IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

MARKSCHEME

May 2007

BIOLOGY

Standard Level

Paper 2

11 pages

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.
- Words that are <u>underlined</u> are essential for 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 markscheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalizing 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]*** are awarded for content and ***[2]*** for the quality of construction of the answer.

- Two aspects are considered:
  expression of relevant ideas with clarity
  structure of the answers.

- ***[1]*** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus ***[2]*** 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 **within** at least two parts of the **same question** (e.g. within part a and within part b, or within part a and within part c etc. but **not between** part a and part b or between part a and part c etc.).*

- 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 ***[2]*** marks 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) falls (initially);
rises to a peak (at 1992);
then falls (to its lowest level); ***[2 max]***

(b) diet / environment / fights / mechanical damage / age ***[1]***

(c) six years *(units required)* ***[1]***

(d) (i) the larger the horn length (index) the lower the longevity / *vice versa* / inverse proportion / negative correlation ***[1]***

(ii) males with large horns are killed by hunters;
males with large horns are killed in fights;
horns more likely to be broken with age; ***[1 max]***

(e) males with short horns survive longer / *vice versa*;
few males with big horns survive beyond six years / to breed;
males with shorter horns have more offspring / *vice versa*;
genes/traits for short horns are passed on to offspring / *vice versa*;
killing (including by hunting) of large horn males causes (natural) selection; ***[3 max]***

(f) reduce hunting / stop selling hunting licences;
allow hunting of small horned sheep only;
alter values in regard to hunting; ***[1 max]***

2. (a) nervous;
endocrine; ***[2]***

(b) removal of waste from the body;
products of metabolism / toxic waste products; ***[2]***

(c) salts/sodium ions / chloride ions;
nitrogenous wastes/urea/ammonia/uric acid/creatinine;
hormones / drugs; ***[2 max]***
Do not award credit for water, glucose and sugar.

(d) kidneys maintain water balance / amount of water that the body needs to remove varies from day to day;
reason for water variation *e.g.* exercise, temperature, humidity;
amount of water/fluid drunk / present in body may vary;
amount of water lost in sweat / breathing may vary;
amount of salt eaten / present in body may vary;
intake of alcohol / other named diuretic; ***[3 max]***

3. (a) (i) photosynthesis / carbon fixation / Calvin cycle / light-independent reaction ***[1]***

(ii) (cell) respiration ***[1]***

(b) (i) only arrows <u>from</u> both pond weeds and algae box <u>and from</u> primary consumers box pointing to saprotrophs box ***[1]***

(ii) saprotrophs break down/decompose / organic matter/organisms/ compounds;
release enzymes into organic matter;
release carbon dioxide; *(do not accept (elemental) carbon)*
produce carbon dioxide by (cell) respiration;
carbon dioxide can then be used by plants / autotrophs; ***[2 max]***

(c) arrow from primary consumer box to secondary consumer box;
only arrows <u>from</u> secondary consumer box to saprotrophs <u>and</u> to carbon dioxide; ***[2]***

(d) (i) burning/use of fossil fuels / example;
burning forests;
destruction of autotrophs that fix carbon dioxide / deforestation; ***[2 max]***
Do not accept "pollution" unqualified.

(ii) increased growth/photosynthesis by plants/pond weeds/algae/ autotrophs/producer / eutrophication;
carbon dioxide used in photosynthesis / photosynthesis provides raw materials for growth;
effect of lower pH of water on a named type of organism (*e.g.* some plants cannot grow in acidic water);
increased carbon dioxide concentration makes water more acidic;

For those candidates who have interpreted increase in carbon dioxide concentration to mean atmospheric carbon dioxide, include these marks:

increased atmospheric carbon dioxide leads to global warming;
global warming causes pond warming;
pond warming may promote growth of aquatic vegetation;
pond warming may kill intolerant plant/animal species; ***[2 max]***

SECTION B

4. (a) name of disease caused by the bacterium;
name of bacterium;
name of method of transmission / infection;
details of method of transmission;
effects on body and symptoms of disease;
effects on body and symptoms of disease; ***[6]***

e.g.
tuberculosis;
*M(ycobacterium) tuberculosis/*tubercule bacterium;
droplet infection;
infected person coughs out droplets containing bacteria that others breathe in;
tubercules / lumps in the lungs;
coughing of blood;
fever;
loss of weight/weakness;

e.g.
gonorrhoea*;*
N(eisseria) gonorrhoea;
sexual transmission;
during sexual intercourse genitals rub together passing bacteria from infected to uninfected person;
inflammation of penis;
inflammation of vagina;
discharge of pus / other symptom of gonorrhoea;

N.B.: *Examiners may want to check reliable resources to verify details of the candidates answer.*

(b) viruses;
fungi;
protozoa/protista;
flatworms;
roundworms; ***[4 max]***

(c) antigens are foreign substances/pathogens;
antigens stimulate antibody production;
organisms causing disease have antigens (on their surface);
antigen is recognized by antibody of (one type of) lymphocyte;
humans have many types of lymphocytes of which one type can recognize a particular antigen;
recognition of antigen activates lymphocytes;
activated lymphocyte divides many times;
clone of lymphocytes results;
lymphocytes produce/secrete antibodies;
antibodies are proteins;
proteins are synthesized by ribosomes / by the rough endoplasmic reticulum; ***[8 max]***
N.B.: *A correct sequence of idea should be recognized when awarding the quality mark for structure of the answer (linked ideas).*

*(Plus up to **[2]** for quality)*

5. (a) mitosis;
DNA replication;
each chromosome consists of two sister / identical chromatids;
chromosomes condense / supercoiling;
nuclear membrane breaks down;
chromosomes align (at equatorial plate);
spindle fibres / microtubules attach to centromeres of chromosomes on opposite sides;
centromeres split;
chromatids become chromosomes;
sister / identical chromosomes pulled to opposite poles;
nuclear membranes reform;
events correctly assigned to interphase, prophase, metaphase, anaphase, and telophase; ***[8 max]***

N.B.: *A correct sequence of idea should be recognized when awarding the quality mark for structure of the answer (linked ideas).*

(b) mortality/cell death;
emigration;
rate of death/mortality equal to or greater than cell division / reproduction;
predation / example of predator / macrophage;
disease;
competition for food / other resources;
food running out;
accumulation of waste products;
change in pH;
change in temperature;
antibiotics:
change in the growth medium;
lack of oxygen/carbon dioxide; ***[6 max]***

(c) more cells needed for growth;
repair / replacement;
cells specialize/differentiate for particular functions;
formation of reproductive cells (meiosis);
cells have to divide when they reach a certain size;
surface area to volume ratio becomes too small;
materials/oxygen/named material cannot be absorbed quickly enough;
rate of use of materials related to volume but rate of exchange related to SA; ***[4 max]***

*(Plus up to **[2]** for quality)*

6. (a) *Award **[1]** for each of the following clearly drawn and correctly labelled.*
labelled phosphate linked to labelled sugar by a single bond;
labelled base linked to a labelled sugar by a single bond;
correctly linked base, sugar and phosphate labelled as nucleotide;
covalent bond(s) labelled between sugar and phosphate/between sugar and base;
at least two nucleotides linked by a single sugar-phosphate bond;
at least two nucleotides linked by base-base bonds;
hydrogen bonds labelled between bases;
A-T and/or G-C base pairing;
phosphate and base shown linked to correct carbon atoms on sugar; ***[6 max]***

(b) gene/sequence of nucleotides that controls a (specific) characteristic/trait;
gene can be inherited;
gene mutation is change in a gene;
change of base sequence;
examples of gene mutation such as substitution; ***[4]***

(c) name of organism that was genetically modified;
source of the DNA / gene used to modify organism;
effect of the gene / characteristic coded for by the gene;

benefit/reason for wanting the recipient to be given this characteristic;
detail about benefit;
another benefit;
detail about another benefit;

possible harmful effect;
detail of possible harmful effect;
another possible harmful effect;
detail of another possible harmful effect;
reference to gene transfer between species being a natural process (with viral vectors);
uncertainty about long-term effect; ***[8 max]***

e.g.
wheat / maize / other crop plant;
Salmonella typhimurium;
resistance to glyphosate / roundup herbicide;
allows use of herbicide on growing crop;
higher yield due to less weed competition;
weeds that are very similar to the crop plants can be controlled;
gene for glyphosate resistance might be transmitted to weeds;
uncontrollable superweeds might be produced;
foreign DNA in the crop plant might cause allergies in humans;
fewer weeds for wildlife that feed on them;
N.B.: *Examiners may want to check reliable resources to verify details of candidates answer.*

*(Plus up to **[2]** for quality)*