



RECOGNISING ACHIEVEMENT

JUNE 2002

ADVANCED GCE UNIT
MARKING SCHEME

MAXIMUM MARK: 60

Syllabus / Component: 2806/01

**Science: Unifying Concepts in
Biology**

Paper Set Date: 17/06/02

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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|---|---|
| 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 _____ = (underlining) key words which must be used to gain credit ecf = error carried forward A = accept AW = alternative wording ora = or reverse argument |
|---|---|

| Question | Expected Answers | Marks |
|-----------|--|-------|
| 1 (a) (i) | 20 <u>cm</u> ; A 19 to 21 | 1 |
| (ii) | <i>credit negative correlation once in (ii) or (iii)</i> greater range at lower altitude / ORA; negative correlation; reference to figures to make a comparison; | 2 max |
| (iii) | greater the altitude the lower the mean height / ORA; negative correlation; reference to figures to make a comparison; | 2 max |
| (iv) | t test / Student's t test; standard deviation, qualified; AVP; (e.g. Mann Whitney U, standard error, Z test; Willcoxon's matched pairs) | 1 max |
| (b) (i) | the plants measured were grown under uniform conditions; the locations are separated (idea of geographic isolation); ref. to allopatric speciation; there are different selection pressures / adaptations needed; | 1 max |
| (ii) | small plants not easily damaged by wind / AW; reference to lower transpiration rates; reference to thinner soil on mountain top; reference to, short growing season / cold; AVP; | 1 max |

- (c)
1. succulence / described; (*e.g. ref. to bulbs*) **R** water stored, unqualified
 2. ref. to xerophytes / xeromorphic;
 3. small / reduced surface area (of above ground parts);
 4. thick / waxy cuticles;
 5. small leaves / needles;
 6. absence of leaves;
 7. leaves lost when dry / AW;
 8. ref. to thorns / spines / bitter taste / toxic to herbivores;
 9. hairy leaves;
 10. leaves curl up;
 11. rosette / short (qualified);
 12. small internal air spaces;
 13. hypodermis / thick (walled) epidermis / AW;
 14. fewer stomata;
 15. sunken stomata;
 16. stomata open at night;
 17. CAM photosynthesis / carbon fixation at night / described;
 18. deep roots;
 19. (shallow) roots extend over wide area;
 20. cells have (very) low water, potential / solute potential; **(A)** high solute concentration
 21. secrete salt;
 22. rapid germination / growth after rainfall / ORA;
 23. heavy rain breaks dormancy;
 24. toxic products inhibit neighbouring plants / allelopathy;
 25. AVP; (*e.g. for explanation / other adaptation*)
 26. AVP; (*e.g. for explanation / other adaptation*)
- QWC – legible text with accurate spelling, punctuation and grammar**

8 max
1

[Total: 17]

| Question | Expected Answers | Marks |
|-----------|--|-------------|
| 2 (a) (i) | <p><i>if only phases named take first three</i></p> <p>increases exponentially / geometric increase / logarithmic increase / log phase; doubling time 24 minutes; for the first 2.5 to 3 hours; increase slows / environmental resistance phase / deceleration phase; between 3 and 4.5 hours; becomes stationary / stationary phase / plateau; after 4.5 hours; sigmoid / S-shaped curve;</p> | 3 max |
| (ii) | <p>(takes time for) lactose to be absorbed / metabolised / respired / digested / hydrolysed / converted to glucose; cells must synthesise enzymes / transport proteins; lac operon; further detail of lac operon;</p> | 2 max |
| (b) | <p>1. <u>density dependent</u> / <u>limiting factors</u>; 2. carrying capacity;</p> <p><i>one mark for each factor described + one mark for further detail or an explanation of how it may stabilise population</i></p> <p>3. nutrient ions in soil; 4. e.g. become used up as plant populations increase;</p> <p>5. food / prey (of animals); 6. e.g. becomes more difficult to get as populations increase;</p> <p>7. competition / overcrowding; 8. e.g. increases at high densities;</p> <p>9. predators; 10. e.g. are able to catch / are attracted to higher density prey populations;</p> <p>11. parasites / disease; 12. e.g. spread between individuals more easily at high densities; 13. e.g. immunity of stressed individuals weakened at high population density;</p> <p>14 & 15 AVP;; (e.g. further examples of density dependent variables / ref. to density independent factors as not stabilising (e.g. <i>climate, fire, flood, other example</i>))</p> <p><i>specific examples may be accepted instead of concepts listed</i></p> | 7 max |
| | | [Total: 12] |

| Question | Expected Answers | Marks |
|----------|---|-------------|
| 3 (a) | <u>small</u> intestine / ileum / jejunum / kidney / placenta / liver; R refs to tissues | 1 |
| (b) | both (greatly) increase the surface area; for absorption / uptake of, ions / named ion / water / nutrients; R organic compounds ref. to mechanism of absorption; both short lived; | 2 max |
| (c) | <i>Award mark if comparison is implied</i> <i>root hairs</i> (cellulose) cell walls; vacuoles; certain organelles / nucleus / correct named organelle; R chloroplast are in direct contact with the environment / external; <i>microvilli</i> several / many microvilli per cell; cannot be resolved / seen with optical microscope / ref. to size difference; | 2 max |
| (d) (i) | to prevent the evaporation of water (from the water surface); | 1 |
| (ii) | <i>two of the following for one mark</i> light, qualified / temperature / air movements / spacing of the tubes / volume of water / humidity / CO ₂ concentration; R heat / pH | 1 max |
| (e) | water loss by <u>evaporation</u> / <u>transpiration</u> (from leaves); through stomata; idea that vaseline blocks stomata; more stomata on lower surface / few on upper surface; cutting stems under water removes resistance of roots; continuous column of water / no air / AW; ref. to figures to make a comparison; (allow valid quotes or ref. to possible lack of significant difference between some results) ref. to use of control value; AVP; R ref. to osmotic uptake of water | 5 max |
| | | [Total: 12] |

| Question | Expected Answers | Marks |
|-----------|---|-------------|
| 4 (a) (i) | 47 / 46.5 / 46; | 1 |
| (ii) | statement is incorrect; pigs / chicken, below 50%; animal mean below 50%; cocoa / coconut high in saturated fatty acids; the mean saturated fatty acid content of the animals is higher than that of the plants; by 11% / 10.5% / 10%; small sample of data / great variation in both groups; all the animals are land vertebrates / homiotherms; A warm blooded no fish / invertebrates / not representative of animals; triglycerides have a mixture of fatty acids; the animals have similar / slightly more monounsaturates than the plants; plants have more polyunsaturates than the animals; AVP; (<i>e.g. butter not a store</i>) | 3 max |
| (iii) | rape has highest proportion of, linolenic acid / essential fatty acid; any function of an essential fatty acid; has half as much / less, saturated fatty acid as olive oil; has more polyunsaturates than olive oil; polyunsaturates lower cholesterol / polyunsaturates raise high density lipoprotein levels / polyunsaturates lower low density lipoprotein levels / ORA; ref. to heart disease / atheroma; | 3 max |
| (b) | glycerol; A glycerine | 1 |
| (c) | must be present in the diet; cannot be synthesised in the body; | 2 |
| | | [Total: 10] |

| Question | Expected Answers | Marks |
|-----------|--|------------|
| 5 (a) (i) | F, mitochondrion; accept mitochondria B, chloroplast; R thylakoids / grana | 2 |
| (ii) | has a nucleus / nucleolus / chromatin / nuclear membrane; has membrane bound organelles; has mitochondria / chloroplasts / vacuole; has starch grains; | 2 max |
| (b) | ATP synthesised in both; ATP synth(et)ase; R ATPase both take place on / across membranes; (series of) electron carriers / cytochromes involved in both; electrons flow in both; movement of hydrogen ions across membrane in both; A protons photophosphorylation in grana / chloroplasts / thylakoids and oxidative phosphorylation in mitochondria / cristae; photophosphorylation needs light (energy), oxidative phosphorylation needs chemical energy / reduced coenzymes; A glucose / other substrates; oxygen is final electron acceptor in oxidative phosphorylation; photophosphorylation can be cyclic; | 5 max |
| | | [Total: 9] |