



RECOGNISING ACHIEVEMENT

JANUARY 2003

ADVANCED GCE UNIT

# MARK SCHEME

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**MAXIMUM MARK: 60**

**Syllabus / Component: 2806/01**

**Unifying Concepts in Biology**

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Paper Set Date: 28/01/03

## 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<br>; = separates marking points<br>NOT = answers which are not worthy of credit<br>( ) = words which are not essential to gain credit<br><u>      </u> = (underlining) key words which <b>must</b> be used to gain credit<br>ecf = error carried forward<br>A = accept<br>R = reject<br>AW = alternative wording<br>ora = or reverse argument |
|---|---|

| Question  | Expected Answers   | Marks        |
|-----------|--|--------------|
| 1 (a) (i) | controls;<br>so that the position of the other samples could be easily compared;<br>both samples should move the same distance through the gel / further detail;   | <b>2 max</b> |
|           | (ii) <i>four correct for two marks, three correct for one mark</i><br><br>2 = A & S, 4 = A & C,<br>6 = A (only), 7 = C & S;;<br><br><b>R</b> ref. to anaemia or disease  | <b>2</b>     |
| (b) (i)   | changes in, gene / allele, frequency;<br>allele / gene, more likely to be passed on;<br>produced because one genotype is more likely to survive than another;<br>A fitter<br>one genotype produces more surviving offspring; |              |
|           | <b>R</b> ref. to passing on characteristics or phenotypes  | <b>2 max</b> |
| (ii)      | new sequence in a small population;<br>which increased;<br>ref to founder effect / explained;<br>linkage of the new sequence to a different, advantageous gene;<br>AVP;  | <b>2 max</b> |

- (c) (i) a triplet / group of three bases;  
stands for / represents one amino acid; **1**
- (ii) shows, uracil / U *or* does not show, thymine / T;  
mRNA codes for amino acids in proteins / peptides (while DNA replicates / is the  
genetic material); **2**
- (iii) Hb S from A to U / from GAG to GUG / from GAA to GUA;  
Hb C from G to A / from GAG to AAG / from GAA to AAA; **2**
- (d) different, side chains / R groups;  
fold differently;  
different, tertiary structure / quaternary structure / (3D) shape;  
may have different charge;  
less soluble;  
ref. to change in behaviour at low  $pO_2$  (e.g. haemoglobin crystallises);  
**R** ref. to changes haemoglobin carrying capacity **2 max**
- [Total: **15**]

| Question | Expected Answers  | Marks       |
|----------|---|-------------|
| 2 (a)    | qualified ref. to fair test / only one variable must be changed;<br>rate of reactions changes with temperature;<br>ref. to enzymes; e.g. denaturing at high temperatures or being more active with moderate temperature rise;<br>photosynthesis influenced by temperature;<br>gases / oxygen (in the leaf air spaces) expands as temperature increases;                     | 2 max       |
| (b) (i)  | discs quicker to float when the distance from tube to lamp is smaller;<br>discs float because oxygen is being produced;<br>as a result of photosynthesis;<br>effect is non linear;<br>ref to inverse square relationship;<br>higher light <u>intensity</u> when lamp close to tube;<br>data quote that illustrates one of the above points;<br>AVP;                         | 4 max       |
| (ii)     | each disc will be slightly different / ref to any variation in the discs;<br>further detail of variation between the discs;<br>discs may shade each other;<br>prevents bias caused by any disc that sticks / other valid reason for delay in floating;  | 2 max       |
| (c)      | no / little, gas / carbon dioxide / oxygen, dissolved in the water;<br>lack of carbon dioxide limits photosynthesis;<br>oxygen produced dissolves in the water rather than forming bubbles;   | 2 max       |
| (d)      | light (energy) is in excess when the distance is small;<br>light not a limiting factor / cells are light saturated;<br><i>in context</i> CO <sub>2</sub> concentration or temperature is limiting at high light intensity;<br>enzyme action is slower at, lower temperature / 5 °C;<br>ref to Q <sub>10</sub> ;<br>data quote used comparatively, from both tables.<br>AVP; |             |
|          | <b>A reverse arguments</b>  | 2 max       |
|          |   | [Total: 12] |

| Question | Expected Answers   | Marks              |
|----------|--|--------------------|
| 3 (a)    | <p><i>advantages of method A</i><br/>           simple; <b>R</b> quick<br/>           balances can weigh to high level of accuracy;<br/>           measures, water loss / transpiration, only;</p> <p><i>disadvantages of method A</i><br/>           change in mass over short time very small;</p> <p><i>advantages of method B</i><br/>           cheap apparatus;<br/>           measures short term changes in water movement easily;<br/>           sensitive (implied);</p> <p><i>disadvantages of method B</i><br/>           air leakage / air bubble blocks system;<br/>           stem easily damaged / squashed / xylem blocked;<br/>           measures water uptake, so rate of transpiration must be assumed to be same;</p> <p>AVP;</p>  | 4 max              |
| (b)      | <p>1 water acts as solvent / ref. to solutions;<br/>           2 for ions / nutrients, in the soil;<br/>           3 water absorbed by osmosis;<br/>           4 for (enzyme) controlled reactions requiring water / hydrolysis;<br/>           5 water moves in xylem / transpiration;<br/>           6 ref to cohesion / adhesion;<br/>           7 ions move with water in xylem;<br/>           8 sugars / organic materials / assimilates, moved in phloem;<br/>           9 cells absorb water to, expand / enlarge; <b>A</b> grow;<br/>           10 vacuolation;<br/>           11 ref to water potential (gradients);<br/>           12 turgor provides support;<br/>           13 ref. to water entering guard cells / turgor opening stomata;<br/>           14 needed for photosynthesis;<br/>           15 ref to photolysis / splitting into oxygen and hydrogen;<br/>           16 further detail; e.g. H<sup>+</sup> and electron<br/>           17 lack of water often limits, growth / photosynthesis;<br/>           18 because stomata shut to conserve water;<br/>           19 AVP;<br/>           20 AVP;</p> | 6 max              |
|          | <b>QWC - clear, well organised using specialist terms</b>  | 1                  |
|          |  | <b>[Total: 11]</b> |

| Question       | Expected Answers   | Marks      |
|----------------|--|------------|
| 4 (a)          | (pressure) filtration / description of filtration;<br>through the, walls / membranes, of (glomerular) capillaries;<br>other detail;  | 2 max      |
| (b) (i)        | hydrolysis;  | 1          |
| (b) (ii)       | an input brings about a response that reduces this input / AW;<br>cells, act as receptors / detect a change in blood pressure;<br>a fall in blood pressure results in the production of, a hormone / angiotensin II;<br>which tends to restore blood pressure to the, previous / resting level / set point;<br>fluctuating, within limits / around a set point;<br><br><i>R statements that imply a one-directional change, or the 'body trying'</i>         | 3 max      |
| (c) (i)        | impulses from nerves;<br>muscle in the walls of the vessels contracts;<br>reducing size of lumen;<br>ref. to <u>smooth</u> muscle;   | 2 max      |
| (c) (ii)       | increase the contraction / excitation of (smooth) muscle cells;<br>ref. to change in membrane permeability / receptors (on muscle cells);<br>AVP;  | 1          |
| (d)            | by vasodilation / increasing size of lumen / widening to allow more blood;<br><br>inhibit the cells surrounding the afferent arterioles;<br>so preventing / reducing, the amount of renin produced;<br><br>inhibiting renin / angiotensin converting enzyme;<br>so preventing / reducing, the production of angiotensin II;<br><br>blocking the receptors for angiotensin II;<br>so preventing the stimulus to the, blood vessels / arterioles;<br><br>AVP;; | 2 max      |
| <b>[Total:</b> |  | <b>11]</b> |

| Question | Expected Answers   | Marks |
|----------|--|-------|
| 5 (a)    | <p><i>reject leaves rather than leaflets but allow an error carried forward</i></p> <p>More leaflets / points / teeth / parts / lobes in <i>acris</i>; <b>R</b> more leaves major lobes / leaflets, stalked in <i>repens</i>, not in <i>acris</i>;<br/>lobes / leaflets, are much more deeply divided in <i>acris</i>;<br/>many, small teeth / indentations, in margin of <i>repens</i>, fewer / larger, in <i>acris</i>;<br/>AVP;</p> | 2 max |
| (b)      | <p>competition;<br/>for resources / a named resource;<br/>niche exclusion / described or explained;<br/>further detail / example;</p> <p>the phrase - <u>competitive exclusion</u>; (as alternative to first and third points)</p>   | 2 max |
| (c)      | <p>amount / mass / volume, of soil per container;<br/>same soil type;<br/>size / type / volume, of containers;<br/>positions of containers;<br/>volume of water given;<br/>frequency of watering;<br/>light intensity (<i>accept amount or duration</i>);<br/>temperature;<br/>AVP;;;</p>  | 3 max |
| (d) (i)  | <p><i>R. acris</i> – 22;<br/><i>R. repens</i> – 0;</p>   | 2     |
| (ii)     | <p>(no evidence for competition from the table)<br/>because the survival rate / germination for each species depends on soil condition rather than the presence of the other species;<br/>data quote;<br/>calculation of, percentage / proportion of seeds, germinating;</p>   | 2 max |
|          | [Total:  | 11]   |