



**2804 Central Concepts**

**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 ( $\frac{1}{2}$ ) 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. 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.

<b>Abbreviations, annotations and conventions used in the Mark Scheme</b>	/	= 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 <b>must</b> be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
A	= accept	
ora	= or reverse argument	

Question	Expected Answers	Marks
1 (a)	<b>A</b> - stroma ; <b>A</b> ribosome <b>B</b> - (outer/ inner) membrane / (chloroplast) envelope ; <b>R</b> cell membrane <b>C</b> - thylakoid / lamella ; <b>A</b> lamellae <b>D</b> - granum / granal stack ; <b>A</b> grana <b>A</b> thylakoid stack	<b>4</b>
(b)	granum / thylakoid / lamella ; <b>A</b> lamellae <b>R</b> the letter C	<b>1</b>
(c)	ATP ; reduced NADP / red NADP / NADP red / NADPH <sub>2</sub> / NADPH + H <sup>+</sup> ; <b>A</b> NADPH oxygen ; <b>A</b> O <sub>2</sub>  <i>if only written on first, mark all the answers. Otherwise mark first answer on each line treat water as a neutral answer</i>	<b>3</b>
(d)	<b>1</b> light absorbed by, pigment / bacteriorhodopsin / protein ; <b>2</b> ref to electron carriers / change in shape of bacteriorhodopsin ; <b>3</b> energy released from electrons ; <b>R</b> produced / created / made <b>4</b> protons into cell wall ; <b>5</b> create, proton gradient / electrochemical gradient / pH gradient / proton motive force ; <b>6</b> protons, diffuse / move down gradient ; <b>7</b> through, ATP synth(et)ase complex / stalked particles ; <b>A</b> ATPase <b>8</b> (ATP formed from) ADP + P(i) ; <b>9</b> AVP ; e.g. ref to chemiosmosis, ref to energy transducing membrane, ref to redox reactions.	<b>4 max</b>

[Total: 12]

Question	Expected Answers	Marks
2 (a)	Animalia / animal ; phylum ; class ; Panthera ; species ; <b>A</b> binomial name	5
(b) (i)	<i>apply ecf if candidate uses species rather than sub species</i> fewer <u>sub</u> species in 2004 / <i>ora</i> ; originally 8 <u>sub</u> species in, 2004 there are 5 <u>sub</u> species / <i>ora</i> ; originally ranges covered much bigger area / <i>ora</i> ; populations more fragmented in 2004 / <i>ora</i> ; any one named sub species that has disappeared ; AVP ; e.g. ref to biggest reduction of South China sub species	2 max
(ii)	1. populations geographically isolated ; 2. mutations ; 3. new alleles arise ; 4. no mixing of populations / reproductively isolated ; 5. different selection pressures in different geographical locations ; 6. example of this ; e.g. coat colour and camouflage 7. beneficial alleles increase in frequency / ref to natural selection ; 8. AVP ; e.g. founder effect, genetic drift	4 max
(iii)	1. geographically / reproductively, isolated ; 2. but could, interbreed / mate / reproduce ; 3. to produce fertile offspring ; 4. ref to morphological, physiological, behavioural and biochemical features ; ( <i>need to name three of the four features for mark</i> ) 5. occupy same ecological niche ;	2 max
(c)	23 ; 6-7 ;	2
(d)	tiger larger than leopard / <i>ora</i> ; tigers require larger prey biomass / <i>ora</i> ;	1 max
(e)	1 disease / pathogen / parasite ; <b>A</b> pests 2 hunting / illegal trade ; <b>A</b> predators 3 habitat destruction ; <b>R</b> space on own, must be biologically qualified 4 tourist activity / disturbance ; 5 decreased number of breeding females ; <b>A</b> lack of mates 6 limited gene pool / increased chance of harmful mutations ; 7 ref to competition ; 8 ref to carrying capacity ; 9 ref to global warming ; <b>A</b> human influence / activities for 1 mark if points 2, 3 or 4 not given <b>A</b> lack of availability of water / AW	2 max

[Total: 18]

Question	Expected Answers	Marks
3 (a) (i)	<b>A, B and E ;</b>	<b>1</b>
(ii)	<i>apply ora throughout</i> produced by, sexual reproduction / fusion of gametes / fertilisation ; ref to random mating ; <i>random fertilisation = 2 marks</i> contain chromosomes from two individuals / diploid organisms ; more <u>alleles</u> ;	<b>2 max</b>
(iii)	<b>C and D</b> are haploid organisms ; haploid cells have, one set of chromosomes / half the number of chromosomes ; meiosis requires pairing of homologous chromosomes ; ref to maintaining chromosome number when gametes fuse / gametes must be haploid ;	<b>2 max</b>
(b)	<i>marking points 1,6 and 9 must be linked to correct statements as to what is taking place in these stages to gain the mark.</i>	
	<ul style="list-style-type: none"> <li>1 prophase 1 ;</li> <li>2 synapsis / homologous chromosomes pair up / bivalents form ;</li> <li>3 <u>crossing over</u> ;</li> <li>4 chiasma(ta) occur ;</li> <li>5 DNA / alleles, exchanged ; <b>A</b> linked genes separated ;</li> <li>6 metaphase 1 ;</li> <li>7 <u>independent / random, assortment</u> ;</li> <li>8 bivalents line up on equator, independent of each other / randomly ;</li> <li>9 metaphase 2 ;</li> <li>10 independent assortment of <u>chromatids</u> ;</li> <li>11 <u>chromosome</u> mutation ;</li> <li>12 named example ; e.g. non-disjunction</li> <li>13 AVP ; e.g. ref to non-sister / non-identical, chromatids.</li> </ul>	<b>7 max</b>
	<b>QWC – clear well organised using specialist terms ;</b>	
	<i>award the QWC mark if four of the following are used in correct context</i> prophase, metaphase, homologous, bivalent, chiasma, crossing over, independent assortment	<b>1</b>
(c)	parent genotypes      baby blood group	
	$I^O I^O \times (I^O I^O)$ <u>O</u> ; <i>mark across each line in table</i> $I^A I^B \times I^O I^O$ <u>B</u> ; <i>if no marks gained mark down columns</i> $I^A I^O / I^A I^A \times I^O I^O$ <u>A</u> ; <i>max 2 marks if baby blood groups correct</i> $I^A I^B \times I^A I^O / I^A I^A$ <u>AB</u> ;	<b>4</b>

**[Total: 17]**

Question	Expected Answers	Marks
4 (a)	removal of, unwanted / toxic / waste, products ; of metabolism ;	2
(b)	proteins / polypeptides ; <b>R</b> amino acids <b>A</b> enzymes nucleic acids / DNA / RNA / polynucleotides ;	2
(c) (i)	<i>award two marks if correct answer (568.18 / 568.2 / 568 / 570) is given evidence of <math>14.7 - 2.2 = 12.5</math> or <math>14.7/2.2</math> gains one calculation mark</i>  $12.5/2.2 \times 100 = 568.18 / 568.2 / 568 / 570 ; ;$	2
(ii)	(more) proteins to amino acids ; ref to deamination / removal of amino group ; (more) ammonia formed ; ref to ornithine cycle ; (more) ammonia converted to urea ;	2 max
(d)	ammonia is, alkaline / highly toxic / <i>ora</i> ; ammonia is more soluble / <i>ora</i> ; large volumes of water to excrete it ; would cause dehydration ;	2 max
(e)	1 both filtered / AW ; 2 both small molecules / AW ; <b>A</b> RMM close to 69 000 3 (all filtered) glucose reabsorbed ; 4 active uptake, carrier / cotransporter, proteins ; 5 (some) glucose used in, respiration / active processes, in kidney ; 6 some urea reabsorbed ; 7 by diffusion ; 8 ref to reabsorption in PCT ; <i>apply once to either glucose or urea</i>	5 max

[Total: 15]

Question	Expected Answers	Marks
5 (a)	ADH / anti diuretic hormone ; reduces blood sugar levels / correct mechanism to achieve this ; increases blood sugar levels / correct mechanism to achieve this ; ABA / abscisic acid ; auxin / IAA ;	5
(b)	<ol style="list-style-type: none"> <li>1 ref to change in receptor ;</li> <li>2 creates, receptor potential / generator potential ;</li> <li>3 if greater than threshold value ;</li> <li>4 depolarisation / AW, (of axon / sensory / afferent, neurone) ;</li> <li>5 ref to <u>action potential</u> (<i>anywhere in answer</i>) ;</li> <li>6 ref to, myelin sheath / myelinated neurones ;</li> <li>7 saltatory conduction / AW ;</li> <li>8 ref to nodes of Ranvier ;</li> <li>9 synapse with, motor / effector / efferent, neurone ;</li> <li>10 ref to, calcium ions / calcium channels ;</li> <li>11 vesicles of neurotransmitter fuse with <u>presynaptic membrane</u> ;</li> <li>12 named neurotransmitter ;</li> <li>13 secretion / exocytosis (from presynaptic membrane) ; <b>R</b> release</li> <li>14 <u>diffusion</u> across synaptic cleft ;</li> <li>15 receptors on <u>postsynaptic</u> membrane ;</li> <li>16 depolarisation / AW, (of postsynaptic membrane / motor neurone) ;</li> <li>17 ref to, neuromuscular junction / motor end plate ;</li> <li>18 AVP ; e.g. ion movement, refractory period voltage-gated channels</li> </ol>	8 max
	<b>QWC – legible text with accurate spelling, punctuation and grammar ;</b>	1

[Total: 14]

Question	Expected Answers	Marks
6 (a)	A ; C ; C ; B ;	4
(b)	cytoplasm / cytosol ;	1
(c)	2 ;	1
(d)	conversion to, lactate / lactic acid ; by addition of hydrogen ; A pyruvate acting as hydrogen acceptor from reduced NAD ; ref to lactate dehydrogenase ; recycle NAD for glycolysis ;	3 max
(e)	ref to oxidative phosphorylation and ATP production ; needs supply of hydrogen ; to form reduced, NAD / FAD ; lipids have more, hydrogen / hydrogen – carbon bonds ; more acetyl coenzyme A generated / more 'turns' of Krebs cycle ;	2 max
(f)	dinitrophenol in body ; ETC still functioning ; <u>less</u> ATP formed in respiration ; food not enough to meet metabolic demands of body / AW ; had to respire, body tissues / food stores ; AVP ; e.g. heat production increasing metabolic rate	3 max

[Total: 14]