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BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2018**

MARK SCHEME

Maximum Mark: 30

Published

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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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
I	ignore (for answers that include irrelevant information that does not contradict the expected answer)
AW	alternative wording (where responses vary more than usual)
ora	or reverse argument (for answers which are written as the opposite to the expected answer)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ecf	error carried forward
mp	marking point (with relevant number)

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Question	Answer	Marks	Guidance
1(a)(i)	*independent variable*: type of leaf / type of plant / type of disc / species (of plant) **;** *dependent variable*: time for (leaf) discs to, rise to / reach, the surface / the top **;**	**2**	 **I** rate of photosynthesis
1(a)(ii)	*any 7 of:* 1 *ref. to* a method of transferring leaf discs **;** 2 same, height / volume / depth, of solution / $NaHCO_3$, in beaker (for all leaf types) **;** 3 use, timer / stop clock, to find time for leaf disc(s) to reach, surface / top **;** 4 *ref. to* using same number of leaf discs (for all leaf types) **;** 5 *ref. to* the same concentration of solution (for all leaf types) **;** 6 *ref. to* standardising some aspect of the discs **;**	**7**	*max. 6 if critical step mp9 missing* 1 e.g. forceps, glass rod, paint brush, tweezers 2 **A** other suitable containers e.g. syringe / boiling tube / test tube 3 **A** time for first leaf disc / all leaf discs / stated number of leaf discs / each one in a separate beaker **R** if different types of leaf in same beaker at same time 4 minimum of 3 6 e.g. same, size / diameter / age / position in leaf sampled

Question	Answer	Marks	Guidance
1(a)(ii) cont	7 *ref. to* keeping same light intensity **;**		7 **A** methods that achieve same light intensity, e.g. lamp(s) at fixed distance / same wattage (bulbs) / variable resistor / dimmer
	8 *ref. to* **method** for keeping temperature of solution constant **;**		8 e.g. temperature-controlled room or chamber / environmental chamber / incubator / water-bath / thermostatic control **I** air conditioning / heat shield
	critical step 9 start timer (immediately) when disc(s) reach bottom (of beaker) **;**		
	10 low / medium, risk, experiment / investigation / procedure / assessment / AW **;**		10 **R** no risk **I** 'low hazard' experiment. **A** Allergy to leaves **and** wear, gloves / protective clothing **A** $NaHCO_3$ is a mild skin irritant to **and** wear, gloves / protective clothing **I** *ref. to* water and electricity / care with cutting discs
	11 *ref. to* minimum of 3 readings (for at least one leaf type) **and** calculating a mean **or** excluding / identifying, anomalies **;**		11 **A** having at least 3 discs in one beaker **A** one disc in 3 separate beakers **I** average / average mean **A** mean average
1(b)(i)	divide 1 by the time **;**	**1**	**A** distance disc travels divided by time **A** divide 10 / 100 / 1000 by time **I** volume of oxygen divided by time

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Question	Answer	Marks	Guidance
1(b)(ii)	*idea that:* 1 leaves (with thick cuticles) may be heavier which will, increase time to rise / require more oxygen to raise them **or** cuticles, are transparent / do not affect light absorption **or** thick cuticle only on upper surface so light absorption via lower surface not affected **or** difference between spiderwort with thin cuticle and sorghum with thick cuticle, is small / may not be significant **or** leaves (with thick cuticles may) have fewer stomata so less gas exchange **;** 2 the purple parts of the leaf may contain chlorophyll (which is hidden by the purple pigment) / cannot assume that the purple stripes do not contain chlorophyll **or** no actual data on the chlorophyll content **or** the purple pigments may also absorb light (*idea of* accessory pigments) **or** spiderwort rate, close to sorghum / faster than ivy, which does not have purple stripes ; 3 experiment carried out at, 20 °C / room / low temperature, and C4 plants / Sorghum, only efficient at high(er) temperatures / ora **;**	**3**	1 **A** in terms of leaves being thicker **A** no evidence that thick cuticles reduce light absorption **I** *ref. to* no lower cuticle **A** *with ref. to* carbon dioxide in / oxygen out 2 **A** *idea that* green stripes are more chlorophyll dense (than other leaves) could relate to purple stripes or whole leaf

Question	Answer	Marks	Guidance
1(c)(i)	1 *idea of* using same, quantity / amount, of leaf tissue from each plant **;** e.g. (weigh to) obtain same mass / same number of discs / cut same area of leaf 2 *ref. to* outline method of extracting pigments **;** e.g. (crush / leave, the leaves in) solvent / acetone / propanone / ethanol / alcohol or extraction solvent 3 *ref. to* using red filter (in a colorimeter) **;** 4 *idea that* taking a reading for, absorbance / transmission, to compare each extract **;**	**3**	1 **A** dry mass 2 **I** water as a solvent 3 **A** *idea of* shining a red light through the extract **I** 'chlorophyll absorbs red light' **A** if leaf / discs are used e.g. 'spiderwort chlorophyll has a lower / the lowest absorbance (of red light in the colorimeter)'
1(c)(ii)	solvent / named solvent (used to extract the chlorophyll) **;**	**1**	**A** water

Question	Answer	Marks	Guidance
1(d)	*max 3 if only mp1-4 given* *use of t-test:* 1 3 **;** 2 *idea of* carrying out (separate) *t*-test on (pairs of data from) spiderwort and (each of) the other (3) plants / AW **;** *finding the significance:* 3 calculate / find / use, the degrees of freedom / *v* **;** 4 *ref. to* critical / table, value at, 0.05 (probability/significance) or 5% (confidence, level / index. limit) **;** 5 if (calculated) value of *t,* is greater than / > , critical / table, value, the difference is significant **; ora**	**4**	2 **I** value stated in mp1 3 must be in correct context **A** calculation (10–1)+(10–1) **A** 20 – 2 or statement that *v* is 18 **I** formula, as given **4** *ref. to* using 0.05 / 5% (column) **R** 0.05% **A** at 95% / 0.95 confidence limit / index 5 **A** in terms of results (of *t*-tests) were significant **I** 'values' are significant

Question	Answer	Marks	Guidance
2(a)(i)	*any 3 of*: 1 habitat / tree species / broad-leaved trees, good for grey squirrels, has increased (overall) **or** habitat / tree species / broad-leaved trees, good for grey squirrels, has increased more in Scotland than England **;** 2 habitat / tree species, good for red squirrels, has decreased **or** habitat / tree species, good for red squirrels, has decreased more in England than in Scotland **;** 3 habitat / tree species, good for both squirrel species, has decreased **;** 4 habitat / tree species, poor for both squirrel species, has increased **or** habitat / tree species, poor for both squirrel species, has increased more in Scotland than in England **;**	**3**	**I** *simple data quotes unqualified* 2 could be in terms of (large) decrease in European Larch **or** could be in terms of the Japanese Larch increase in Scotland 3 could be in terms of decrease in Norway spruce 4 could be in terms of the large increase in Sitka Spruce **or** much larger increase in Sitka Spruce in Scotland

Question	Answer	Marks	Guidance
2(a)(ii)	*any 2 of:* 1 less, habitat / suitable woods / places to live (for red squirrel) **;** 2 less food (for red squirrels) **;** 3 less, cover / places, to hide from predators **;** 4 *ref. to* disease in red squirrels **;**	**2**	2 **A** fewer nesting sites for reds **I** shelter **A** in terms of habitat / competition **R** if state <u>same</u> niche 3 **A** changed habitat conditions favour more, predators / predation **I** *ref. to* interbreeding
2(b)(i)	*any 2 of:* trap density **or** same trap density (in each / either type of woodland) **;** trap size / type **or** same sized traps / humane steel traps **;** test for antibodies **or** standard test for antibodies **;** time of sampling **or** *idea of* sampling between the same months / year / AW **;**	**2**	**A** quoted densities 1 per 0.01 km^2 (broad-leaved) / 2 per 0.01 km^2 (narrow-leaved) **A** 'number in a given area' as description of density **A** 'same time of sampling' **I** *ref. to* regular sampling
2(b)(ii)	(between 2002 and 2010 / over time) the percentage of squirrels with, immunity / antibodies / testing positive, has decreased **or** (in 2010) compared to control group the percentage of squirrels with, immunity / antibodies / testing positive is (much) lower **;**	**1**	**I** *ref. to* no. of squirrels (killed) **I** unqualified data quotes

Question	Answer	Marks	Guidance
2(b)(iii)	*idea that* on the mainland the squirrels can (rapidly) re-invade **or** *idea that* the mainland area, will be larger / has more areas to 'hide', so less easy to remove them (all) / so more survive post cull **or** *idea that* survivors post cull provide a breeding population to build up the population (rapidly) **;**	**1**	**A ora** throughout **A** in terms of no barrier to the migration of the grey squirrels **A** in terms of *idea of* (red) squirrels being isolated on the island

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