International Baccalaureate®
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MARKSCHEME

May 2008

BIOLOGY

Standard Level

Paper 2

Subject Details: Biology SL Paper 2 Markscheme

Mark Allocation

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

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

2. Each marking point has a separate line and the end is signified by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/) – either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are <u>underlined</u> are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. Indicate this with **ECF** (error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the mark scheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover page.

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) female *[1]*

(b) *Laticauda colubrina* / *L. colubrina* / *colubrina* *[1]*

(c) females / *L. colubrina* / *Laticauda colubrina* / female *colubrina* *[1]*

(d) $25.5(\pm 0.1) - 20.0(\pm 0.1) = 5.5(\pm 0.2)$ *(arbitrary units)* *[1]*
Calculation must be shown.

(e) (i) (slightly) more *L. laticaudata* / less difference at start/5 seconds;
at 40 seconds both species hold on equally;
more *L. colubrina* after 120 seconds / *L. colubrina* better able to cling to the cliff;
difference between species greater at end than beginning; ***[2 max]***

(ii) *colubrina* are stronger / strong snakes (cling better);
smaller snakes grip crevices/coral better;
L. laticaudata are heavier / *vice versa*; ***[2 max]***
Accept anatomical features such as shape of snake, type of scales on belly or other reasonable suggestions.

(f) *advantages*: ***[2 max]***
(snakes with) lower mass reach top of cliff faster providing reproductive advantage;
higher mass better able to compete for nesting sites / other reproduction points;
better able to compete for food;
females have more resources for reproduction;
(more mass) reduces threat from predator;
greater ability to capture prey;
Award credit for additional reasonable arguments.

disadvantages: ***[2 max]***
higher mass less able to climb coral cliffs;
therefore inhibits breeding;
slower moving; ***[3 max]***
Award credit for additional reasonable arguments.

2. (a) (i) (approximately) 1 μm ***[1]***
Accept any value between .5 μm *and* 1.0 μm.

(ii) (approximately) 10 μm to 100 μm ***[1]***
Accept any value within this range.

(b) rate of transport of materials across membrane;
energy/heat is a function of surface area;
rate of metabolism is a function of mass to volume ratio;
as size increases the ratio between SA and volume decreases;
causing problems in transport/rate of exchange; ***[2 max]***

3. (a) maintains the internal environment at constant levels/between narrow limits ;
maintains as steady state/balance in the internal environment (of organisms);
NB: examples are not a definition ***[1 max]***

(b) (i) insulin;
produced in beta cells of pancreas;

or

glucagon;
produced in alpha cells of pancreas; ***[2 max]***

(ii) high blood glucose levels stimulates the production of insulin;
(insulin) is transported in blood;
insulin increases uptake of glucose by cells/storage of glucose;
converts glucose to glycogen;
lowers blood glucose levels;

or

low blood glucose levels stimulates the production of glucagon;
glucagon increases breakdown of glycogen/release of glucose from liver;
raises blood glucose levels;
(glucagon is) transported in blood; ***[2 max]***

(c) at puberty estrogen production is increased;
(increased estrogen) stimulates female secondary sex characteristics;
example of secondary sex characteristics *e.g.*: initiates menstrual cycle / growth of vagina and uterus / growth of breasts / growth of pubic and armpit hair / fat deposit;
another example from same list; ***[3 max]***

4. (a) carbohydrates / glycogen; *Do not accept glucose.*
fats/lipids / triglycerides; ***[2]***

(b) (i) light (energy) to chemical (energy)/ATP/glucose/NADPH/sugar; ***[1]***

(ii) chlorophyll ***[1]***

(c) (the shape of pyramid) shows energy lost from base to top of pyramid/at each trophic level;
(because) energy is used/released through cell respiration/heat/movement (at each trophic level);
not all tissues are eaten *i.e.* bone/hair/cellulose/excretion/undigested/die;
less energy available at each trophic level / only 10 - 20% passed on so each level is (80-90%) smaller than the preceding / a diagram must show the approximate changes in levels; ***[3 max]***

SECTION B

5. (a) large total surface area;
wall of single layer of flattened cells;
moist lining;
walls elastic;
network of capillaries;
capillary walls are thin/one cell thick; ***[4 max]***

(b) *Each characteristic must be linked to a function for the mark to be awarded.*
Arteries: Award ***[3 max]***
thick muscular wall to help pump blood / to help distribution of blood;
thick outer wall (of collagen and elastic fibres) to withstand high pressure / to avoid bursting/leaks;
narrow lumen results in fast-moving blood;

veins: Award ***[3 max]***
thin outer muscular walls so no pumping action;
thin walls allow pressure from surrounding muscles to move blood;
thin walls (of collagen and elastic) as not likely to burst / low pressure;
wide lumen allows for slow-moving blood;
valves to prevent back flow/control direction of blood flow; ***[6 max]***

(c) cell respiration produces energy;
controlled release of energy;
by breakdown of organic molecules/glucose;
energy from them is used to make ATP;
aerobic respiration is in mitochondria;
requires oxygen;
pyruvate is produced by glycolysis / glucose broken down;
pyruvate is broken down in the mitochondria;
into carbon dioxide and water;
large production of ATP;
per molecule/mass of glucose;
much higher production of ATP than in anaerobic respiration; ***[8 max]***

6. (a) sugar drawn as pentagon / pentose sugar indicated / labelled as deoxyribose;
nucleotide;
both strands with phosphate-sugar backbone shown;
bases joined to sugars;
complementary base pairs shown as rungs;
adenine paired with thymine and cytosine paired with guanine;
hydrogen bonds linking strands/base pairs;
covalent bonds linking nucleotides; ***[5 max]***

(b) when DNA replicates the 2 strands separate;
each single strand acts as template/serves as a base for base-pair matching;
free nucleotides of adenine/A bond only with thymine/T / vice versa and free nucleotides of cytosine/C bond only with guanine/G / vice versa;
thus copying the opposite strand of the original DNA molecule;
replication is semi-conservative;
original order of bases is maintained/conserved;
new DNA identical to parent molecule;
(significance of base-pair matching) is that the information encoded in one DNA molecule is passed to others;
DNA structure indicates the manner of DNA replication; ***[5 max]***

(c) sickle cell anaemia is caused by mutation in Hb/hemoglobin gene;
a base substitution;
changes the triplet code;
GAG mutated to GTG;
resulting in an amino change/glutamic acid replaced by valine;
new allele formed/Hb^S;
causes sickle-shaped/mishapen red blood cells / causes Hb^S molecules to stick together;
hemoglobin molecule not as functional / carries less oxygen / less efficient;
untreated homozygote condition is lethal;
mutation (in heterozygotes) provides resistance/heterozygote advantage to malaria / OWTTE;
malaria is caused by a (protozoan) pathogen;
the pathogen invades red blood cells;
Hb^S is selected for in malaria regions; ***[8 max]***

7. (a) *Award **[1]** for each of the following clearly drawn and correctly labeled.*
sigmoid/s-shaped graph;
time labelled on x-axis;
population (size/number) labelled on y-axis;
<u>exponential</u> growth phase;
plateau phase / *accept accurate annotations*;
transitional phase / *accept accurate annotations*; ***[5 max]***

(b) meiosis / segregation of alleles;
random orientation of chromosome pairs (at metaphase I);
when attaching to spindle fibres;
2^n possibilities/combinations of chromosomes if n = number of chromosome pairs;
clear diagram of above;
large genetic variation in haploid gametes;
random fertilization increases variety (even with same parents);
so specific population with very wide genetic variety; ***[5 max]***

(c) *Two examples required. Award **[4 max]** for each example.*
Example 1
name of population and characteristic: *e.g.* antibiotic resistance in bacteria (for example Gonorrhea);
environmental change: exposure to the antibiotic;
response 1: antibiotic-sensitive bacteria die / antibiotic-resistant ones survive;
response 2: pass on antibiotic-resistance gene/inherited trait;
drug-resistance gene transferred to other bacteria (by plasmids);
over time resistance in the population is increased;

Example 2
name of population and characteristics: Galapagos finches, some with strong/big beaks and some with small beaks;
environmental change: wet years with abundant small seed change to drought years with only large seeds (as a prevalent food source);
response 1: small beaked finches die leaving primarily finches with strong/large beaks / vice versa;
response 2: finches with large beaks survive to <u>pass gene/inherited trait</u> to offspring;
over time large beaks predominate; ***[8 max]***