



2806/01 Unifying Concepts in Biology

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.

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
	<i>ora</i>	= or reverse argument

Question	Expected Answers	Marks
1 (a)	cholesterol not soluble (in water) ; lipids / cholesterol, hydrophobic / non-polar ; glucose is (very) soluble (in water) ; glucose is, hydrophilic / polar ;	2 max
(b)	low (TC:HDL) ratio = low risk ; <i>ora</i> low (resting systolic) blood pressure = low risk ; <i>ora</i> data quote ; AVP ; e.g. if ratio is 3 high systolic pressure does not increase risk	3max
(c)	<i>A day 1 → 2 for rest → walk, A day 2 → 3 for walk → run</i> <i>pulse</i> 1 rest to walk transition, has no (significant) effect / is anomaly ; 2 rest / walk, to run transition increases pulse ; 3 pulse data quote ; 4 heart beats faster ; 5 more O ₂ , supplied to / needed by, <u>muscles</u> ; 6 for respiration ; 7 to remove, more CO ₂ / lactate / heat ; <i>systolic pressure</i> 8 rises as, exercise / level of activity, increases ; A ref days 9 systolic pressure data quote ; R if no units 10 heart beats more forcefully / greater stroke volume ; <i>diastolic pressure</i> 11 changes less than systolic ; A relatively constant 12 because diastolic depends on elasticity of artery walls ; 13 AVP ; e.g. ref to aerobic (respiration), ref to cardiac output (qualified)	5 max
	[Total:	10]

Question	Expected Answers	Marks
2 (a) (i)	<p>higher, number / proportion / percentage / ratio / fraction, of mounds have thyme ; (c.f. quadrats) <i>ora</i></p> <p>A figs, e.g. $\frac{2}{3}$ vs $\frac{1}{2}$, 2:1 vs 1:1, 36 vs. 24</p>	1
(ii)	<p><i>look for a statement and a reason</i></p> <p>use smaller quadrat ; e.g. 50 cm x 50 cm for fair test ; AW</p> <p>use grid and random numbers ; throwing keys biased ; AW</p> <p>estimate, percentage cover / abundance ; A point (frame) quadrat may be single plants in some samples and many in others ;</p> <p>bigger study area / more data ; (keep equal numbers mounds and quadrats) improves reliability / AW ;</p> <p>record other plants ; could influence thyme ;</p> <p>measure / note, abiotic variables ; A example explanation of how named variable affects thyme ;</p> <p>AVP ; AVP ;</p>	4 max
(b)	<p>better drainage ; finer soil ; A looser more, nutrients / minerals / ions ; A more fertile decay of, ants / prey / faeces ; ants, eat / kill / drive away, animals that eat thyme ; slopes of mound influence incident, light / sun (idea) ; thyme, tolerates / grows well, when buried by growing mound ; metabolism of ants warms soil ; competing plants do not, thrive on / tolerate, the mounds ; A less competition ants carry seeds of thyme ; more wind on raised mounds ; AVP ; AVP ;</p>	2 max

- (c)
- 1 named pioneer species ;
 - 2 ref to pioneer species change environment ;
 - 3 (as succession proceeds) stability increases ;
 - 4 example ;
 - 5 (as succession proceeds) nutrients increase ; **A** more fertile
 - 6 ref to leguminous plants increasing N ;
 - 7 ref to decay / nutrient cycle ;
 - 8 new species of plant can grow ; **A** example
 - 9 (pioneer) legumes outcompeted ; **A** example
 - 10 more food for herbivores / primary (1^o) consumers ; **A** example
 - 11 ref to specialised herbivores ; **A** example
 - 12 ref to specialised pollinators ; **A** example
 - 13 (more herbivores) more variety of food for next trophic level ; **A** example
 - 14 food webs more complex ;

 - 15 larger plants provide more, shelter / nest sites ;
 - 16 more microhabitats ; **A** example
 - 17 more spatial niches ; **A** idea
 - 18 AVP ; e.g. pioneers outcompeted (qualified)
 - 19 AVP ; adaptation of pioneer **6 max**
- QWC- legible text with accurate spelling, punctuation and grammar ; 1**
- [Total: 14]**

Question	Expected Answers	Marks
3 (a) (i)	steep increase, for the first 1 - 2 hours / till 2.2 - 3.8 (a.u) ; A linear, steady became constant at, 3 hours / 4.3 (a.u) ; <i>if no figs in description, e.g. 'rose then constant' award 1 mark max</i>	2
(ii)	(increased as) enzyme working / rate of reaction high / reaction proceeding ; (increased as) substrate converted into, drug / product ; (levelled off / became constant, after the) enzyme, became inactive / was denatured; (levelled off / became constant) because product inhibits, reaction / enzyme ; R references to enzyme or substrate being used up R T °C limiting	2
(b)	pH ; degree of mixing ; enzyme concentration ; AVP ; e.g. ref to concentration of inhibitors	1 max
(c)	<i>max of 2 marks for predicting or explaining</i> P1 concentration of drug higher / AW ; P2 rate of reaction slower / AW ; P3 may not level off (in time scale shown on graph) ; P4 time taken to reach the maximum yield (approximately) doubles ; (c.f. 15 °C) E1 not denatured ; E2 adapted to 5 °C / optimum / body / usual, temperature ; E3 ref to Q ₁₀ of about 2 ; E4 ref to lower kinetic energy / AW ; E5 ref to E-S, collisions / complexes ; AVP ; e.g. ref to active site	3 max
(d) (i)	(shaded amino acids) form the active site ; substrate may not attach to the active site ; enzyme-substrate complex may not be formed / AW ;	1 max
(ii)	44 and 66 not part of active site ; hold, active site / 3° structure / 3D structure, in shape ; A stop denaturing hydrogen bonds weak ; easily broken by, vibration / heat ; A pH disulphide bridge strong ; not broken by heat ;	2 max
(e)	nucleotide / base/ DNA, sequence codes for, protein / amino acid, sequence ; changes DNA ; A change triplet makes different mRNA ; A change codon transcription ; different tRNAs line up ; A change anticodon translation ; different (amino acid sequence in), enzyme / protein / polypeptide ;	2 max
	[Total: 13]	

Question	Expected Answers	Marks
4 (a)	<p><i>any two of the following</i></p> <p>(monomer) not glucose ; contains nitrogen ; contains, sulphur ; AVP ; R ref to branching</p>	2 max
(b)	<p>amount of glycoprotein varies (in different cells) ; (cells carry out) endocytosis to different extents ; cells have different life spans / example ; no time for polysaccharide to accumulate in short lived cells ; number / role, of lysosomes not same in all cell types ; AVP ;</p>	1 max
(c)	<p><i>with Hunter's syndrome, lysosomes / vesicles, might be</i></p> <p>larger ; more numerous ; have different shape ; stain differently ; AVP ; e.g. granular cytoplasm</p>	1 max
(d) (i)	<p>unaffected parents can have an affected child ; <i>ora</i> e.g. 3, 4, 8 / 11, 12, 16, 17 ;</p>	1 max
(d) (ii)	<p>only males affected ; <i>ora</i> mothers pass it on ; <i>ora</i> on the X chromosome ; carrier women asymptomatic / dominant normal allele masks trait ; 4 / 11 / 1 , could be carriers ;</p>	2 max
(e)	<p>there are only 3 cases / too small a sample ; mostly female line shown ; AVP ; e.g. pedigree of, 3 / 12, not known progeny of, 13 / 14 / 15, not known</p>	1 max
(f)	<p>drug must act in all cells ; lysosomes are within cells ; hard for drug to reach ; if drug acts as enzyme, polysaccharide on cell membranes may be broken down ; tissue mechanical support would break down ; AVP ; AVP ; e.g. no animal model protein drug digested in gut rare condition (qualified), economic argument</p>	2 max
	[Total:	10]

Question	Expected Answers	Marks
5 (a)	avoid attracting a mate of a different species ; <i>ora</i> ensure reproductive isolation ;	1 max
(b) (i)	diffusion ;	1
(ii)	so that they do not receive oxygen constantly ; there are mitochondria between them and the cell surface ;	1 max
(c)	mitochondria / aerobic respiration / oxidative phosphorylation, inhibited only briefly ; oxygen concentration decreases again ; preventing, action of luciferase / production of light ; each flash short ; <i>ora</i> e.g. so not continuously lit AVP ;	2 max
(d)	active transport ; A e.g. Na ⁺ /K ⁺ pump protein synthesis ; synthesis of named substance ; movement of organelles ; phosphorylation of glucose ; AVP ; ; ; e.g. transcription, translation, anabolic reaction R respiration, DNA replication, chromosome movement, mitosis	3 max
(e)	cells / membranes, damaged / disrupted ; nitrous oxide released ; mitochondria stop using oxygen ; oxygen, allows light production / reaches light-producing organelles ; in unlimited quantities / continuously, so light is brighter ; respiration / oxidative phosphorylation, ceases ; no more, ATP / NADH ₂ ; luciferin, synthesis / regeneration, stops ; AVP ;	3 max
(f)	live bacteria, respire / produce ATP ; <i>ora</i>	1
(g)	<u>mRNA</u> (coding for luciferase) ; A DNA	1
[Total:		13]