

**2806/01 Unifying Concepts in Biology**

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

<b>Mark Scheme</b> Page 3 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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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 <u>      </u> = (underlining) key words which <b>must</b> be used to gain credit ecf = error carried forward R = reject A = accept AW = alternative wording ora = or reverse argument
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Question	Expected Answers	Marks
1 (a) (i)	oxygen not carried, by blood / in blood / in capillaries / in blood vessels; oxygen not carried by haemoglobin;  tracheoles are, narrower / smaller, than capillaries; air in tracheoles does not, move / circulate; tracheoles, enter / penetrate, muscle fibres; direct pathway from, spiracles / atmosphere / outside air, to muscle fibres;	<b>3 max</b>
(ii)	muscle fibre, close to tracheole and capillary; (oxygen) diffuses / moves, down concentration gradients; <b>A</b> high to low concentration <i>idea that</i> large surface area in tracheoles and capillaries; <b>R</b> alveoli / lungs	<b>1 max</b>
(b)	number of, renewals / visits, to surface increases with temperature; frequency approximately doubles with 10 °C rise / Q <sub>10</sub> of about 2; metabolic activity / respiration rate, increases with temperature; diffusion rate is greater at higher temperatures; reference to increased kinetic energy of molecules; <b>A</b> molecular movement oxygen is less soluble at higher temperatures; figures used to make a comparison; AVP;	<b>4 max</b>
<b>[Total:</b>		<b>8]</b>

<b>Mark Scheme</b> Page 4 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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Question	Expected Answers	Marks
2 (a)	<p><i>award two marks if correct answer (7) is given</i>  <i>award 1 max for calculation if correct answer not given</i>  <i>award 1 max if answer not rounded up to nearest whole number</i></p> <p>4000 ÷ 544; 7;</p>	2
(b)	<p><i>any two of the following</i></p> <p>carrying capacity, exceeded / reached;  shortage of, food / resources;  disease;  parasites;  cold winters / other plausible climatic factor;  AVP;; e.g. no emigration possible / stress reduces breeding / culling (by park wardens) / other predators  <b>R</b> hunting / high death rate unqualified</p>	2 max
(c)	<p>trees / forest, removed;  (secondary) succession;  ashes increase soil fertility;  more shrubs / young trees / other low growing vegetation, can grow;</p>	2 max
(d)	<p>virus spreads (more easily) when population is more dense; <b>A</b> ref to transmission proportion / fraction / percentage, of animals that die increases at higher population densities;  whilst smaller populations have little disease, so increase;  more, food / resources, available to survivors;</p>	2 max
	<p><i>In (e) and (f) data quotes may be given if candidates refer to increases / decreases in wolf / moose numbers linked with years, AVP may be given for numbers of wolf and moose</i></p>	
(e)	<p>moose do not increase in population as rapidly after wolves arrived on the island as they did before;  a crash in wolf population is followed by a sharp rise in moose population;  data quote to support hypothesis using both curves; (+/- one year)  big fluctuations before the wolves arrived / more stable after wolves arrived;  peak / increase, in wolves follows, peak / increase, in moose;  AVP;</p>	2 max

<b>Mark Scheme</b> Page 5 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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- (f) wolf population starts to rise after wolves first colonise even though the moose population is (very) low;  
wolf population peaks when the moose population is falling;  
data quote to support hypothesis using both curves; (+/- one year)  
wolves eat other foods;  
in 1966, wolf population peaked before moose population;  
AVP; e.g. poor correlation between rises and falls in moose and wolf numbers      **2 max**

**[Total: 12]**

<b>Mark Scheme</b> Page 6 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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<b>Question</b>	<b>Expected Answers</b>	<b>Marks</b>
3 (a) (i)	water content, of cells / samples / seeds / tissues, varies with, growth / uptake; so that a (valid) comparison can be made / water is an (uncontrolled) variable;	<b>1 max</b>
(ii)	lipids metabolised; <b>A</b> used up / respired / converted to starch respiration / use as energy source; <b>R</b> metabolism unqualified carbon dioxide and water produced in respiration both lost;	<b>2 max</b>
(b) (i)	(organic compounds) contain carbon; <b>A</b> as part of list minerals are, ions / named ion; <b>A</b> sodium etc	<b>2</b>
(ii)	nucleic acids; DNA; RNA; ATP; sugar / named sugar; amino acids / named amino acid; steroids; AVP;; e.g. another named sugar, another named amino acid  <b>R</b> carbohydrates, enzymes, phospholipids, fatty acids, proteins, glycogen	<b>2 max</b>
(iii)	no significant increase in the amount of cellulose;  <b>R</b> refs to proteins	<b>1</b>
(iv)	lipids; mass / amount, decreases / from 33 to 15 g;	<b>2</b>

<b>Mark Scheme</b> Page 7 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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- (c)
- 1 ref. anabolism / protein synthesis / making a macromolecule / catabolism / breakdown in respiration;
  - 2 named process in photosynthesis catalysed by enzyme(s);  
    **A** light independent stage / Calvin cycle / named stage   **R** 'dark reaction'
  - 3 named enzyme involved in photosynthesis; e.g. rubisco
  - 4 enzymes for, synthesis / storage, of, starch / glycogen;
  - 5 ref. to lipid storage / triglyceride synthesis;
  - 6 enzymes of glycolysis;
  - 7 further detail; e.g. in cytosol / cytoplasm / stage of glycolysis (named or described)
  - 8 link reaction;   **R** refs to co-enzyme A as an enzyme
  - 9 further detail;
  - 10 Krebs cycle;
  - 11 further detail;
  - 12 ATP synthetase / action described;   **A** synthase / ATP-ase
  - 13 ref. to oxidases / reductases;
  - 14 ref. to carboxylases;
  - 15 ref. to decarboxylases;
  - 16 ref. to dehydrogenases;
  - 17 ref. to proteases;   **R** if in gut / extracellular
  - 18 nucleases / DNAase / RNAase, to break down appropriate nucleic acid;
  - 19 any detail of assembly of polynucleotides;
  - 20 transcription; e.g. ref to RNA polymerase
  - 21 DNA replication; e.g. ref to DNA polymerase
  - 22 further detail, of replication / transcription; e.g. another enzyme
  - 23 ref. to lysosomes / lysosomal enzymes;
  - 24 ref. to phagocytosis / phagocytes;
  - 25 amylase / phosphorylase, to break down, starch / glycogen;
  - 26 food reserves broken down in germination;
  - 27 membrane-bound enzyme(s); e.g. in mitochondrion
  - 28 explanation / example;
  - 29 ref. to catalase breaks down hydrogen peroxide / detoxification;
  - 30 AVP;   e.g. hydrolysis in correct context
  - 31 AVP;

*13 to 17 - named type of enzyme + function must be given in appropriate contexts*

**7 max**

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

**1**

**[Total: 18]**

Mark Scheme Page 8 of 9	Unit Code <b>2806/01</b>	Session January	Year 2004	Version Final
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Question	Expected Answers	Marks
4 (a)	cholesterol deposited / plaque / atheroma; <b>A</b> LDLs endothelium / lining, lost / rougher / damaged by blood pressure; increase in smooth muscle (in tunica media); narrow lumen / described; <b>R</b> constriction / narrow artery loss of elasticity / less elastic fibres / scar tissue; <b>A</b> hardening / Ca deposits	3 max
(b)	the protein in the diet (also has energy);	1
(c)	eliminates variable / controls variable / ensures all the animals were similar; male (humans) have a higher incidence of, CHD / atherosclerosis;	1 max
(d)	<i>candidates must state that they are supporting or refuting the hypotheses or think that further investigation is needed</i> <i>the two AVPs are available for any of the subsections to a maximum of 2 for (d) as a whole</i>  results for animals not always similar to humans; <i>credit this idea <u>once</u></i>	
(i)	all diets contained carbohydrate / no diet was low in carbohydrate; the switch in diet to carbohydrate rich ( <b>C</b> to <b>A</b> ) and corn oil rich ( <b>C</b> to <b>B</b> ) gave similar results; <b>B</b> and <b>C</b> have, similar carbohydrate; diet <b>C</b> had low(est) carbohydrate, smallest cross sectional area; figures in support (cross-sectional areas) used comparatively;	
(ii)	monkeys that changed diet had arteries with larger lumen than those remaining on diet <b>C</b> ; groups that had changed diet still showed reduced lumen; figures in support used comparatively;	
(iii)	link between high cholesterol in the diet and reduced cross-sectional area; correlation does not prove cause and effect; diet <b>C</b> has other fats besides cholesterol; no group had diet <b>B</b> throughout; egg yolk diet may have contained other substances; reference to saturated fatty acids; diet <b>C</b> associated with high blood cholesterol;	
	AVP; e.g. use of blood cholesterol figures in (i), (ii) and (iii), AVP; ref. to other factors, e.g. genetic	7 max
	<b>[Total: 12]</b>	

<b>Mark Scheme</b> Page 9 of 9	<b>Unit Code</b> <b>2806/01</b>	<b>Session</b> January	<b>Year</b> 2004	<b>Version</b> Final
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Question	Expected Answers	Marks
5 (a) (i)	<p><i>note - one of these marking points gets two marks</i></p> <p>no evidence of carriers passing it on; is passed down without skipping generation; example; 7 / 8 inherit from 2           9 / 10 from 4           14 / 15 / 18 from 8 and 9 16 / 17, unaffected but their parents (8 and 9) both have achondroplasia;; ora <i>accept 'When both parents are affected, unaffected offspring can result' for two marks</i></p> <p>(so the allele for normal height must be recessive / ora)</p>	<b>2 max</b>
(ii)	sex linked genes cannot pass from father to son; (are on the X chromosome) 4 passes achondroplasia to his, son(s) / offspring / 9 and/or 10;	<b>2 max</b>
(b)	<p>genotypes of the parents - both Aa, gamete genotypes - A and a, possible genotypes of children - AA Aa aa; possible phenotypes of children - with achondroplasia or unaffected;</p> <p><i>one mark deducted for each error or omission</i></p>	<b>2</b>
(c)	<p>ref. to mutation; shows in the phenotype (immediately) as it is dominant; as mutation is a rare chance event the siblings or other family are very unlikely to be affected; (the mutant individual is Aa) half the gametes will be A and half a;</p>	<b>2 max</b>
(d)	<p>achondroplasia is caused by, genes / genotype / mutation; <b>A</b> it is a genetic disease; not a <u>deficiency</u> disease; <b>A</b> correct ref to diet only limbs are affected so, calcium, metabolism / nutrition, must be normal; AVP;</p>	<b>2 max</b>
<b>[Total:</b>		<b>10]</b>