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

MARKSCHEME

May 2007

BIOLOGY

Standard Level

Paper 2

12 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) pattern is periodic / bleaching tends to occur every 2 to 4 years;
bleaching alternates with recovery / peaks alternating with dips;
(with some exceptions) there is a trend toward increasing numbers of bleached areas / more frequent bleaching;
1996 to 1998 shows a greater increase overall; ***[2 max]***

(b) coral bleaching follows El Niño events / coincides with El Niño events;
coral bleaching appears (strongly) correlated with El Niño events / El Niño may be the cause of the bleaching;
other periodic events might be triggering the bleaching; ***[3 max]***

(c) prevents the corals from recovering from bleaching / greater number of reef areas affected / increased frequency of bleaching ***[1]***

(d) $29(\pm 1)\%$ *(no units required)* ***[1]***

(e) in both cases, removal increases bleaching;
little difference in percentage bleaching;
bleaching is more than doubled at Goold Island / less at Great Palm Island;
sample results are more variable for Great Palm Island (suggesting little difference); ***[2 max]***

(f) light (penetration) / light (levels);
(water) temperature;
pH/CO_2 concentration; ***[2 max]***

(g) *Award **[1]** for human impact and **[1]** for effect.*
increased CO_2/greenhouse gas emissions;
causes an increase in global sea temperatures / more El Niño events (therefore more coral bleaching);

thinning of/hole in the ozone layer;
leading to greater UV/light penetration (therefore more coral bleaching);

harvesting of *Sargassum* for commercial purposes;
leading to greater UV/light penetration (therefore more coral bleaching);

other appropriate human impact;
outline of how the impact might increase coral bleaching; ***[2 max]***

2. (a) light microscopes produce colour images;
light microscopes are portable;
light microscopes are cheaper;
light microscopes provide a larger field of view;
light microscopes involve easily prepared sample material;
movement observable in a light microscope;
material viewed using a light microscope is living; ***[2 max]***
*Award **[2 max]** for three correct answers and **[1 max]** for two or one correct answers.*

(b) all living things are composed of cells / cells are the simplest living components of organisms;
unicellular organisms carry out all the functions of life;
cells arise only from pre-existing cells;
unicellular organisms use cell division for reproduction;
some biologists consider unicellular organisms to be acellular; ***[3 ma***

(c) *image A*: anaphase;
image B: prophase;
image C: telophase;
image D: metaphase; ***[2 max]***
*Award **[2]** if all four are correct, **[1]** if three or two are correct and **[0]** if one or none are correct.*

3. (a) light penetration is required for photosynthesis;
plants/phytoplankton/photosynthetic organisms are the base of many aquatic food chains;
allows interacting organisms to find one another (*e.g.* predator-prey relationship, courtship);
allows interaction with the physical environment (*e.g.* finding shelter); ***[2 max]***

(b) (i) light / sunlight ***[1]***

(ii) the feeding level/position an organism occupies in a food chain ***[1]***

(iii) secondary consumer ***[1]***

(iv) *heterotroph*: immature game fish / trout / pike / shad / zooplankton;
autotroph: phytoplankton; ***[1 max]***
*Two correct answers needed for **[1]**.*

4. (a) to copy/amplify (small quantities of) DNA ***[1]***

(b) substrate of enzyme is (soluble) pectin;
pectin is broken down/hydrolysed into soluble sugars;
cellular components adhere/attach to pectin;
enzyme action clarifies/makes clear juice;
increases the yield of fruit juice production; ***[2 max]***

(c) *Award **[1]** for any two of the following.*
size/length / centromere position / banding pattern ***[1 max]***

SECTION B

Remember, up to TWO "quality of construction" marks per essay.

5. (a) *Award **[1]** for each of the following clearly drawn and correctly labelled.*
nucleotide sub-units;
composed of sugar-phosphate-base;
sugar is deoxyribose;
hydrogen bonds between bases;
A-T and C-G base pairing;
sugar-phosphate backbone;
covalent bonds between sugar and phosphate / between sugar and base;
helical structure appropriately drawn; *(label not required)*
double-stranded appropriately drawn; *(label not required)* ***[6 max]***

(b) transcription is the production of RNA;
DNA sequence determines mRNA sequence;
translation is the production of a polypeptide using mRNA;
which determines polypeptide sequence;
gene mutation is a change in the base sequence of a gene;
substitution is when a single base is changed into another base;
leads to a different mRNA sequence;
which may change the amino acid sequence in the polypeptide;
in sickle-cell anemia, glutamic acid/glu is replaced by valine/val / polar by non-polar amino acid;
which affects hemoglobin conformation/shape / function;
sickling occurs in low oxygen conditions/sickle cells carry less oxygen; ***[8 max]***

(c) *Direct comparisons must be made to achieve a mark.*
both are polymers of nucleotides / both are nucleic acids;
sugar is deoxyribose in DNA whereas ribose in RNA;
DNA is double stranded whereas RNA is single stranded;
DNA contains thymine whereas RNA contains uracil;
complementary base pairing involved in DNA <u>but not in</u> RNA;
both contain four nitrogenous bases; ***[4 max]***

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

6. (a) nutrients are recycled;
e.g. the carbon cycle;
some (atmospheric) carbon fixation through fossilization;
energy is a one-way flow/not recycled / depends on a constant supply of energy from the sun;
in cellular respiration, carbon/carbon dioxide is released to the atmosphere;
decomposers also release CO_2 from feeding on dead/organic matter;
process releases energy/heat/is exothermic;
in photosynthesis, carbon/carbon dioxide is fixed;
photosynthesis as a process stores energy / is endothermic;
light energy is converted to chemical energy;
energy is made available to food chain;
energy and carbon is passed through food chains;
only 10-20 % of energy is passed from one trophic level to the next;
remaining energy is released through cellular respiration; ***[8 max]***

(b) *Direct comparisons must be made to achieve a mark.*
anaerobic in the absence of oxygen whereas aerobic in the presence of oxygen;
both may produce CO_2;
both produce ATP;
aerobic releases considerably more ATP per glucose molecule than anaerobic;
anaerobic/fermentation in plants produces alcohol / anaerobic in animals produces lactic acid neither produced in aerobic respiration;
glucose can be the substrate for both;
glucose can be the substrate for both;
anaerobic entirely in cytoplasm whereas aerobic requires mitochondria/specialized region of membrane;
glucose is broken down into pyruvate in the cytoplasm in both; ***[5 max]***

(c) rate can be measured by the disappearance of raw materials / CO_2 (in solution);
rate of change of CO_2 can be measured (indirectly) by pH change;
rate can be measured by the appearance of products/ O_2 /starch;
rate can be measured by measuring rate of change of biomass;
description of apparatus to measure the rate of photosynthesis / annotated diagram;
explanation of expected experimental outcome: *e.g.* increased photosynthesis in an aquatic plant – more O_2 bubbles counted per unit time; ***[5 max]***

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

7. (a) rate of production of waste products/heat/ rate of demand for raw materials/ metabolism is a function of volume;
ability to exchange waste products / raw materials is a function of surface area;
with growth in size, surface area increases by the square whereas volume increases by the cube / volume increases at a greater rate than surface area;
with growth, surface area to volume ratio diminishes;
(growth of) cell size is a trigger for cell division;
cell membrane / villus / alveolus transport function depends (in part) on diffusion;
exchange of waste / raw materials depends on sufficient surface area to volume ratio;
many small alveoli form a large surface area to volume ratio for more effective gas exchange;
in villus, microvilli on cell surfaces increase surface area to volume ratio for more effective absorption of food;
villi are flattened projections that increase the surface area and so maximize surface area to volume ratio; ***[7 max]***

(b) *Award **[1]** for each of the following clearly drawn and correctly labelled.*
phospholipid bilayer – with head and tails;
hydrophilic / phosphate / polar heads and hydrophobic / hydrocarbon / fatty acid / non-polar tails labelled;
integral protein – embedded in the phospholipids bilayer;
peripheral protein – on the surface;
glycoprotein with carbohydrate attached on outside;
cholesterol – shown embedded in bilayer;
thickness indicated $(10 (\pm 3) \text{nm})$; ***[6 max]***

(c) temperature regulated by negative feedback;
thermoreceptors detect temperature change;
thermoregulatory centre (hypothalamus) in brain;

warming the body actions: ***[3 max]***
shivering to produce waste heat;
no release of sweat;
behaviours including increased motion / huddling/reduction of exposed surfaces;
vasoconstriction of skin arterioles;
leading to retention of heat;

cooling the body actions: ***[3 max]***
vasodilation of skin arterioles;
leading to loss of heat by radiation;
sweating accompanied by evaporative cooling;
reduction of activity / relaxation of muscles;
loss of heat by radiation; ***[5 max]***

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