



# **MARKSCHEME**

**November 2010**

**BIOLOGY**

**Standard Level**

**Paper 2**

11 pages

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.
4. Unexplained symbols or personal codes/notations are unacceptable.
5. Record marks in the right-hand margin. For Section A this should be against each mark allocation shown in square brackets *e.g.* [2]. The total mark for a question must equal the number of ticks for the question.
6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question.**
7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.
8. Where work for Section A is submitted on additional sheets the marks awarded should be shown as ticks and a note made to show that these marks have been transferred to the appropriate square bracket in the body of the script.
9. Section A: Add together the total for each question and write it 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.
10. 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. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**
11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.
12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **unless the candidate has indicated the question(s) to be marked on the cover sheet.**
13. A mark should not be awarded where there is contradiction 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 [**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 underlined 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) (i) (GMF) C [1]
- (ii)  $\frac{(50-22)}{22} \times 100$ ;  
 = 127%; (units required) (allow answers in the range of 127 to 127.3) [2]
- (b) error bars show the range/variability/uncertainty of the data / OWTTE;  
 error bars/standard deviation about the same length for day 0 and day 11 /  
 spread of data (around the means) about the same;  
 overlapping bars indicate that there is no (significant) difference in the data/ means;  
 68 % of population within one standard deviation; [2 max]
- (c) inversely proportional / the higher the tolerance, the less the growth / *vice-versa* [1]
- (d) first name/*Oryza* for genus / second name/*sativa* for species;  
 (all) members of *Oryza sativa* share special/unique features;  
 two names make a unique combination to designate species / worldwide  
 recognizable nomenclature;  
 varieties (*japonica* and *indica*) have some (consistent) differences (in tolerance); [2 max]
- (e) (i) *Sub1C* [1]
- (ii) *Sub1A* is expressed strongly/the most / *Sub1A* produces the most RNA;  
*Sub1B* (always) has the lowest expression/produces least mRNA;  
*Sub1A* expressed/produces mRNA for the longest time/days 1 to 10;  
*Sub1C* expressed/produces mRNA for the shortest time/days 3 to 7; [2 max]
- (iii) *Sub1A* only expressed/produces mRNA in *indica* / not/never expressed/  
 never produces mRNA in *japonica*;  
*Sub1C* expressed/produces mRNA from day 1 in *japonica*, but not *indica*;  
*Sub1B* has lower expression/production of mRNA than *Sub1C* in both  
 varieties; [2 max]  
 other accurate comparisons;
- (f) *Sub1A*;  
 is only expressed in *indica*;  
*indica* is the variety showing submersion tolerance; [2 max]
- (g) genetically modified rice/rice with *Sub1A* is more tolerant to submersion;  
 can withstand seasonal flooding/torrential rain;  
 GMF/tolerant rice ensures greater harvest/provides more food during flooding; [2 max]

2. (a) anaphase [1]
- (b) growth (through increasing cell number);  
embryonic development;  
tissue production/repair;  
(asexual) reproduction; [2 max]
- (c) uncontrolled mitosis/cell division [1]
- (d) pair of homologous chromosomes moves in same direction/does not separate during anaphase I / chromatids move in same direction/do not separate during anaphase II;  
leaving a cell with an (some) extra chromosome(s)/missing chromosome(s);  
an example; (e.g. *Down syndrome / trisomy 21*); [2 max]
3. (a) hormone binding sites / receptors;  
(immobilized) enzymes;  
cell adhesion;  
cell (to cell) communication;  
passive transport/channels;  
active transport/pumps;  
facilitate diffusion;  
carry electrons; [2 max]
- (b) many molecules are too large to be absorbed (by the villi) / small molecules are soluble and can be absorbed;  
large food molecules are broken down so they can be reorganized/rearranged; [1 max]
- (c) antibiotics block/inhibit specific metabolic pathways/cell functions found in bacteria;  $\left\{ \begin{array}{l} \textit{Accept specific examples of} \\ \textit{inhibition such as cell protein} \\ \textit{synthesis, cell wall formation.} \end{array} \right.$   
viruses must use host/eukaryotic cell metabolism / viruses do not have their own metabolic pathways;  
host/eukaryotic cell metabolism/pathways not blocked/inhibited by antibiotics; [2 max]
- (d) strands of DNA (fragments) split/denatured with heat;  
complementary nucleotides added to split stands (when cooling);  
with the use of (DNA) polymerase (and primers);  
process/heating and cooling cycle is repeated (until enough DNA is obtained);  
example of PCR application; (e.g. paternity cases or forensic investigations) [2max]

**SECTION B**

*Remember, up to TWO “quality of construction” marks per essay.*

4. (a) nitrogen – structure of organic molecules/proteins/nucleotides;  
sulfur – amino acid / protein structure;  
phosphorus – nucleic acids / energy carriers;  
calcium – bone structure / trigger exocytosis (*e.g.* neurotransmitters);  
iron – prosthetic groups / hemoglobin;  
sodium – membrane potential; **[4 max]**  
*Accept other valid roles for those elements already listed.*  
*Accept other valid examples of elements with their roles.*  
*To award [4 max], responses need an appropriate role for each element stated.*
- (b) chlorophyll is the (main) photosynthetic pigment;  
absorbs (mainly) red and blue light;  
green light is reflected;  
light energy absorbed is converted into chemical energy;  
ATP produced;  
water split;  
to form oxygen and hydrogen;  
ATP and hydrogen used to fix carbon dioxide to make organic molecules; **[6 max]**
- (c) A-T and C-G in DNA;  
A-U and C-G in RNA;  
complementary base pairing in replication ensures identical nucleotide sequence of new complementary strands;  
semi-conservative replication;  
transcription produces RNA sequence complementary to the DNA sequence (of the gene);  
triplets of nucleotides on mRNA are codons;  
translation converts mRNA sequence of information into a specific amino acid chain (polypeptide);  
(each class of) tRNA carries a specific triplet of (three) bases called an anticodon;  
anticodons bind to codons by complementary base pairing;  
(each class of) tRNA with specific complementary anticodons carry specific amino acids;  
sequence of mRNA codons translates into specific amino acid sequence;  
enables conservation of information transfer from DNA to RNA to polypeptide; **[8 max]**

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

5. (a)  $x$ -axis labelled as time/ $t$  and  $y$ -axis labelled as number/ $N$ /population size;  $\left. \begin{array}{l} \text{Both labels needed.} \\ \text{Do not accept "population" by itself.} \end{array} \right\}$
- curve clearly showing the shape of the three phases;  $\left\{ \begin{array}{l} \text{oscillations of plateau} \\ \text{phase not required} \end{array} \right.$
- exponential/rapid growth phase labelled/highlighted properly; (*accept log phase*)  
 transitional/slowing phase labelled/highlighted properly;  
 plateau/no growth phase labelled/highlighted properly; (*accept stationary phase*)  
 carrying capacity/ $K$  drawn and labelled as a parallel line to  $x$ -axis at plateau level; **[4 max]**
- (b) *Accept examples of the points below, provided that the terms underlined are clearly identified. Accept only named examples (latin or common names) from natural ecosystems only. Do not award marks for general names such as "fish" or "tree".*
- food chain shows transfer of nutrients/energy in an ecosystem / arrows from one trophic level to the next in examples;  
 between different trophic levels / shown in a correct chain or web;  
 starting with a producer;  
 followed by at least two levels of consumers / shown in a correct chain or web;  
 food web is the (branched) interaction of multiple food chains / cross arrows in examples;  
 using (multiple) producers as a source;  
 transferring nutrients/energy to consumers from different food chains;  
 same consumer could be at different trophic levels in a food web; **[6 max]**
- (c) *Award [2 max] from the following list of greenhouse gases:*
- water vapour;  
 carbon dioxide;  
 methane;  
 oxides of nitrogen;
- all (of these gases) occur naturally;  
 and human activity has increased the normal level of these gases in recent years;  
 incoming shorter wave radiation from the Sun;  
 is re-radiated as longer wave radiation/infrared;  
 (mainly) in the form of heat;  
 captured by greenhouse gases;  
 which increases the atmospheric/ocean temperature;  
 at a higher rate than normal / creating a positive imbalance;  
 which threatens ecosystems/climatic patterns/ocean patterns;  
 Earth's history had many fluctuations in gas levels/global temperature / some scientists are skeptical about enhanced greenhouse effect; **[8 max]**

(Plus up to [2] for quality)



6. (a) example of a nutrient *e.g.* glucose;  
oxygen/O<sub>2</sub>;  
carbon dioxide/CO<sub>2</sub>;  
nitrogen/N<sub>2</sub>  
hormones;  
antibodies;  
urea; [4 max]
- (b) is myogenic;  
pacemaker / SA node / *OWTTE*;  
stimulates atria to contract;  
leading to contraction of ventricles;  
(autonomic) nerves can alter the pace;  
(by secretion of) epinephrine/adrenaline/norepinephrine/noradrenaline increase the pace;  
(by secretion of) acetylcholine reduces the pace;  
adrenal glands release epinephrine/adrenaline;  
carried by blood to heart;  
to increase pace; [6 max]
- (c) *cause: [4 max]*  
AIDS caused by HIV;  
penetrates (T) lymphocytes;  
(envelope) (glyco)protein and cell receptors involved;  
reverse transcriptase enables DNA to be produced from viral RNA; { (reject DNA transformed  
into RNA)  
number of lymphocytes reduced over years;  
results in lower immunity;  
other illnesses develop (as result of lower immunity);  
AIDS is the observed syndrome when final stages of infection develop / *OWTTE*;
- transmission: [3max]*  
HIV transmitted through blood/sexual contact/body fluids/placenta/childbirth/breastfeeding;  
distribution/transmission uneven around the world;  
transmission risk increased depending on society's traditions/beliefs/behaviour;  
(rare minority of) individuals do not have cell receptors and do not develop AIDS;  
condoms/latex barriers only protection against transmission through sexual contact;
- social implications: [3max]*  
treatment expensive;  
discrimination against victims;  
moral obligation of wealthy countries to help poorer countries;  
economic consequences / loss of wage earners *etc.*;  
increase in the number of orphans;  
comment on traditions/beliefs/behaviour; *(if not already awarded in transmission)* [8 max]

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