

MARKSCHEME

May 2004

BIOLOGY

Standard Level

Paper 2

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General Marking Instructions

After marking a sufficient number of scripts to become familiar with the markscheme and candidates' responses to all or the majority of questions, Assistant Examiners (AEs) will be contacted by their Team Leader (TL) by e-mail or telephone. The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. It may be necessary to review your initial marking after contacting your TL.

DO NOT BEGIN THE FINAL MARKING OF YOUR SCRIPTS IN RED INK UNTIL YOU RECEIVE NOTIFICATION THAT THE MARKSCHEME IS FINALIZED. *You will be informed by e-mail, fax or post of modifications to the markscheme and should receive these about one week after the date of the examination. If you have not received them within 10 days you should contact your Team Leader by telephone. Make an allowance for any difference in time zone before calling.*

AEs WHO DO NOT COMPLY WITH THESE INSTRUCTIONS MAY NOT BE INVITED TO MARK IN FUTURE SESSIONS.

You should contact the TL whose name appears on your “Allocation of Schools listing” sheet.

Note:

Please use a personal courier service when sending sample materials to TLs unless postal services can be guaranteed. Record the costs on your examiner claim form.

1. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED**.
2. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.
3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.
4. Unexplained symbols or personal codes/notations on their own are unacceptable.
5. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer (next to the mark allocation for Section A). Do **not** circle subtotals. **Circle the total mark for the question in the right-hand margin opposite the last line of the answer.**
6. For Section B, show a mark for each part question (a), (b), *etc.*
7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin.
8. Section A: Add together the total for each question and write in the Examiner column on the cover sheet.
Section B: Insert the total for each question in the Examiner column on the cover sheet.
Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.
9. After entering the marks on the cover sheet, check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **We have script checking and a note of all clerical errors may be given in feedback to examiners.**
10. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.
11. If a candidate has attempted more than the required number of questions, mark only the required number in the order in which they are presented in the paper, **unless the candidate has indicated on the cover sheet the questions to be marked.**
12. A candidate can be penalized if he/she clearly contradicts him/herself within an answer. Make a comment to this effect in the left hand margin.

Subject Details: **Biology SL Paper 2 Markscheme**

Mark Allocation

Candidates are required to answer **ALL** questions in Section A total **[30 marks]** and **ONE** question in Section B **[20 marks]**. Maximum total = **[50 marks]**.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- ◆ Each marking point has a separate line and the end is signified by means of a semicolon (;).
- ◆ An alternative answer or wording is indicated in the markscheme by a “/”; either wording can be accepted.
- ◆ Words in (...) in the markscheme are not necessary to gain the mark.
- ◆ The order of points does not have to be as written (unless stated otherwise).
- ◆ If the candidate’s answer has the same “meaning” or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- ◆ Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- ◆ Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- ◆ Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with “**ECF**”, error carried forward.
- ◆ Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by “**U-1**” at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- ◆ Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Section B

Extended response questions - quality of construction

- ◆ Extended response questions for SL P2 carry a mark total of 20. Of these marks, **[18 marks]** are awarded for content and **[2 marks]** for the quality of construction of the answer.
- ◆ Two aspects are considered:
expression of **relevant** ideas with clarity
structure of the answers.
- ◆ **ONE** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **TWO** quality marks are awarded when a candidate satisfies **BOTH** criteria.

Clarity of expression:

The candidate has made a serious and full attempt to answer all parts of the question and the answers are expressed clearly enough to be understood with little or no re-reading.

Structure of answer:

The candidate has linked relevant ideas to form a logical sequence in at least two parts [(a), (b), etc.] of the question.

- ◆ It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.
- ◆ Candidates that score very highly on the content marks need not necessarily automatically gain the two points for the quality of construction (and vice versa).
- ◆ The important point is to be consistent in the awarding of the quality points. For **sample scripts for moderation** the reason why quality marks have been awarded should be stated.
- ◆ Indicate the award of quality marks by writing **Q2, Q1** or **Q0** in **red** at the end of the answer.

SECTION A

1. (a) (i) 1990 [1]
(ii) 1970 [1]
- (b) (i) the higher the temperature the earlier the date of leaf opening [1]
(ii) there is evidence of warming;
at the end of the twentieth century most years are warmer than the mean;
all but one of the last (12) years are warmer than the mean;
6 colder than mean years in the first 15 years and only 2 in the second 15 years; [2 max]
- (c) (i) date of egg laying is (always) earlier than the date of maximum caterpillar biomass / date of maximum caterpillar biomass is (always) later than the date of egg laying [1]
(ii) many caterpillars available to feed the young when they have hatched [1]
- (d) date of maximum caterpillar biomass has got earlier/reduced/decreased; [1]
- (e) birds that lay eggs earlier find more caterpillars / their young are better fed;
offspring of early egg layers have a better chance of survival;
these birds inherit the early egg laying characteristic / others eliminated; [2 max]
2. (a) translates RNA into/synthesises polypeptides/proteins;
lysosomes;
mitochondria;
aerobic respiration / production of ATP;
Do not accept production of energy. [4]
- (b) eukaryotic;
membrane bound organelles/nucleus (as reason for being a eukaryote)
could be plant or animal;
probably animal because of the lysosomes; [2 max]

3. (a) oxygen;
hydrogen / reduced NADP (NADPH) / H^+ / protons;
ATP; *[2 max]*
- (b) measure oxygen production over a fixed period of time/rate;
collect bubbles of oxygen (from water plant);
or
measure carbon dioxide uptake over a fixed period of time/rate;
measure (colour) change of pH indicator / other method over a fixed period of
time/rate;
or
measure increase in biomass/height/leaf size etc over a fixed period of time/rate;
harvest replicate samples at time intervals for biomass determination; *[2 max]*
- (c) straight line increase;
followed by a plateau at high light intensities; *[2]*
- (d) temperature;
carbon dioxide concentration;
water / humidity; *[2]*
4. (a) (i) III *[1]*
- (ii) IV *[1]*
- (iii) I *[1]*
- (b) II and III have the most similarities;
both have ring shaped molecules;
both have one oxygen atom in the ring;
both have the same relative amounts of C, H and O;
both have only –OH and –H linked to the carbon atoms;
both are monosaccharides / sugars / reducing sugars;
I and IV both have a carboxyl / COOH / acid group;
I and IV both are linear; *[3 max]*

SECTION B

5. (a) one codon in the DNA is altered;
mRNA with one altered base / codon;
GAG → GUG in mRNA / CTC → CAC in DNA / GAG → GTG in DNA;
different tRNA binds to this codon;
different amino acid inserted into the polypeptide;
glutamic acid → valine;
structure of the polypeptide / protein is altered;
active site of an enzyme may not function;
altered hemoglobin may cause red cells to become sickle shaped;
single proteins can have vital roles within the body;
details of symptoms of sickle cell anemia;

[6 max]

- (b) *Arguments against [2 max].*
diagnosis is of little use if no treatment is available;
does not show how serious the effect of a gene will be as this varies between individuals;
diagnosis in fetuses may encourage more abortions;
might make parents only accept a “perfect” fetus;
may cause depression in individuals who find out that they have a harmful gene;
difficulties in obtaining jobs / insurance / partners;

Arguments for [2 max].

- allows treatment of some genetic diseases before harmful effects develop;
harmful genes could be found and eliminated / replaced to eliminate a genetic disease;
suffering of an individual who would have had a genetic disease is prevented;
parents with the same harmful recessive mutation can choose other partners / not reproduce;
screened embryos can be discarded/aborted;

[4 max]

- (c) cystic fibrosis / SCID / other named example of gene therapy;
details of a symptom of the condition;
normal form of gene must be inserted into affected cells;

e.g. SCID caused by lack of normal gene for ADA;
genetic screening before birth to test for SCID;
stem cells removed from umbilical cord / bone marrow;
(ADA) gene inserted into a retrovirus / adenovirus;
virus inserts the gene into the stem cells;
virus inserts gene into chromosome;
recombinant stem cells injected into blood system;
ADA synthesized successfully in these cells;

e.g. cystic fibrosis caused by lack of normal gene for a chloride channel;
test for cystic fibrosis using DNA from a mouthwash;
gene for chloride channel / CFTP gene inserted into plasmid;
recombinant plasmid cloned in bacteria;
(recombinant) plasmids inserted into liposomes;
liposomes sprayed through nose into lungs;
liposomes fuse with lung cells;
normal allele expressed in lung cells;
relief of symptoms temporary;

[8 max]

(Plus up to [2] for quality)

6. (a) both have pubic hair;
both have axillary / underarm hair;
both produce gametes;
men have more body hair;
male larynx enlarges/voice deepens, female does not;
men have facial hair women do not;
men are more muscular;
women have more subcutaneous fat;
women have larger breast / mammary glands;
women have wider hips; **[4 max]**
- (b) *Award [1] for each of the following structures, clearly labelled and drawn in the correct position relative to the other organs, up to [6 max].*
ovary;
oviduct / fallopian tube;
uterus;
cervix;
vagina;
vulva/labia;
clitoris;
endometrium; **[6 max]**
- (c) FSH stimulates the development of follicles;
FSH stimulates estrogen secretion (by the developing follicle);
estrogen stimulates the repair of the uterus lining;
estrogen stimulates LH secretion;
LH causes ovulation;
LH causes the development of the corpus luteum;
LH causes secretion of progesterone;
progesterone causes thickening of the uterus lining/prepares uterine lining for implantation;
progesterone / estrogen inhibits the secretion of LH / FSH;
falling progesterone levels at the end of the cycle allow FSH production/menstruation;
feedback control; **[8 max]**

(Plus up to [2] for quality)

7. (a) light is the initial source of energy for almost all communities;
plants absorb light and use it in photosynthesis;
plants produce food / organic matter;
plants are the main producers in most communities;
energy flows along food chains / webs from plants;
first consumers eat plants / producers;
second consumers eat first consumers that have eaten plants / producers;
plants produce oxygen;
oxygen needed for cell respiration by many organisms;
dead plants / parts of plants available to saprotrophs / fungi and bacteria / detritivores;
plants provide a habitat for other organisms / epiphytes; **[6 max]**
- (b) use quadrats;
position them randomly;
count the number of individuals of the plant (species) in each quadrat;
as many quadrats as possible;
total (density) = $\frac{\text{mean number per quadrat} \times \text{total area}}{\text{area of quadrat}}$; **[4 max]**
- (c) natality / births / reproduction increases populations;
as long as natality is higher than mortality;
abundant food allows increase / food shortage causes decrease;
low level of predation allows increase / high level causes decrease;
low level of disease allows increase / high level causes decrease;
immigration increases populations;
as long as immigration is greater than emigration;
population rise until a plateau is reached;
carrying capacity of the environment;
when the resources of the environment cannot support any more individuals;
graph of sigmoid population growth;
environmental factor and its consequence (*e.g.* flood causes decrease); **[8 max]**

(Plus up to [2] for quality)
