

2806/03 Practical Examination (A2)

January 2005

Mark Scheme

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

x = incorrect response (errors may also be underlined)
^ = omission mark
bod = benefit of the doubt (where professional judgement has been used)
ecf = error carried forward (in consequential marking)
con = contradiction (in cases where candidates contradict themselves in the same response)
sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Examiners will be expected to use their professional judgment in marking answers that contain more than the number required. Advice about specific cases will be given at the standardisation meeting.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

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Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit R = reject () = words which are not essential to gain credit <u> </u> = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording A = accept ora = or reverse argument
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Planning Exercise

The mark scheme for the Planning Exercise is set out on page 4. The marking points **A** to **T** follow the coursework descriptors for Skill P.

Indicate on the plans where the marking points are met by using a tick and an appropriate letter. There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

Practical Test

Pages 5 to 7 have the mark scheme for Questions 1 and 2 for the Practical Test.

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A2 Biology. Planning exercise

Checking Point	Descriptor	The candidate
A	P.1a	plans a suitable procedure that involves monitoring changes in colour of hydrogen carbonate indicator solution in response to different light intensities;
B	P.1a	gives a prediction that shade leaves have compensation points at lower light intensities than corresponding sun leaves / ora;
C	P.1b	selects suitable equipment and materials to include - tubes with bungs (or equivalent), lamp with different wattage bulbs or metre rule or light meter, stop watch / stop clock;
D	P.3a	identifies at least 2 factors to control e.g. volume of indicator, amount (area) of leaf material, leaves from same plant, temperature, wavelength of light, time of illumination, leaves facing same way, A size of boiling tubes;
E	P.3a	states that light intensity influences rate of photosynthesis, but not respiration;
F	P.3b	decides on appropriate number of, light intensities / distances, minimum of four ;
G	P.3b	decides on an appropriate range of light intensities, e.g. 10, 20, 40 and 80 cm equivalent to light intensities of x, x/4, x/16 and x/32; R > 1 m
H	P.3b	describes way(s) of obtaining reliable results by e.g. excluding ambient light, using fresh leaves, using heat filter, using control tube without leaves, A replicates and calculating means;
I	P.5a	uses appropriate scientific knowledge and understanding in developing a plan, e.g. structure of leaves, relative positions of sun and shade leaves, inverse square law;
J	P.5a	uses results from preliminary work, previous practical work or identified secondary source in developing a plan;
K	P.5a	refers to a safety hazard and precaution e.g. heat from bulbs, electricity (and water), A ref to eye protection / glassware;
L*	P.5b	<i>gives a clear account, logically presented with accurate use of scientific vocabulary (QWC);</i>
M	P.5b	describes way(s) of measuring light intensity e.g. use of inverse square law, use of calibration curve, use of light meter;
N	P.7a	uses information from at least two identified sources, e.g. preliminary work / class practicals / text books / web sites;
O	P.7a	shows how results from sun and shade leaves are to be presented in the form of a table;
P*	P.7a	<i>uses spelling, punctuation and grammar accurately (QWC);</i>
Q	P.7b	explains how data would be interpreted to find the compensation points;
R	P.7b	comments on precision, e.g. repeating with narrower range of light intensities, precision of light meter;
S	P.7b	comments on reliability with reasoning, e.g. difficulty interpreting colour changes, use of colour comparator / control tube / colorimeter, use of CO ₂ at high light intensities decreases rate of photosynthesis;
T	P.7b	relates results to biochemistry of, respiration / photosynthesis / photorespiration A productivity of plants;

Point mark up to **14** by placing letters A to T **excluding L and P**, in the margin at appropriate points.

Then award **1** mark for each of **L** and **P** (QWC).

Total: 16

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Question	Expected Answers	Marks
1 (a)	appropriate format (informative column headings) ; table design (tube number/condition in first column, five additional columns) ; records tube 1 as green throughout ; R blue records tube 2 as blue-green throughout ; records tube 3 as turning green after tube 4 ; records tube 4 as turning green after tube 5 ;	6
(b)	<i>tube 1</i> to show dye changes colour / to show when dye in other tubes had changed colour A to see if there is any colour change without dye <i>tube 2</i> to show that light is necessary for colour change / AW ; to show that light is necessary for, photolysis / splitting water / AW ; ref to, H ⁺ / e ⁻ , reducing the dye ;	<i>max 2</i> max 3
(c)	tube, with reaction medium only / without leaf extract / AW ; to show that leaf extract is necessary for colour change / AW ;	2
(d)	light intensity ; temperature ; CO ₂ , availability / concentration ; ambient light ; tubes set up at different times ;	max 2
(e)	<i>buffered</i> to maintain pH / give a constant pH ; same pH as, cell / sample ; to maintain chloroplast activity / AW ; <i>chilled</i> to reduce <u>enzyme</u> activity ; homogenisation may have released (hydrolytic) enzymes (from lysosomes) ;	max 4
(f)	ref to chlorophyll, absorbing / not absorbing, light ref to electrons / H ⁺ , produced / not produced ; ref to (H ⁺ / e ⁻), reducing / not reducing, dye ;	max 3

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- (g) *tube 3*
- 1 green filter only transmits green light / AW ;
 - 2 chlorophyll, reflects / does not absorb, green light ; **R** only uses red and blue
 - 3 does not emit (m)any, H^+ / e^- ;
- tube 4*
- 4 red filter only transmits red light / AW ;
 - 5 chlorophyll absorbs red light ;
 - 6 emits, more / some, H^+ / e^- ;
- tube 5*
- 7 exposed to, all / additional / optimum / wider range of, wavelengths / colours ;
 - 8 ref to effective blue wavelengths ;
 - 9 chlorophyll absorbs maximum amount of light ;
 - 10 emits, many H^+ / e^- (to reduce dye) ; **max 6**
- (h) (i) chloroplasts lack, inner and outer membranes / envelopes ;
thylakoids / grana / lamellae / internal membranes, exposed ; **A** only have these
stroma, dissolved / lost ;
no ribosomes ;
no starch grains ; **max 3**
- (ii) dye does not have to pass through, membranes / envelope ;
improves accessibility of thylakoids to dye / AW ;
where light dependent stage takes place ; **max 2**

[Total: 26 max]

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Question	Expected Answers	Marks
2 (a) (i)	<i>drawing quality</i> clear bold continuous lines ; no chloroplasts or nuclei or vacuoles, i.e. no internal structure ; no shading ; cellulose walls shown as double lines ; correct shape of guard cells ; correct shape of epidermal cells ;	6
	(ii) no internal detail visible / only an imprint / AW ;	1
(b)	<i>either</i> <i>more stomata on shade leaf</i> to take up more CO ₂ / allow more gas exchange / so CO ₂ not limiting / only light limiting ; to make more efficient use of low light intensities ; <i>or</i> <i>more stomata on sun leaf</i> to take up more carbon dioxide / allow more gas exchange ; to make more efficient use of high light intensities ;	2
(c)	2 x five counts made ; suitable numbers recorded ; means correctly calculated ; R decimals	3
(d)	<i>limitations</i> 1 five counts / one leaf, too small sample ; 2 difficulty counting / may count same stoma twice ; 3 different parts of same leaf may have different densities of stomata ; 4 different, aged / sized, leaves may have different densities of stomata ; 5 uncertainty distinguishing shade leaves from sun leaves ;	max 4
	<i>improvements</i> 1 more counts / more leaves ; 2 use photomicrographs for counting ; 3 grow, plants / leaves, in different light intensities to provide leaves for counting ; 4 calculate standard deviations ; 5 use statistical test to see if difference is significant ; R chi squared test 6 use other species ;	6

[Total: 18 max]