RECOGNISING ACHIEVEMENT

2801 Biology Foundation

January 2004

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. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

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

Question	Expected Answers	Marks
1 (a)	**A** (upper) epidermis **;** **R** cuticle **B** xylem **;** *If both C and D totally correct, award both marks* *if one is totally correct, award 1 mark.* *If correct way round, need to see 'mesophyll' at least once to get 2 marks* *if mesophyll alone is given for both C and D award 1 mark* **C** palisade mesophyll **;** **D** spongy mesophyll **;**	**4**
(b)	*award two marks if correct answer (50) is given* *if measurement incorrect but in the range 25 –35 mm, allow one mark for a correct calculation* $^{30}/_{0.6}$ / $^{3(cm)}/_{0.6(mm)}$ / $^{3(cm)}/_{0.06(cm)}$ **;** **A** +/- 1mm 50 **;** **A** 48 - 52 **R** if units given	**2**
		[Total : 6]

Question	Expected Answers	Marks
2 (a) (i)	**J** allows passage of **,** polar substances / water soluble substances / ions / suitable e.g. (allow water) **;** **R** large molecule alone allows facilitated diffusion **;**	**1 max**
	K cell recognition / antigen / receptor / cell adhesion / binds to water molecules to stabilise membrane **;** **R** enzyme / receptor <u>cell</u> / effect at a distance	**1**
	L allows passage of lipid soluble substances (**A** water / O_2 / CO_2) / prevents passage of water soluble substances **;** forms **,** barrier / boundary / AW **;**	**1 max**
	M regulates, fluidity / stability **;** restricts movement **;** influences permeability of membrane **;** storage **;**	**1 max**
(ii)	7 nm **;**	**1**
(b)	<u>membrane</u> **,** folding in / engulfing / invaginates / AW **;** fuses with itself / pinches off **;** formation of **,** vesicle / vacuole **; A** completely surrounded by membrane fate of vesicle **;** e.g. moves through cytoplasm / fate of contents ref. fluid nature (of membrane) / requires energy **;** **A** active / ATP **R** active transport triggered by binding of molecule (to receptor site) **;** ref. to uptake of solid <u>and</u> liquid (not name alone) **;**	**3 max**

[Total : 8]

Question		Expected Answers	Marks
3	(a)	*UV and γ rays = max 1* mutation / mutagen / carcinogen / causes cancer ; control of division reduced / uncontrolled division ; adverse health risk to , fetus / baby ; **R** child cell division / mitosis / growth , occurring ; dividing cells more susceptible to effects of X-rays ;	**2 max**
	(b)	dumping of industrial waste ; site / waste , containing / releasing , (low level) radiation / toxic chemicals / carcinogens / mutagens ; **R** burning e.g. ; lead heavy metal asbestos aniline dyes radon PCBs dioxins **R** CFCs / tar site polluted from former , industry / use of site ; prevailing wind ; waste enters water courses ;	**2 max**
	(c)	enzymes (of microorganisms) work in low temperatures ; enzymes used in stain removal / AW ; can be used for cool washes ; saves energy ;	**2 max**
			[Total : 6]

Question		Expected Answers	Marks
4	(a)	ref. change in external Ψ ; correct linking Ψ to salt concentration ; correct ref. osmosis in , loss / gain ; consequence ; time / no problem , when $\Psi_i = \Psi_o$ (isotonic) *or* way to overcome problem ;	**2 max**

Question	Expected Answers	Marks
4 (b)	*marking points 1, 4, 8, 14, 19, 20 and 22 relate to the bullet points in the question*	
	1 liquid at normal temperatures **;** **2** hydrogen bonding between water molecules **;** **3** molecules more difficult to separate **;**	
	4 ice floats on water / water freezes from top down **;** **5** insulates water beneath **;** **6** large bodies of water don't freeze completely / animals can still swim etc **;** **7** (change in density with temperature) causes currents to circulate nutrients **;**	
	8 solvent for **,** polar / ionic **,** substances **;** **9** solubility of gases in environment **;** **10** allows reactions to take place **;** **11** transport medium **;** **12** e.g. (of substance carried in what) **;** **13** transport medium for **,** gametes / blood cells **;**	
	14 water slow to change temperature **;** **15** lakes / oceans / large volumes **,** provide thermally stable environment **;** **16** internal body temperature changes minimised **;** **17** used for cooling **;** **18** e.g. (sweating / panting / transpiration) **;** **19** large amount of energy must be removed for water to freeze **;**	
	20 organisms can use surface of water (as habitat) **;** **21** e.g. **;** (of organism)	
	22 can form (long / unbroken) columns of water **;** **23** ref. to vascular tissue / xylem **;**	
	24 reactant (photosynthesis) **;** **25** role in **,** hydrolysis / condensation **;**	
	26 AVP **;** e.g. transparency **27** AVP **;** plants can photosynthesise under water incompressible hydrostatic skeleton / turgor buoyancy guard cell mechanism support for large organisms on ice (penguins / polar bears) further detail of any point	**9 max**
	QWC – legible text with accurate spelling, punctuation and grammar;	**1**
		[Total : 12]

Question		Expected Answers	Marks
5	(a)	deoxyribose in DNA ; thymine in DNA ; **R** thiamine DNA is , made of two chains / double helix ; **R** double molecule longer ;	**2 max**
	(b) (i)	*answer has to relate to <u>DNA</u> nucleotide* monomer unit ; <u>deoxyribose</u> ; nitrogenous base / named base(s) ; ecf for thiamine phosphate ; AVP ; e.g. deoxyribose is a pentose sugar / correct diagram	**3 max**
	(ii)	hydrogen bonds between bases ; <u>complementary</u> (base pairs) ; purine to pyrimidine ; A to T <u>and</u> C to G ; 2 H bonds between A and T / 3 H bonds between C and G ; DNA polymerase ;	**3 max**
	(c)	DNA codes for , protein / polypeptide ; transcription <u>and</u> translation (or described) ; enzyme is <u>globular</u> (protein) ; 3 bases ≡ 1 amino acid ; sequence of , bases / triplets , determines , sequence of amino acids / primary structure ; coiling / α helix / β-pleated sheet / particular secondary structure ; determines projecting side groups ; folding / bonding , for tertiary structure ; 3-D structure is tertiary structure ; AVP ; e.g. ref. active site related to shape 2 or more genes produce quaternary structure	**4 max**
			[Total : 12]

Question		Expected Answers	Marks
6	(a)	*mark (i) and (ii) to max 3 each – part (a) to max 4*	
	(i)	*nitrifying bacteria* convert , ammonium / NH_4^+ , to , nitrate III / nitrite / NO_2^- ; **A** *ammonia / NH_3* nitrite , converted to , nitrate (V) / NO_3^- ; **A** *one mark for single step 'ammonium to nitrate* (*V*)*'* requires , aerobic conditions / oxygen / aerated soil ; (nitrate (V) ions) can be , taken up / used , by plants ; 3 max	
	(ii)	*denitrifying bacteria* remove nitrate (V) (ions) / convert nitrate (V) (ions) to nitrogen (gas) ; in , anaerobic conditions / oxygen poor soil / non-aerated soil ; recycles nitrogen / further use of nitrogen (by fixing) ; prevents nitrogen being trapped / AW ; 3 max	**4 max**
	(b) (i)	*look for prokaryote feature* no nucleus / no nuclear membrane / no nucleolus / DNA free (in cytoplasm) ; **R** DNA moving naked DNA / DNA not associated with proteins / no chromosomes ; circular / loop , DNA ; no , membrane-bound organelles / e.g. ; smaller / 18nm / 70S , ribosomes ; no ER ; cell wall , not cellulose / polysaccharide and, amino acids / murein ; AVP ; e.g. mesosomes / plasmids	**1 max**
	(ii)	glycosidic (link) <u>and</u> peptide (bonds) (in correct context) ; condensation ; ref. OH groups ; ref. NH_2 and OH group ; water , removed / produced / by-product ; enzyme ; AVP ; e.g. energy required	**3 max**
	(iii)	iron / Fe ; *ignore pluses / minuses*	**1**
	(iv)	*treat enzyme as neutral* nitrogenase ; leghaemoglobin ; haemoglobin ;	**2 max**
	(v)	(nitrogen) fixation ; **A** reduction	**1**
	(vi)	type of inhibition (competitive / non-competitive / reversible / irreversible); basic mode of action (e.g. binds to active site) ; detail ; consequence (e.g. prevents , substrate / nitrogen , from binding) ;	**2 max**

(c) can fix nitrogen ;
does not deplete soil nitrogen / improves nitrogen content of soil (over time) ;
allows cultivation of poor soil ;
reduces use of fertilisers ;
higher yield ;
AVP ; e.g. reduce contamination of environment by fertilisers
qualified cost ref.
ref. leaching of nitrate **2 max**

[Total : 16]