrosive or allergy to algae / solvents – gloves and goggles Ignore low risk / radiaton	[max 8]
(e) (i)	strain **B and** pigment S / AW;	**A** spot / dot / number 4	[1]
(ii)	2 of: 1. chromatogram for **B** has a pigment / spot / number 4 missing; 2. at about Rf 0.9(1) (in solvent 1); 3. the absorption spectrum for **B** has low(est) absorbance at 490nm; 4. the action spectrum for **B** has low(est) activity at 490nm;	***ecf*** *for incorrect pigment in (i),mp1, 3 or 4* 2. **A** Rf 0.19 / 0.2 (in solvent 2) **A** it has the highest Rf in solvent 1 / a low Rf in solvent 2 3. **A** if the range 470 – 530nm is given 4. **A** if the range 490 – 510nm is given. **A** rate of photosynthesis is low(est) at 490nm	[max 2]
(iii)	1 of: allows the alga to use a greater variety of wave lengths / use blue end of spectrum / short wave length (for photosynthesis); may allow strain **A** to survive better / photosynthesise in deeper water;	***ecf*** *for incorrect pigments **R** or **T** in **(i)***	[1]
		Total:	**[20]**

Question	Expected answer	Extra guidance	Ma
2 (a)	1 × 2 of: *Mark as prose. One mark for the factor, one mark for a suitable method of controlling the factor*		
	temperature; keep breeding units in temperature controlled room / incubator / thermostatically-controlled water bath;	**A** warm / heat **R** air conditioned room	
	culture medium for larvae; ref. to same composition / idea of sufficient ;	**A** food source / nutrient / named food ignore volume / mass **A** ref. to water if in the context of the culture medium	
	oxygen (supply / concentration); ref. to suitable covering / container that allows oxygen / air entry; pH ; ref. to using a buffer ;	**A** air	[1] [1]
(b)	ref. to a method of magnifying the abdomen;	e.g. microscope / hand lens / binocular / magnifying glass **R** telescope / electron microscope	[1]
(c)	offspring are in approximately 9:3:3:1 ratio / correct description	**A** ref. (offspring with) recombinant phenotypes / varieties / types / combinations that are different from either of the parents / four different phenotypes **A** named recombinants, e.g. grey and short wings / ebony and long wings / ebony and short wings **A** linkage would give 2 phenotypes **R** answers that just copy the figures in the table	[1]
(d) (i)	there is no (significant) difference between the observed and expected ratio ;	**A** no (significant) difference from the ratio 1:1:1:1 the null hypothesis must be in terms of 'there is no (significant) difference between….' ignore any differences are due to chance'	[1]

Question	Expected answer				Extra guidance	Ma
(ii)	Offspring phenotype	O	E	$\frac{(O-E)^2}{E}$	1 mark for E column 1 mark for $\frac{(O-E)^2}{E}$ column ***ecf*** *from E* **A** as fractions ignore number of decimal places 1 mark correct addition to χ^2 to **2 decimal** places **A** 1.40 from rounded up figures ***ecf*** *from* $\frac{(O-E)^2}{E}$	[3]
	grey bodies long wings	15	**16**	**0.06**		
	grey bodies short wings	19	**16**	**0.56**		
	Ebony bodies long wings	13	**16**	**0.56**		
	Ebony bodies short wings	17	**16;**	**0.06;**		
			χ^2 =	**1.24 (/5);**		
(iii)	one less degree of freedom than number of categories ;				**A** there are four: types of data / types of offspring / phenotypes / rows / (sets of) observations/ categories / (sets of) results/ samples ignore any formula unqualified e.g. 4 – 1	[1]
(iv)	1 of : not significant; results are due to chance ;				ignore references to probability **ecf** of the candidates calculated chi square **R** answers which: quantify significance. e.g. more / less significant qualify significance. e.g. 'there is a significant difference between the means' 'it is significant which improves reliability / accuracy / AW'	[max 1]
					Total:	**[10]**