

# **MARKSCHEME**

**MAY 2006**

**BIOLOGY**

**Standard Level**

**Paper 2**

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## General Marking Instructions

### 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.
- ◆ 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.
- ◆ Units should always be given where appropriate. Omission of units should only be penalized once. 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 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 **[2]** marks for the quality of construction (and *vice versa*).
- ♦ Indicate the award of quality marks at the end of the answer.

**SECTION A**

1. (a)  $82\% - 29\% = 53(\pm 1)\%$ ; (*units required*) **[1]**
- (b) 550 nm is in the green region of the spectra and plants do not absorb green light as well as other wavelengths;  
550 nm / green light is the light reflected by the pigments of the plant; **[1 max]**
- (c) at 0.82 absorbance the maximum rate is 4.1 while at 0.53 absorbance the maximum rate is  $2.5 \text{ n mol cm}^{-2} \text{ s}^{-1}$  / higher rate at 0.82 than 0.53 absorbance **[1]**
- (d) (i) the higher the pubescence the less the light absorption / negative correlation **[1]**
- (ii) as pubescence increases the uptake of  $\text{CO}_2$  declines / a negative correlation **[1]**
- (e) *E. farinosa* grows in the desert where water is scarce/a limiting factor / *E. californica* grows in climate with more water;  
presence of pubescence decreases water loss / transpiration;  
mutation causing increased pubescence gives a selective advantage in dry areas; **[1 max]**
- (f) December **[1]**
- (g) highest leaf pubescence occurs during summer/May to September (periods of little growth);  
lowest leaf pubescence occurs during winter/December to February (when new leaves emerge); **[2]**
- (h) water use efficiency is low in July due to decreased  $\text{CO}_2$  uptake / high water loss;  
water use efficiency is higher in December due to a higher increase in  $\text{CO}_2$  uptake / low water loss;  
leaf pubescence in July is high and decreases  $\text{CO}_2$  uptake which decreases water use efficiency; **[2 max]**

2. (a) Award [1] if both A and B are named but no functions are given.

	<i>Name</i>	<i>Function</i>
A	DNA polymerase	adds complementary base pairs / links nucleotides together forms complementary strands;
B	helicase	which unwinds the DNA helix / separates the two strands;

[2]

(b) nucleus

[1]

(c) interphase / S phase

[1]

(d) A (hydrogen) bonds with T and G (hydrogen) bonds with C; complementary base pairing ensures proper base incorporated into DNA strand; thus making identical copies of the DNA strand (ensuring conservation of the base sequence);

[2 max]

3. (a) Award [1] for any two of the following.

hormone / receptor binding;  
enzymes;  
electron carriers;  
channels / facilitated diffusion;  
pumps active transport;

[1 max]

(b) diffusion is the movement of molecules/particles from an area of high concentration to an area of low concentration;  
down a concentration gradient;

[1 max]

(c) active transport requires energy, facilitated diffusion does not;  
active transport moves substances against a concentration gradient, facilitated diffusion cannot;

[2]

(d) exocytosis uses (membrane bound) vesicles to transport molecules;  
fuses with plasma membrane to release molecules outside the cell;

[2]

4. (a) (i) homeostasis maintains the internal environment at a constant level / between narrow limits **[1]**
- (ii) nervous system and endocrine system **[1]**  
*Both are required for [1].*
- (b) helps to maintain water balance (of the organism);  
by retaining or excreting water;  
helps to maintain blood pH;  
excretion of urea/salts / gets rid of wastes; **[2 max]**
- (c) a rise in level would feedback to decrease production;  
as levels drop to low this would feedback to increase production;  
*e.g. blood glucose concentration / body temperature;* **[3]**  
*Award [2 max] if example given is inappropriate.*

**SECTION B**

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

5. (a) *Award [1] for any two of the following clearly drawn and correctly labelled.*

- right atrium;
- left atrium;
- right ventricle;
- left ventricle;
- semilunar valves;
- atrioventricular valves;
- pulmonary artery;
- pulmonary vein;
- vena cava (inferior/superior);
- aorta;
- chordinae tendinae/chords and septum;
- relative wall thickness accurately drawn;

**[4 max]**

- (b) the heart is myogenic/beats on its own accord;  
60-80 times a minute (at rest);  
coordination of heartbeat is under the control of pacemaker;  
located in the muscle/walls;  
sends out signal for contraction of heart muscle;  
atria contract followed by ventricular contraction;  
fibres/electrical impulses cause chambers to contract;  
nerve from brain can cause heart rate to speed up;  
nerve from brain can cause heart rate to slow down;  
adrenalin (carried by blood) speeds up heart rate;  
artificial pacemakers can control the heartbeat;

**[6 max]**

(c) *Answers must refer to all three vessels to achieve [8 max].*

*arteries: [3 max]*

- thick muscle layers / elastic fibres to help pump blood;
- thick collagen/fibres to avoid bursting/withstand high pressure;
- narrow lumen relative to overall diameter;
- narrow lumen to maintain pressure;

*veins: [3 max]*

- thin muscle layers with few fibres because blood not under high pressure;
- thin so they are able to be pressed by muscles to pump blood;
- wide lumen relative to overall diameter;
- wide lumen to maintain blood flow / decrease resistance to flow;
- contains valves to prevent backflow;

*capillaries: [3 max]*

- single layer of (thin) cells for diffusion;
- pores between cells so phagocytes can squeeze out;
- narrow lumen to fit into small spaces;
- large number resulting in increased surface area;

**[8 max]**

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



6. (a) *Accept any of the points below if clearly drawn and correctly labelled in a diagram.*  
in metaphase homologues in centre of cell / spindles attached;  
homologues are separating;  
one pair doesn't separate/ non-disjunction;  
in telophase cells divide into two;  
cells have either one more/one less chromosome;  
can occur in second division of meiosis;  
sister chromatids fail to separate;  
fertilization with one gamete / sperm / egg carrying extra chromosome;  
Down's syndrome is trisomy of chromosome 21; **[4 max]**
- (b) genetic screening is testing for the presence or absence of gene/chromosome;  
screening for chromosomes can involve karyotyping;  
genetic screening is controversial;  
*advantages: [4 max]*  
parents can choose to avoid having children with disorder;  
parents can prepare for a child with a disorder;  
parents can use IVF to select embryos that are normal;  
can use gene therapy to correct the problem;  
treatment can start to prevent symptoms;  
fewer children with the disorder are born;  
*disadvantages: [4 max]*  
frequency of abortion can increase;  
parents can select embryos for sex of the child;  
can have harmful side effects such as depression if you know you will develop a disorder later;  
can create a genetic underclass;  
health insurance / treatment can be denied if there is genetic predisposition; **[8 max]**
- (c) mRNA is extracted;  
DNA copy of RNA is made using reverse transcriptase;  
plasmids are cut open with endonucleases (at specific sequences);  
insulin gene and plasmid are mixed together;  
addition of "sticky ends" to the DNA copy (so that it will combine with the cut plasmid);  
DNA ligase will seal the plasmid;  
recombinant plasmid is inserted into *E. coli*;  
*E. coli* is cultured;  
*E. coli* begins to make insulin; **[6 max]**

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

7. (a) *Answers must refer to both plant and animal populations to achieve [6 max].*

*plant populations: [3 max]*

randomly locate plots/quadrats;

count numbers of a particular species in the plot;

repeat procedure;

$$\frac{\text{average number of quadrat} \times \text{total area}}{\text{area of quadrat}}$$
 gives estimate of plant population size;

*animal populations: [3 max]*

capture and mark individuals;

release back into wild;

recapture individuals;

count marked and unmarked individuals;

use Lincoln index/equation to estimate population size;

**[6 max]**

(b) graph showing S-shaped curve;  
axes labeled correctly, x-axis = time, y-axis = number / population size ;

lag phase;

exponential phase / population increase / natality greater than mortality;

transitional phase / population growth slowing / natality falling and mortality increasing;

plateau phase / population growth zero / natality equals mortality;

carrying capacity;

**[4 max]**

(c) populations grow exponentially;  
more offspring than the environment can sustain;  
populations still remain constant;  
individuals in populations show variation;  
mutations are a source of variation;  
individuals may have characteristics that are better suited to the environment;  
the variation has to be heritable;  
those individuals will survive;  
they will reproduce and leave more offspring;  
the population will tend to accumulate the adaptation;  
therefore, the population will evolve;  
theory proposed by Darwin / Wallace;

*e.g.:*

antibiotic resistance in bacteria;

heavy metal tolerance in plants;

beak size in Darwin's finches;

industrial melanism in peppered moths;

**[8 max]**

*Award [6 max] if no example for natural selection is given or if it is inappropriate.*

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

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