

Biology Central Concepts

Mark Scheme 2804

June 2005

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

Question	Expected Answers	Mark
1 (a)	S ; R ; S ; A – correct names instead of letters	3
(b)	(carry genes for) production of m / t / r, RNA ; A transcription R ribosomes (carry genes for) synthesis of (mitochondrial), proteins / polypeptides ; (carry genes for) synthesis of (mitochondrial), enzymes / correctly named enzyme ; ref to mitochondrial replication ;	max 1
(c)	FAD / NAD ; A reduced FAD / reduced NAD / AW	1
(d)	1 hydrogen split into protons and electrons ; 2 flow of electrons / electrons pass along, ETC / cytochromes ; 3 energy is released ; R created / produced 4 protons pumped (into intermembranal space) ; 5 sets up, electrochemical / proton, gradient ; 6 protons diffuse (down concentration gradient) ; 7 protons flow through <u>protein</u> channel ; 8 site of ATP, synthase / synthetase ; A ATPase / stalked particle 9 energy of proton gradient linked to ATP formation ; 10 ref to chemiosmosis ; 11 oxygen as final electron acceptor ;	max 5
(e)	1 no proton gradient set up ; 2 no proton flow through, ATP synthase / ATP synthetase ; A ATPase / stalked particle 3 no ATP formed ; 4 no ATP for muscle contraction / description of muscle contraction ; 5 cardiac muscle fails / intercostals muscles fail ; R diaphragm fails 6 Krebs cycle stops ; 7 only glycolysis occurs ; 8 lactate poisoning / AW ; R lactate build up and refs to pain and fatigue 9 AVP ; e.g. 2 ATP (per mol of glucose) formed in glycolysis, no anaerobic respiration in cardiac muscle	max 3

[Total: 13]

Question	Expected Answers	Marks
2 (a)	chlorophyll a ; A chlorophyll for one mark as an alternative to chl. a and b chlorophyll b ; xanthophylls ; carotenoids / carotene ;	2
(b) (i)	thylakoid / lamella / granum ; A membranes R inner membrane	1
(ii)	<i>must be a comparative statement</i> different, reaction centre / form of chlorophyll a / absorption wavelengths / 700nm (PS1) and 680nm (PS2) / PS1 mainly on intergranal lamellae and PS2 mainly on granal lamellae ; R different pigments A cyclic photophosphorylation involves PS1 only ; A PS1 not involved in photolysis / AW ;	max 1
(c)	ATP reduced NADP ; need both for one mark	1
(d)	1 occurs in stroma ; 2 a series of enzyme-controlled reactions ; 3 carbon dioxide fixed by RuBP ; 4 carboxylation ; 5 enzyme is Rubisco ; 6 (unstable) 6C intermediate ; 7 forms (2 molecules) of GP ; 8 forms TP ; 9 using ATP (linked to point 8) ; 10 reduction step ; 11 using reduced NADP ; 12 ref to either ATP or NADP red coming from light dependent reaction ; 13 (most of) TP regenerates RuBP ; 14 rearrangement of carbons to form pentose sugars ; 15 ATP required, for phosphorylation / ribulose phosphate to ribulose biphosphate ; 16 AVP ; e.g. TP can be used to form, lipids / amino acids / hexose sugars / suitable named example	max 7
	QWC – legible text with accurate spelling, punctuation and grammar ;	1

[Total: 13]

- | Question | Expected Answers | Ma |
|----------|---|----|
| 3 (a) | <p>parental genotypes RrBb x Rrbb ;</p> <p>gametes RB Rb rB rb Rb rb ;</p> <p>offspring genotypes RRBb RrBb (RrBb) Rrbb RRbb (Rrbb) rrBb rrb ;</p> <p>offspring phenotypes rough black rough white smooth black smooth white ;</p> <p>expected ratio 3 : 3 : 1 : 1 ;</p> <p>accept correct gametes, offspring genotypes and offspring phenotypes in Punnett square</p> <p>use ecf except for ratio Reject the ratio 6 : 6 : 2 : 2</p> <p>ratio not a stand alone mark – there must be some correct working to support it</p> | |
| (b) (i) | <p>length of DNA ;</p> <p>codes for a (specific), polypeptide / protein / RNA ;</p> <p>found at a, locus / particular position on, a chromosome ;</p> <p>variety / form of a gene ; R type of gene A type of a gene</p> | |
| (ii) | <p>assume the allele = coat colour allele</p> <p>(coat colour) gene / alleles, only on X chromosome ;</p> <p>A no (coat colour), gene / allele, on Y chromosome</p> <p>male cats, XY / only have one X chromosome ;</p> <p>(males have) only one (coat colour) <u>allele</u> / cannot have two (coat colour) <u>alleles</u> ;</p> <p>need black and orange <u>alleles</u> for tortoiseshell colour ;</p> | m |
| (c) | <p>1 ref to <u>operon</u> ;</p> <p>2 normally <u>repressor</u> substance bound to <u>operator</u> ;</p> <p>3 prevents RNA polymerase binding (at promoter) / prevents transcription ;</p> <p>4 lactose binds to <u>repressor</u> ;</p> <p>5 changes shape of protein molecule ;</p> <p>6 unable to bind (to operator) ;</p> <p>7 RNA polymerase binds (at promoter) / transcription occurs / genes switched on ;</p> <p>8 production of <u>lactose permease</u> ;</p> <p>9 production of <u>beta – galactosidase</u> ;</p> | m |

[Total: 15]

Question	Expected Answers	Marks
4 (a)	ductless gland ; secretes hormones ; R excrete (directly) into blood ;	max 2
(b) (i)	islets of Langerhans ;	1
(ii)	<u>glucagon</u> ;	1
(iii)	insulin ;	1
(iv)	negative feedback ;	1
(v)	binds to (glucagon) receptors ; on cell surface membrane ; activation of phosphorylase ; stimulates breakdown of glycogen to glucose ; <u>glycogenolysis</u> ; use of fatty acids as main respiratory fuel ; production of glucose from other molecules ; <u>gluconeogenesis</u> ; glucose released into blood ; AVP ; e.g. ref to cAMP	max 5
(c)	insulin produced by, microorganisms / bacteria ; cheaper source of insulin / more reliable supply / ref to large scale production ; more rapid response / shorter duration of response ; less chance of, immune / allergic, response ; R reference to rejection better for people who have developed a tolerance for animal insulin / less needed ; R immune acceptable to people who have ethical, moral or religious objections ; A vegetarians no risk of, infection / contamination ;	max 3

[Total: 14]

Question	Expected Answers	Marks
5 (a)	<p>$R^R R^R$ - low, do not have enough vitamin K in diet / ref to figures ;</p> <p>$R^R R^S$ - high, (warfarin resistant) and have enough vitamin K / ref to figures ;</p> <p>$R^S R^S$ - low , will be killed by warfarin / ref to effects of warfarin ;</p> <p><i>If quote probabilities for survival less than 50% is low and over 50% is high</i></p>	3
(b)	<p>(i) mutation / named mutation ; change in DNA base sequence ;</p> <p>(ii) variation within population ; some individuals produce enzyme not susceptible to warfarin ; these individuals survive / selective advantage ; reproduce / breed ; pass, resistance / advantageous <u>allele</u> , to offspring ; R gene those without resistance die ; ref to selective pressure of warfarin ;</p>	max 1 max 5
(c)	does not directly involve humans ; environment selects individuals that will reproduce ;	max 1
(d)	<p>resistant allele / R^R , will decrease and , susceptible allele / R^S , will increase ; $R^R R^R$ at a disadvantage due to vitamin K requirements / $R^S R^S$ at an advantage due to warfarin being removed ;</p> <p>A frequencies of both alleles will stay the same ; <i>must be linked to second statement</i></p> <p>no longer any selective pressure / no directional selection ;</p>	max 2
[Total: 12]		

Question	Expected Answers	Marks						
6 (a)	thick axons transmit impulses quicker than thin ones / AW ; myelinated fibres quicker than unmyelinated / AW ; invertebrates have slower speed of impulse / ora ; ref to one set of comparative figures from table ;	max 2						
(b)	<ol style="list-style-type: none"> 1 depolarisation of membrane ; 2 sodium ions move into axoplasm ; 3 sodium ions flow sideways inside axon ; A move down axon 4 ref to local circuit ; 5 towards, negatively charged region / region at resting potential ; 6 sodium voltage gated channels open ; 7 region behind local circuit not yet recovered / sodium voltage gated channels closed ; 8 impulse moves in one direction along axon ; 9 myelin sheath acts as (electrical) insulator ; 10 ref to Schwann cell and myelin ; 11 lack of sodium and potassium gates in myelinated regions ; 12 ref to nodes of Ranvier ; 13 depolarisation occurs at nodes only ; 14 (therefore) longer local circuits ; 15 jumps from one node to another ; 16 saltatory conduction ; 17 AVP ; e.g. detail of why thicker axons have faster impulses i.e. less leakage of ions or offer less resistance 	max 7						
	<p>QWC – clear well organised using specialist terms ;</p> <p><i>award the QWC mark if four of the following are used in correct context</i></p> <table border="0"> <tr> <td>depolarisation</td> <td>voltage gated channels</td> </tr> <tr> <td>node of Ranvier</td> <td>local circuits</td> </tr> <tr> <td>saltatory,</td> <td>sodium ions or Na+</td> </tr> </table>	depolarisation	voltage gated channels	node of Ranvier	local circuits	saltatory,	sodium ions or Na+	1
depolarisation	voltage gated channels							
node of Ranvier	local circuits							
saltatory,	sodium ions or Na+							
(c)	<p>following an action potential ; need to, redistribute sodium and potassium ions / restore <u>resting potential</u> ; sodium voltage gated channels are closed ; (during which) another impulse cannot be, generated / conducted ; ensures impulses separated ; determines maximum frequency of impulse transmission ; impulse passes in one direction only along axon ; AVP ; e.g. ref to absolute and relative refractory periods</p>	max 4						

[Total: 14]

Question	Expected Answers	Marks	Notes
7 (a)	B ; C ; D ; A ;	4	4
(b) (i)	award two marks if correct answer (26.18 / 26.2 / 26) is given 24 x 60 = 1440 ÷ 55 ; 26.18 ; A 26 / 26.2	2	2
(ii)	less oxygen / ora ; reduced amount of nutrients / ora ; ref to pH / ora ; competition from other bacteria / interspecific competition / ora ; use of antibiotics ; AVP ; ref to intestinal enzymes or immune system R reference to temperature <i>treat toxins as neutral</i>	max 3	max

[Total: 9]