RECOGNISING ACHIEVEMENT

2804 Central Concepts

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 R = answers which are not worthy of credit A = accept this alternative answer ( ) = 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 ora = or reverse argument

Question	Expected Answers	Marks
1 (a)	sodium / potassium, hydroxide / soda lime / carbabsorb; **A** correct chemical formula	1
(b)	absorb / AW, carbon dioxide / CO_2 ; **R** uses carbon dioxide	1
(c)	to equilibrate / adjust to surroundings / AW; correct ref to temperature of apparatus / pressure / temperature of maggots / activity of maggots;	2
(d)	control; **R** comparison unqualified, fair test. (monitor changes in position of meniscus) due to <u>temperature / pressure</u> changes; **A** ref to thermobarometer to show only maggots respire / ora;	2 max
(e)	respirometer A – 2.0 mm; *must have correct units* respirometer B – 0.2 mm; *must have correct units* *award one mark if both figures are correct but without units or with wrong units*	2
(f)	*award three marks if correct answer is given* distance due to respiration 2.0 – 0.2 = 1.8 mm; **A** 1.8 without working calculation ($3.14 \times 1.0^2 \times 1.8$); 5.652 / 5.65 / 5.7; *ecf – can score three marks if use incorrect values from (e)* *if calculated value is 6.28 / 6.3 give 2 marks*	3

(g) volume / mass / weight, of maggots;
age of maggots;
species of maggots;
same mass / concentration of chemical X;
same equilibration time;
AVP; e.g. same apparatus / AW
same light intensity
same pre treatment of maggots **2 max**

(h) *modification* - keep in dark ;
reason - to prevent photosynthesis;

modification - narrower diameter tube;
reason - movement of liquid easier to measure / AW;
A leaves have lower rate of respiration

modification - larger specimen tube;
reason - more leaves; **2**

(i) (final) electron / hydrogen / proton acceptor; **1**

[Total: 16]

Question		Expected Answers	Marks
2	(a)	photosystems / antennae complex / LHC / quantasome;	1
	(b)	chlorophyll; *treat a and b as neutral*	1
	(c)	electron carrier / cytochrome / protein / electron acceptor / ferredoxin / plastoquinone;	1
	(d)	higher concentration of / more, hydrogen ions / protons; **R** hydrogen, H **A** hydrogen ions produced in lumen	1
	(e)	hydrogen (ions) move down gradient / diffuse; ref to, an electrochemical gradient / proton motive force; across / through, (thylakoid) membrane / lumen, to stroma; (through) ATP synthetase / synthase / protein channel / stalked particles; generates ATP; by chemiosmosis;	3 max
	(f)	no photophosphorylation; no ATP produced; no NADP red produced; no, Calvin cycle / light independent / dark stage; no, GP to TP / no TP to RuBP; no fixation of carbon dioxide; no production of, organic molecules / named organic molecules; **A** autotrophic nutrition stops; **R** food ref to no respiratory substrate;	5 max
	(g)	do not absorb the chemical; thick cuticle / small surface area of leaves / AW; resistant; **R** immune break herbicide down / have specific enzymes / inhibit herbicide; have tolerance allele; AVP; e.g. ref to mutation inheritance of allele natural selection.	2 max
			[Total: 14]

Question		Expected Answers	Marks
3 (a)	1	ref to sodium and potassium pump / AW;	
	2	3 Na^+ out and 2 K^+ in;	
	3 (A)	axoplasm / inside, low Na^+ <u>and</u> high K^+ ***or*** tissue fluid / outside, high Na^+ <u>and</u> low K^+;	
	4 (B)	ref to voltage gated channels;	
	5	sodium channels open;	
	6	(sodium) ions move into neurone;	
	7	depolarisation;	
	8 (C)	until reaches +40mV;	
	9	sodium channels close;	
	10 (D)	potassium channels open;	
	11	(potassium) ions move out of neurone;	
	12	repolarisation;	
	13 (E)	hyperpolarisation / refractory period;	
	14	more negative than resting potential / overshoots, due to excess potassium ions;	
	15	potassium channels close;	
	16	AVP; e.g. different diffusion rates of potassium and sodium ions ref to threshold values in opening of sodium channels	
			7 max
		QWC – legible text with accurate spelling, punctuation and grammar;	**1**
(b)		*accept ora for these points* no insulation of neurone; permeable to (sodium and potassium) ions; no saltatory conduction / shorter local circuits / AW; (without sheath) transmission slows down;	**3 max**
(c)		action potential stimulates calcium channels to open; calcium enters (from extracellular fluid); stimulates vesicles of ACh to move towards presynaptic membrane; (and) fuse with presynaptic membrane; release / exocytosis, of ACh; into synaptic cleft;	**3 max**
			[Total: 14]

Question		Expected Answers	Marks
4	(a)	*species*	
		similar morphological, physiological, biochemical and behavioural features; *(require 3 features for mark)* (inter)breed / reproduce; produce fertile offspring; reproductively isolated; occupy <u>same</u> (ecological) niche;	**3 max**
	(b)	geographical / mountains / distance; <u>allopatric</u>;	**2**
	(c)	**1** associated with human settlements; **2** mouse population scattered; **3** mountain ranges / geographical barriers / distance; **4** no breeding / gene flow / mixing, between populations / separate breeding populations; **5** <u>random</u> mutations occur; **6** different selection pressures / example of, in different areas; **7** different <u>alleles</u> selected for *or* change in, gene pool / allele frequency; **8** develop different chromosome numbers; **9** AVP; e.g. founder effect genetic drift	**5 max**
	(d)	**1** unable to reproduce / unsuccessful breeding / infertile offspring / no offspring, produced; **2** due to different (parental) chromosome numbers / AW; **3** no pairing of chromosomes (in offspring); **4** meiosis unable to take place; **5** no gametes produced (by offspring); **6** hybrid vigour / heterosis;	**4 max**
			[Total: 14]

Question		Expected Answers	Marks
5	(a)	**O** where repressor binds / AW; **P** where RNA polymerase binds / AW; **I** prevents RNA polymerase binding with promoter; *if correct answer to **P,** 'prevents RNA polymerase binding' is acceptable* binds to operator; **Z** breaks down lactose; **Y** increases uptake of lactose;	**5**
	(b)	(regulator gene) produces repressor protein; binds to operator region; prevents RNA polymerase binding; no, transcription / reading of genes; saves energy; saves, amino acids / resources;	**3 max**
	(c)	lactose binds to repressor; changes its shape / AW; unable to bind to operator; RNA polymerase binds (to promoter); transcription / reading of genes; translation / protein synthesis / production of (named) enzymes; increased uptake of lactose; breakdown of lactose; to glucose and galactose;	**5 max**
			[Total: 13]

Question		Expected Answers	Marks
6	(a)	**X** glomerulus / blood capillaries; **Y** renal / Bowman's, capsule; **Z** kidney tubule / convoluted tubule / proximal tubule / distal tubule / brush border / cuboidal epithelial cells;	**3**
	(b) **1**	endothelium of, blood capillaries / glomerulus;	
	2	more / larger, gaps in / between, endothelial cells;	
	3	basement membrane made of, collagen / glycoproteins;	
	4	podocytes;	
	5	large gaps between them / filtration slits;	
	6	basement membrane, selective barrier / filter;	
	7	prevents large proteins passing through;	
	8	no cells pass through;	
	9	one example of molecule which is filtered;	
	10	high, blood / hydrostatic, pressure in capillary;	
	11	afferent arteriole wider than efferent arteriole;	
	12	lower (hydrostatic) pressure in renal capsule;	
	13	water potential / AW, lower in glomerulus;	
	14	ref to effective filtration pressure;	
	15	AVP; e.g. glomerular filtrate is identical to blood plasma minus proteins filtration is by charge and size	**7 max**
		QWC - clear, well organised using specialist terms;	**1**
			[Total: 11]

Question		Expected Answers	Marks
7	(a)	farming / agriculture / slurry / fertiliser / ploughing grassland / organic nitrogen sources;	1
	(b)	avoid ploughing old grassland; do not apply excessive amounts of fertilisers; leave a strip (10 metres wide) next to water courses; keep livestock away from water courses; apply fertiliser when crop actively growing; apply in spring rather than, autumn / winter; do not apply during rainfall; do not leave bare land for any length of time; legumes / crop rotation; reduce run off by, terracing / applying less fertiliser on slopes / application at suitable depth;	4 max
	(c)	transfer nitrogen fixation genes; from nitrogen-fixing bacteria (to crop plants); plants able to fix own nitrogen; less fertilisers applied; (modify for) efficient use / absorption, of nitrogen; **A** (modify for) lower nitrogen requirement; (modify to) form mutualistic relationship with N fixing bacteria / AW;	3 max
			[Total: 8]