

**2806/01 Unifying Concepts in Biology**

**January 2005**

**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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<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 ( ) = words which are not essential to gain credit _____ = (underlining) key words which <b>must</b> be used to gain credit ecf = error carried forward AW = alternative wording A = accept R = reject ora = or reverse argument
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Question	Expected Answers	Marks
1 (a)	<i>accept reverse arguments</i>	
(i)	monozygotic (MZ) twins produced by, <u>mitosis</u> / <u>mitotic division</u> ; MZ twins have the same, DNA / genes / genotype / chromosomes ; ora egg / sperm / gametes, different because of meiosis ; independent assortment / crossing over / recombination, produces (genetically) different, gametes / eggs and sperm ; AVP ; e.g. further relevant detail of, meiosis / cleavage / twinning	
(ii)	ref to, environment / upbringing / surroundings / lifestyle, influencing development / phenotype / characteristics ; example (diet / exercise / smoking habits / occupation) ; ref to different experiences in the uterus before birth ; AVP ; e.g. further development of points above	<b>max 4</b>
(b)	unlikely to be due to chance ( <b>A</b> not due to chance) / random error ; ref to null hypothesis or probability ; differences as great as those observed would be expected by chance less than once in 20 times / ref to 0.05 or 5% probability ;	<b>max 2</b>
(c)	<i>accept</i> <ul style="list-style-type: none"> <li>• <i>any of these points as data quotes</i></li> <li>• <i>reverse arguments</i></li> <li>• <i>use of the terms identical, non-identical and fraternal</i></li> </ul> <i>mark the first 4 answers</i>	
1	monozygotic twins were less common (in this study) (than dizygotic) ;	
2	monozygotic twins more likely both to die of CHD (than dizygotic) ;	
3	female twins were more common than male twins ;	
4	males develop CHD more often than females ;	
5	about twice as often ;	
6	genes / inheritance / genetic factors, are involved in the development of CHD ; <b>R</b> genetics as the cause of CHD	
7	AVP ;	
8	AVP ; e.g. deduction from any of the above other valid statements of fact based on the table	<b>4</b>

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- (d) same-sex pairs more likely to have had similar environments ;  
example ;  
sex known to affect risk of developing CHD / males more likely to develop CHD ;  
ref to, sex chromosomes / XY difference / more genes on X ;  
males and females have different hormones ;  
as all the monozygotic pairs are the same sex, so should the dizygotic pairs ;  
one less, variable / factor, to 'take account of' / AW ;  
AVP ;

**max 1**

**[Total: 11]**

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Question	Expected Answers	Marks
2 (a)	<p>1 rate of respiration can equal rate of photosynthesis / <math>\text{CO}_2</math> used = <math>\text{CO}_2</math> produced / <math>\text{O}_2</math> used = <math>\text{O}_2</math> produced ;</p> <p>2 ref to compensation point ;</p> <p>3 mitochondria use oxygen ;</p> <p>4 chloroplasts produce oxygen ;</p> <p>5 mitochondria are always active / respiration continues independently of light ;</p> <p>6 chloroplasts are inactive in dark / photosynthesis does not take place without light ;</p> <p>7 oxygen released by, chloroplasts / photosynthesis, can be utilised by mitochondria / respiration ;</p> <p>8 at high light intensities, chloroplasts produce more oxygen than the mitochondria consume ;</p> <p>9 AVP ; e.g. valid refs to <math>\text{CO}_2</math> exchange</p>	max 4
(b)	<p>phosphate ions are used to produce ATP ; in oxidative phosphorylation / Krebs cycle / chemiosmosis / electron transport / ATP synth(et)ase ; ATP leaves mitochondria ;</p>	max 2
(c)	<p>carrier protein / transport protein / transmembrane protein involved ; <b>A</b> ref to a specific channel concentration of triose phosphate is higher in the chloroplast (than in the cytoplasm) ; because it is a product of, photosynthesis / light independent reaction / Calvin cycle ; triose phosphate moves, down concentration gradient / from high to low concentration ; ATP not involved / no energy used ;</p>	max 2
(d)	<p><i>ignore references to chloroplasts or mitochondria being cells, having cytoplasm and reference to free ribosomes</i></p> <p>free / naked, DNA ; <b>A</b> DNA not surrounded by, membrane / envelope have an inner folded membrane / AW ; ribosomes, smaller than those in cytosol / similar in size to prokaryotic ribosomes ; <b>A</b> ref to 70S and 80S circular DNA ; <b>A</b> loop AVP ; e.g. absence of introns</p> <p><b>R</b> absence of a nucleus from the chloroplast or mitochondrion <b>R</b> ref to membranous organelles as chloroplasts and mitochondria are these organelles</p>	max 2

**[Total: 10]**

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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
<b>3 (a)</b>	<p><i>mark the first two answers</i> <i>both correct for one mark</i></p> <p>sex / body mass / height / fitness / smoking habit / age / AVP ;</p> <p><b>R</b> respiratory disease and ref to time for which the forced ventilation was carried out</p>	<b>1</b>
<b>(b)</b>	<p><i>no mark for stating whether supports or not</i></p> <p><i>accept suggestions of either positive or negative effect of the first attempt on the second</i></p> <p>ref to male female imbalance in the two groups ; for each student the time was always greater after forced ventilation ; significant difference in the two groups / ref to group <b>B</b> having higher (mean) time, after forced ventilation ; AVP ; e.g. a data quote that supports or refutes ref to exceptional 115 value</p>	<b>max 2</b>
<b>(c)</b>	<p><i>mark (i) and (ii) together to max 4</i></p> <p><b>(i)</b> <b>A</b> increase in (blood) oxygen (concentration) ; less / decrease in, (blood) carbon dioxide (concentration) ; rise in pH ; AVP ; e.g. more oxyhaemoglobin formed larger, volume / mass, of, CO<sub>2</sub> removed / O<sub>2</sub> absorbed (by blood)</p> <p><b>(ii)</b> <i>note that the second marking point also implies the first</i></p> <p>air in the, alveoli / lungs, more completely changed ; concentration of oxygen in alveolar air increase ; <b>A</b> reverse for carbon dioxide increase in concentration gradient between blood and air / increased diffusion rate ; AVP ; e.g. more alveoli are used / larger proportion of alveoli are used ref to, haemoglobin dissociation curve / Bohr shift ;</p>	<b>max 4</b>

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(d) award a max of **two** marks for factors that are regulated

- 1 & 2 glucose (concentration) **A** blood sugar / temperature / lactate **A** lactic acid / pH / pressure / water potential **A** water content / salt content ; ;
- 3 more glucose is used, for named process ;
- 4 release of glucagon from, pancreas / islets of Langerhans / alpha cells ;
- 5 less insulin, released from / produced by, pancreas / islets of Langerhans / beta cells ;
- 6 conversion of glycogen to glucose ;
- 7 further detail of blood glucose control mechanisms ;  
e.g. glucose enters blood from liver
- 8 ref to, glycogenolysis / gluconeogenesis ;
- 9 vasodilation in skin / described ;
- 10 allows blood to cool (as it passes through skin) / heat radiated ;
- 11 reversing the temperature rise that occurs during exercise ;
- 12 sweating / perspiration / ref to latent heat ;
- 13 increased reabsorbtion of water by kidneys / decreased urine production ;
- 14 ref to ADH ;
- 15 further detail of osmoregulation ;
- 16 increased, salt / sodium, reabsorbtion by kidneys ;
- 17 lactic acid, reduces blood pH ;
- 18 lactic acid removed by liver ;
- 19 ref to a mechanism to restore blood pH ; e.g. buffering *or* excretion of,  $H^+$  /  $NH_4^+$  /  $HCO_3^-$
- 20 ref to chemoreceptors ;
- 21 heart rate / stroke volume / cardiac output, increases ;
- 22 this maintains and or increases blood pressure ;
- 23 vasodilation / increased lumen of blood vessels, during exercise would otherwise result in a fall in pressure ;
- 24 further detail of cardiovascular control mechanisms linked to homeostasis ;
- 25 AVP ;
- 26 AVP ; e.g. haemoglobin dissociation curves / Bohr shift  
explanation in terms of negative feedback

*the AVPs must be awarded for further detail of different processes*

**max 7**

**QWC – legible text with accurate spelling, punctuation and grammar**

**1**

**[Total: 15]**

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Question	Expected Answers	Marks
4 (a)	1 : 2 : 1 ;	1
(b)	<p>1 ref to, codominant / equally dominant (alleles) ;  <b>A</b> incomplete dominance but <b>R</b> genes as alternative to alleles</p> <p>2 appropriate symbols for two codominant alleles ; eg G<sup>1</sup> and G<sup>2</sup>  <b>R</b> a capital and a lower case symbol or two different letters such as G and Y</p> <p>3 parent plant shown or stated to be heterozygous ; <b>A</b> if it is explained that any sunny plant is heterozygous</p> <p>4 gamete genotypes shown appropriately ;</p> <p>5 correct offspring genotypes ;</p> <p>6 the 'Sunny' / yellow-green, were heterozygous / genotype shown by diagram ;</p> <p>7 the dark green / the yellow, were homozygous / genotype shown by diagram ;</p>	max 5
(c)	<p>1 ref to, randomness / chance (sampling) ;</p> <p>2 ref to random fertilisation ;</p> <p>3 totals are (quite) a large sample, pot <b>B</b> / single pot / six, is a small sample ;</p> <p>4 if (only) six seeds, there is a greater chance of departing from an expected ratio /  AW ;</p> <p>5 probability of six seedlings all the same is <math>\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}</math> ;</p> <p>6 with, many seedlings / the totals, the deviations of the individual results cancel out ;</p> <p>7 some departure from an expected ratio is always likely / idea ;</p> <p>8 only the yellow number (33) deviates from the expected / 28 is half 56 ;</p> <p>9 chi squared test could be used ;</p>	max 3
10	AVP ;	max 3
(d)	<p><i>credit ora here</i></p> <p><b>A chloroplast as alternative to chlorophyll</b></p> <p>yellow seedlings have, no / very little, chlorophyll ;  cannot photosynthesise ;  die when, energy reserve / carbohydrate (accept food), in seed is exhausted ;</p> <p>dark green grow more because they have more chlorophyll (than the yellow-green) ;  so dark green have more, photosynthetic products / named product ;  ref to competition between the seedlings ;  ref to, selection / selective advantage ;</p>	max 3

**[Total: 12]**



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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
5 (a)	dissolve / destroy, cell membranes (idea) ;	1
(b)	block the receptor / prevent ACh from binding ; no longer able to stimulate post synaptic membrane ; muscle fibres, not stimulated (by nerve fibres) / do not contract ; <b>A</b> tetany idea AVP ; e.g. ref to lack of synaptic transmission	max 2
(c)	toxin acts too fast, for immunity / antitoxin to develop (idea) ; human unlikely to have been, bitten before / exposed to toxin or antigen ; one / a / few (immature), lymphocyte(s) / stem cell(s) (able to bind the toxin) ; these must be stimulated to divide / ref to clonal selection or clonal expansion ; mitosis takes too long ; has no memory cells ; AVP ;	max 2
(d)	more, antibody-secreting cells / B lymphocytes, produced ; enough / more, antitoxin produced ; (idea of good yield) faster / goes on for longer ; <u>secondary response</u> ; more mitosis (of antibody producing cells) ; second injection of toxin would result in <u>clonal expansion</u> ; ref <u>memory cells</u> ; AVP ; e.g. large dose would kill the horse	max 3
(e)	<i>answers may be phrased in context of neurotoxin or haemolytic enzyme or both</i>  toxin must bind to, receptor / enzyme ; idea of specificity ; heat would <u>denature</u> ; change, secondary / tertiary, structure ; <b>A</b> change to $\beta$ pleated sheet AVP ; e.g. ref to hydrogen bonds breaking <b>R</b> ref to peptide bonds breaking	max 2
(f)	antibody / antitoxin, only remains in, blood / body, for short time ; acquired immunity / passive immunity ; person not themselves producing any antitoxin ; no clonal selection ; no memory cells ; immune system will (soon) reject / destroy the (foreign) horse antibody ; AVP ; e.g. further detail explaining why immune system not stimulated different snakes have different toxins	max 2

**[Total: 12]**