

2804 Central Concepts

June 2003

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. 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.

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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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- 1 (a) **P** – sensory / afferent, neurone; **A** dendron **R** references to nerve
Q – cell body / nucleus / centron;
R – intermediate / relay / internuncial / connector, neurone;
A interneurone **R** references to nerve
S – motor / effector / efferent, neurone; **A** axon **R** references to nerve **4**

ACh is acceptable as neurotransmitter for parts (b) and (c)

- (b) vesicles / ACh found in, synaptic knob / presynaptic neurone;
neurotransmitter / named neurotransmitter, released from presynaptic
membrane;
receptor / sodium channels, on post synaptic membrane;
diffusion of neurotransmitter, in one direction only / from **P** to **R** / from **R**
to **S** / ref to concentration gradient; **2 max**

- (c) *the idea of no action potential (5 and 9) may only be credited once*

- 1 inhibit ACh synthesis;
- 2 block ACh secretion / reduce number of vesicles / AW;
- 3 prevent uptake of calcium ions (into synaptic bulb);
- 4 no ACh crosses gap / no ACh to bind to receptor;
- 5 no action potential;
(4 and 5 must be linked to either 1, 2 or 3)
- 6 block receptors (on post synaptic membrane);
- 7 block sodium ion channels;
- 8 hyperpolarisation / threshold not reached;
- 9 no action potential;
(8 and 9 must be linked to 6 or 7)
- 10 inhibits acetylcholine esterase;
- 11 no removal of ACh from receptors;
- 12 no repolarisation of post synaptic membrane / AW; **3 max**

[Total: 9]

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Question	Expected Answers	Marks
2 (a)	<p><i>parental genotypes</i> $C^r C^r \times C^w C^w$; <i>gametes</i> C^r , C^w;</p> <p><i>F₁ genotypes</i> (all) $C^r C^w$ <i>F₁ phenotypes</i> (all) pink;</p> <p>(F₁ genotypes and phenotypes 1 mark)</p> <p><i>gametes</i> C^r , C^w C^r , C^w;</p> <p><i>F₂ genotypes</i> $C^r C^r$ $C^r C^w$ $C^r C^w$ $C^w C^w$ <i>F₂ phenotypes</i> red pink (pink) white;</p> <p>(F₂ genotypes and phenotypes 1 mark)</p> <p><i>F₂ ratio</i> 1:2:1;</p> <p><i>accept other symbols if key given.</i> <i>accept r and w as symbols without key.</i></p>	6
(b) (i)	65; 130; 65;	3
(ii)	0.138 + 0.007 + 0.061; (or other suitable working) 0.206 – 0.208;	
	<i>2 marks for correct value if no working shown</i> <i>ecf for both marks but calculated value must be to three decimal places</i>	2
(iii)	support, figure lower than 5.991 / figure lower than critical value; R 'support' on its own. <i>ecf applies if value in (ii) is incorrect</i>	1
(c)	named characteristic; named environmental factor;	
	<i>mark first example only</i>	2

[Total: 14]

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Question	Expected Answers	Marks
3 (a)	cytoplasm / cytosol; mitochondrial matrix; R mitochondrion alone / matrix alone mitochondrial matrix; R mitochondrion alone / matrix alone inner mitochondrial membrane / cristae / stalked particles;	4
(b) (i)	unable to make ATP / ADP limiting; oxidative phosphorylation / <u>aerobic</u> respiration, unable to take place; therefore no oxygen taken up; A – ref to glycolysis; no oxygen needed; glucose to pyruvate;	2 max
(ii)	ATP formed; <u>aerobic</u> respiration / oxidative phosphorylation, proceeds; slows down as ADP is used up;	2 max
(iii)	<u>aerobic</u> respiration / oxidative phosphorylation, not taking place; substrate used up;	2
(c)	1 series of small steps; 2 catalysed by enzymes; 3 ref. to citrate as first intermediate formed; 4 ref. to oxaloacetate as acceptor molecule; 5 addition of 2 carbon fragment / acetyl coA; 6 <u>decarboxylation</u> ; 7 (2 molecules of) carbon dioxide released; 8 <u>dehydrogenation</u> ; 9 (4 pairs of) hydrogen (atoms), released / removed; 10 ref to FAD and NAD; 11 hydrogen acceptors; 12 correct ref to number of reduced FAD formed; 13 correct ref to number of reduced NAD formed; 14 ATP formed; 15 substrate level phosphorylation; 16 hydrogen / reduced FAD / reduced NAD, used in oxidative phosphorylation; 17 intermediates of cycle can form other molecules; 18 catabolism of amino acids / fatty acids feed into cycle; 19 AVP; e.g. 2 turns of cycle per glucose molecule, named enzyme	7 max
	QWC – clear well organised using specialist terms;	1
	[Total:	18]

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Question	Expected Answers	Marks
4 (a)	4,7,1,5,3,6 ;	1
(b)	Protoctista / protista; Fungi; Animalia / animal;	3
(c)	multicellular; differentiated / tissues and organs; photosynthetic / photoautotrophic / chloroplasts / chlorophyll; R autotrophic sap / large, vacuole; R vacuole <u>cellulose</u> cell walls; gametophyte and sporophyte / alternation of generations;	3 max
(d)	1 taxonomists look for, similarities / differences; 2 closely related species have similar, proteins / amino acid sequences / cytochrome C; ora 3 DNA codes for, amino acid sequence / protein structure; 4 closely related species have very similar DNA / ora; 5 mutations result in changed DNA; 6 more differences in DNA; 7 more differences in, amino acid sequence / protein;	4 max
(e)	evolutionary history of organism; closeness of relationship between organisms; create an evolutionary tree / AW;	2 max
		[Total: 13]

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Question	Expected Answers	Marks
5 (a)	<p>A – glomerulus / Malpighian corpuscle; B – Bowman's / renal, capsule; C – proximal / first, convoluted / coiled tubule; A PCT D – loop of Henle; A descending limb E – collecting duct;</p>	5
(b)	<p>the longer the loop of Henle the lower the water potential (of urine) / ora; ref to countercurrent multiplier; ions pass out into, medulla / tissue fluid; lowers water potential / AW; collecting ducts pass through the medulla; water lost from, collecting duct / descending limb; by osmosis; (<i>linked to previous marking point</i>)</p>	4 max
(c)	<p>mitochondria; microvilli / brush border; folded <u>basal</u> membrane; rough ER / ribosomes; tight junction / desmosome;</p>	3 max
(d)	<p>1 selective / differential, reabsorption; 2 active uptake / energy required / ATP required; 3 ATP / energy, from mitochondria; 4 sodium pump; 5 in basal membrane; 6 low sodium ion concentration in cell; 7 sodium ions enter from lumen; 8 uses <u>cotransporter</u> proteins; 9 (linked to) transport of amino acids; 10 (linked to) transport of glucose; 11 vitamins reabsorbed; 12 chloride ions reabsorbed; 13 water reabsorbed by <u>osmosis</u>; 14 some urea reabsorbed by <u>diffusion</u>; 15 uric acid not reabsorbed; 16 creatinine / penicillin, secreted into lumen; 17 AVP; urea becoming more concentrated due to water uptake</p>	7 max
	QWC – legible text with accurate spelling, punctuation and grammar;	1

[Total: 20]

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Question	Expected Answers	Marks
6 (a) (i)	ribulose (bisphosphate) / RuBP;	1
	(ii) Rubisco / ribulose bisphosphate carboxylase;	1
	(iii) A between GP and, GALP / triose phosphate;	1
	(iv) stroma;	1
	(v) ATP;	1
(b)	light reaction stops (when light off); no, ATP / reduced NADP produced; no, GP to, GALP / TP; GP builds up; no, GALP / TP, to RuBP; RuBP used up to form GP;	3
		[Total: 8]

Question	Expected Answers	Marks
7 (a)	X 1800 – 1900 Y 31 - 32; X 27 – 28 Y 37 -38; one mark for each correct row	2
(b)	1 (predator) introduced at day 18 - 19; 2 (population Y) increases due to feeding, on X / prey; 3 increased reproductive rate; 4 reproductive rate greater than 'death rate'; 5 predator / Y , increases until, day 37-38 / numbers 31 - 32; 6 food / prey, shortage causes decline; 7 death rate greater than 'birth rate'; 8 predators die out day 54 – 55; 9 ref to population Y peaking after population X / time lag between populations; 10 ref to lag phase/ log phase of population Y ;	6 max
		[Total: 8]