RECOGNISING ACHIEVEMENT

2806/03 Biology Practical (A2)

January 2006

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 (½) 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.

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 page 4. 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

Pages 5 to 8 have the mark scheme for Questions 1 and 2 for the Practical Test.

A2 Biology. Planning exercise

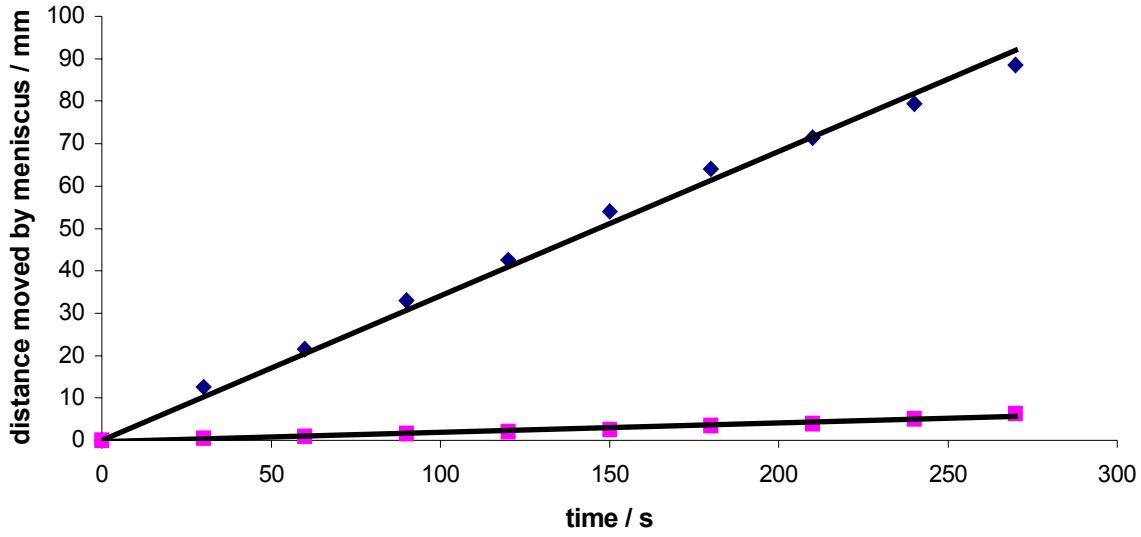
Checking Point	Descriptor	The candidate
A	P.1a	plans a procedure that involves mixing yeast suspension with each sugar solution separately and measuring rate **;**
B	P.1a	gives a prediction about the effect of concentration **and** different monosaccharides **;**
C	P.1b	chooses suitable materials and equipment to measure respiration rates, e.g. measuring volumes / TTC / methylene blue / lime water, etc. **; R** counting bubbles
D	P.3a	uses appropriate knowledge and understanding, ref to effect of substrate concentration on reaction rate **;**
E	P.3a	identifies at least **two** key factors to control or take account of, e.g. temperature / volumes of yeast suspension / volumes of all sugar solutions / concentration of yeast suspension / concentration of all sugar solutions / time **;**
F	P.3b	decides on an appropriate range of measurements (minimum of **five** different concentrations, **A** 0%) with each sugar **;**
G	P.3b	decides on number of measurements to make, (minimum of **three** at each concentration) **;**
H	P. 5a	uses appropriate knowledge and understanding of enzymes, e.g. structure of monosaccharides / uptake into yeast cells **;**
I	P.5a	**uses** information / results from preliminary work or previous practical work **;**
J	P.5a	refers to safety aspect (hazard and precaution), e.g. assembling glassware / allergy to yeast / TTC / NaOH **;**
K	P.5b	describes a way of producing precise results, e.g. agitating yeast suspension and sugar sols before mixing / measuring volumes to nearest 0.5 cm^3 or 1.0 cm^3 / consistent end points **;**
*L**	*P.5b*	*gives a clear account, logically presented with accurate use of scientific vocabulary (QWC)* **;**
M	P.7a	**uses** information from identified secondary source **;**
N	P7a	**uses** appropriate scientific knowledge and understanding, e.g. sources of CO_2 / H in respiration **;**
O	P.7a	shows how data are to be presented as a table, name and concentration of sugar **and** distance moved by meniscus / volume of gas produced / time taken for indicator to change **;**
P	P.7a	shows how rates would be calculated, e.g. d/t / 1000/t / gradients from (time course) graph **;**
Q	P.7a	explains/shows how data are to be illustrated on **one** graph i.e. all four sugars on one graph: x axis = concentration of sugar(s), y axis = rate **;**
*R**	*P.7a*	*uses spelling, punctuation and grammar correctly (QWC)* **;**
S	P.7b	states that rates will be compared quantitatively, e.g. glucose respired twice as fast as sorbose at five minutes / calculates ratios , use of stats to test significance **;**
T	P.7b	comments on using initial rates as being more valid / sugars used up over time / aerobic becoming anaerobic / need for control without sugar **;**
U	P.7b	comments on constraints, e.g. number of yeast cells in suspension / air leaks / judging end points / sugar in yeast / alcohol poisoning / osmotic effects / **A** reassembling apparatus **;**

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**

Example of expected results for Q.1 (a)

time / s	distance moved by meniscus / mm	
	with soda lime	without soda lime
0	0.0	0.0
30	12.5	0.5
60	21.5	1.0
90	33.0	1.5
120	42.5	2.0
150	54.0	2.5
180	64.0	3.5
210	71.5	4.0
240	79.5	5.0
270	88.5	6.3

Example of graph for Q.1 (b)



Calculations

r = 0.2 mm
r^2 = 0.04
πr^2 = 0.125

volume of oxygen used up after 270 s = 88.5 x 0.125 = 11.06 mm^3

volume of carbon dioxide produced after 270 s = (88.5 – 6.3) x 0.125 = 10.28 mm^3

$$RQ = \frac{10.28}{11.06} = 0.93$$

Question		Expected Answers	Marks
1	(a)	results in the form of a table ; informative column headings ; time, distance with soda lime, distance without soda lime appropriate units not in body of table ; results for both conditions ; **R** if mean for both conditions included results with soda lime greater than without soda lime ;	**5**
	(b)	axes round right way (x axis = time, y axis = distance moved) ; axes labelled (time and distance) ; axes scaled <u>with units</u> in ascending order starting at zero ; makes good use of / uses more than half of, available space ; points accurately plotted to include zero plot ; two curves drawn and identified (one with soda lime, one without) ; points joined, clearly / neatly, by straight lines (unless conform to line of best fit) ;	**5 max**
	(c)	shows working i.e. $3.14 \times (0.2)^2 \times l$ / $3.14 \times 0.04 \times l$, where l is correct ; calculates volume of oxygen (used up) correctly to nearest mm^3 ; subtracts distance moved in absence of soda lime from distance moved in presence of soda lime ; calculates volume of carbon dioxide (produced) correctly to nearest mm^3 ;	**4**
	(d)	shows / uses, CO_2 produced over O_2 used up to calculate RQ ; ecf calculates RQ correctly ; ecf calculates RQ <u>correctly</u> to be between 0.6 and 1.1 ;	**3**
	(e) (i)	uses lipid initially ; uses increasing amounts of carbohydrate subsequently ; **R** uses less lipid ; as leaves photosynthesise ; aerobic throughout ; AVP ; e.g. lipid converted to carbohydrate	**4 max**
	(ii)	lipids contain high(er) proportion of, C and/or H / C–H bonds (than C–O bonds) ; more CO_2 and H_2O *formed* ; on oxidation ; (therefore) lipid releases, more / twice as much, energy (as carbohydrates) ; per unit mass ; A volume seeds dispersed ; have smaller mass ; **A** size	**4 max**
	(f)	syringe <u>with soda lime only</u> ; **A** no seeds ; boiled seeds / inert material ; boiled seeds / inert material, with same mass / volume / number as seeds ; at same time / simultaneously ; for same length of time ; suitable comment on need for control ; e.g. to compensate for atmospheric CO_2 in apparatus / atmospheric temp / pressure changes subtract / add, any movement of meniscus in control from experimental results ;	**6**

(g) *limitations* **A** *ora*

inconsistency measuring distance due to shape of / moving meniscus **;**
use of ruler qualified e.g. can only measure to nearest 0.5 mm / percentage error / thickness of line (on ruler or pen) **;**
meniscus sticking in capillary tube **;**
connections not airtight **;**
capillary tube too short **;**
fall off in rate CO_2 absorbed by soda lime **;**
variations in, temperature (affecting volume of air in apparatus / rate of respiration / enzymes) **;**
variations in atmospheric pressure (affecting position / movement of meniscus) **;**
no repeats / anomalies not identified / no means calculated **;**
AVP **;** e.g. seeds not germinated for same length of time
AVP **;** seeds from different batches **4 max**

[Total: 28 max]

Question	Expected Answers	Marks
2 (a)	*drawing* clear continuous lines ; correct proportions - radicle at least twice length of seed ; correct size, no smaller than actual size ;	3
	correct distribution shown by annotations white (at root cap) ; red just above root cap / root tip ; pink further up ; some pink on hypocotyls and/or cotyledon ;	4

(b) (i)

feature	explanation
thin walls / squamous epithelium / high density of alveoli / capillaries ;	to minimise diffusion distance ; **R** to make diffusion 'easier' / efficient / quicker etc.
capillaries / blood vessels ;	to maximise volume of gases exchanged / to maintain diffusion gradient ;
large S.A. / high density of alveoli ;	to maximise volume of gases exchanged / rate of gas exchange ;

AVP ; e.g. bronchioles to bring air to maintain diffusion gradient
cartilage to keep airways open to maintain diffusion gradient **6**

(ii) alveoli cut in section / seen in one plane ;
sections pass through different, levels / planes / positions ;
A annotated drawing **2**

(c) fewer alveoli ;
damaged / ruptured walls / alveoli ; **R** cell walls / membranes
thinner walls / less prominent nuclei ;
fewer capillaries / blood vessels ; **R** "blood supply"
larger air spaces ; **R** "gaps"
less surface area ;
AVP ; no bronchioles visible / greater variation in size of air spaces **3 max**

(d) NAD / FAD, not limiting rate of respiration ;
more dehydrogenases ;
more electron carriers ;
more cristae ;
higher rate of respiration (per unit mass of tissue) ; **A** glycolysis / link reaction / Krebs cycle / oxidative phosphorylation / ETC **R** more “active”
AVP ; e.g. to compensate for reduced oxygen availability **3 max**

[Total : 16 max]