RECOGNISING ACHIEVEMENT

2806/03 Practical Examination (A2)
June 2005

Mark Scheme

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
	___	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	A	=	accept
	ora	=	or reverse argument

Planning Exercise

The mark scheme for the planning exercise is set out on the next page. The marking points **A** to **U** 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

The mark scheme for Questions 1 and 2 for the Practical Test are on the pages following the mark scheme for the Planning Exercise.

A2 Biology. Planning exercise

Checking Point		The candidate
A	P.1a	plans a suitable procedure that involves measuring species abundance / distribution in a specific habitat and water content of soil**;**
B	P.1a	gives a prediction about abundance / distribution of two **named** plant species**;**
C	P.1b	selects suitable equipment and materials to include quadrat (point or frame), tape / rule, balance, drying oven / incubator**;**
D	P.3a	chooses species frequency / species density / percentage cover, to determine abundance / distribution**;**
E	P.3a	identifies at least two key factors to control, **one** for field e.g. size of quadrat, time of sampling, depth of soil, volume of soil, **one** for lab e.g. drying time, drying temperature**;**
F	P.3b	decides on appropriate number of measurements to take - minimum of **ten** different quadrats**;**
G	P.3b	decides on an appropriate way to sample whole habitat, e.g. using (belt) transect / random numbers to generate co-ordinates**;**
H	P.3b	describes ways of obtaining reliable results, e.g. soil sample from every quadrat / at least 3 transects / at least 3 soil samples from different habitats**;**
I	P.5a	uses appropriate scientific knowledge and understanding in developing a plan, e.g. distinguishing features of chosen plants, shows percentage dry mass calculations**;**
J	P.5a	uses results from preliminary work, previous practical work or uses a relevant, identified secondary source in developing a plan**;**
K	P.5a	identifies one hazard and an appropriate precaution, e.g. avoiding infection, avoiding burns by wearing gloves, anything appropriate for fieldwork**;**
*L**	*P.5b*	*gives a clear account, logically presented with accurate use of scientific vocabulary (uses capital letter for generic name, small letter for specific name) (QWC)***;**
M	P.5b	describes way(s) of obtaining precise results, e.g. use of keys, drying soil to constant mass, use of desiccator**;**
N	P.7a	uses information from at least **two** relevant identified sources, e.g. preliminary work / class practical / text book / web site**;**
O	P.7a	shows how results are to be presented in **one** table with data from field and with percentage water content**;**
P	P.7a	shows how both sets of data are to be presented graphically to enable a comparison to be made, e.g. bar charts / kite diagrams / scatter graphs**;**
Q	P.7a	comments on an adaptation of **named** plant(s) to water content of soil, e.g. buttercups in wet soil with aerenchyma**;**
*R**	*P.7a*	*uses spelling, punctuation and grammar accurately (QWC)***;**
S	P.7b	explains how data would be analysed, i.e. correlates species distribution / abundance data with water content data, e.g. suitable statistical test, such as correlation coefficient, Spearman's rank**;**
T	P.7b	comments on precision and/or reliability with **justification**, e.g. use gridded quadrat, strategy for plants half in quadrat, soil prevented from drying before placing in oven**;**
U	P 7b	comments on validity, e.g. influence of other environmental factors**;**

Point mark up to **14** by placing letters A to U **excluding L and R** in the margin at appropriate points. Then award **1** mark for each of **L** and **R** (QWC). **Total: 16**

Question		Expected Answers	Marks
1		colour of filtered potato extract - brown red / AW ; **R** no change / colourless	1
		pH **A** = 3 ± 1 ; pH **B** = 9 ± 1 ;	2
	(a)	records results in the form of a table ; informative, column / row, headings ; identity of tube in first, column / row ; time with unit heading ; **R** if units in body of table time taken for **C** shortest ; no starch in **D** ;	5 max
	(b)	starch absent ; crushing ruptures, cells / cell walls ; **A** releases cell contents starch / grains / amyloplasts, too large to pass through filter paper ;	2 max
	(c)	*in **A** or **B*** not optimum pH / enzymes only work within narrow pH range ; ref to acid making basic side chains +ve / bases making acidic side chains –ve ; ref to, attraction / repulsion, between side chains ; *in **A**, **B** or **D*** disruption of, H-bonds / ionic bonds ; tertiary structure changed ; active site distorted ; substrate no longer fits ; enzyme denatured ; *in any tube that produced starch (ora in tube that did not produce starch)* enzyme catalyses ; formation of glycosidic bonds ; with elimination of phosphate groups ; forming / synthesising, starch ;	8 max
	(d) **(i)**	glucose phosphate / phosphate group attached to glucose ;	1
	(ii)	ATP ;	1
	(e)	concentration of P_i in extract very low ; concentration of glucose phosphate very high ; enzyme catalyses reversible reaction ; concentration of P_i in plants (100x) higher than glucose phosphate ;	4
	(f)	glucose phosphate not an enzyme ; **R** tube contained just glucose phosphate glucose phosphate present in all tubes ; but starch not produced in **D** ;	2 max

(g) *limitations*

1 unknown concentration of enzyme in extract **;**
2 different volumes in tubes **A**, **B** and **C**/**D** **;**
3 different concentrations in tubes **A**, **B** and **C**/**D** **;**
4 pHs estimated **;**
5 only two pHs estimated / pH of **C** and **D** not estimated **;**
6 pH not estimated after addition of glucose phosphate **;**
7 temperature not controlled **;**
8 optimum temperature not used **;**
9 judging colour changes of iodine solution **;**
10 ref to drop size **;**
11 cross contamination **;**
12 sampling intervals too infrequent **; R** ref to regular intervals
13 not possible to take samples simultaneously **;**
14 no repeats / should be repeated **;**
15 ref to no control with just plant extract **;**
16 AVP **;** e.g. no buffer solution used

improvements to give more accurate and reliable results

17 make up, equal / same, volumes with (distilled) water **;**
18 use pH, meter / probe **;**
19 use colorimeter **;**
20 use of standard in colorimeter to define end point **;**
21 ref to calibrating colorimeter to measure concentration of starch **;**
22 calculate rate 1/t **;**
23 two or more repeats **;**
24 correct ref to anomalies in context of repeats **;**
25 calculate means **;**
26 AVP **;** e.g. thermostatically-controlled water bath **8 max**

[Total: 28 max]

Question			Expected Answers	Marks
2	(a)		*drawing quality* clear continuous lines not too, faint / bold ; no shading ; proportions correct ; no cells ;	4
			labels xylem ; phloem ; sclerenchyma ; **A** fibres parenchyma ; **A** cortex epidermis ; **R** upper / lower epidermis aerenchyma / chlorenchyma ; **A** photosynthetic <u>tissue</u>	6
	(b)	(i)	counts squares / calculates area, 1600 - 2400 squares / 64 - 96 cm^2 ; records no of squares / area of vascular tissues ; **&** correct method for calculating percentage ;	
		(ii)	percentage of stem that is vascular tissue calculated as between 5 and 20% ; percentage that is phloem calculated as less than half area of vascular tissue ; *ecf*	5
		(iii)	*drawing quality* draws minimum of three sieve tubes and three companion cells ; **R** circles walls of sieve tube elements angular ; companion cells have contents ; **A** annotation size of companion cells $^1/_4$ to $^1/_3$ size of sieve tubes ; no spaces between cells ; cell walls double lines ;	5 max
				[Total: 16 max]