

# **MARKSCHEME**

**November 2003**

**BIOLOGY**

**Standard Level**

**Paper 2**

## 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. 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 marks]** are awarded for content and **[2 marks]** for the quality of construction of the answer.
- ♦ Two aspects are considered:
  - expression of **relevant** ideas with clarity
  - structure of the answers.
- ♦ **ONE** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **TWO** 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 the two points for the quality of construction (and vice versa).

**SECTION A**

1. (a) concentration rises throughout pregnancy;  
the rise is exponential / levels rise significantly later in pregnancy; [2]  
*Award [0] for a description which only implies a rise.*
- (b) the CRH concentration is lower in late deliveries / higher in full-term deliveries;  
differences greater / become more pronounced later in the pregnancy;  
both rise gradually; [2 max]
- (c)  $57 \text{ pmol dm}^{-3}$  of plasma; ( $\pm 3$ ) [1]  
*Value and unit needed for [1].*
- (d) high concentration would indicate women at high risk of premature delivery;  
low concentration would indicate women at risk of going past term / delivering late;  
concentration could be used to indicate when delivery is imminent;  
concentration might indicate special precautions or medical technique needed;  
(e.g. reduce physical activity of mother or provide special incubator for likely  
premature birth or induce labour for past term mothers); [2 max]
- (e) *low water:*  
toads can mate earlier as conditions dry;  
toads can move to larger ponds;  
tadpole / organism cannot survive in absence of water;  
  
*high water:*  
larger toads more resistant to predation;  
larger toads more attractive to mates; [3 max]
- (f) concentrations of thyroxine and corticosterone higher in low water group/vice versa;  
greater difference in thyroxine concentration / less difference in corticosterone  
concentration between the two groups;  
in both groups thyroxine concentrations are higher than corticosterone concentrations; [2 max]  
*Comparisons need to be made between the two hormones in the high water  
environment/low water environment.*
- (g) CRH levels would be higher in the low water group/vice versa; [1]

2. (a) (i) with time, the atmospheric concentration of CO<sub>2</sub> has increased; [1]
- (ii) the increased use of fossil fuels / more automobiles;  
increased deforestation; [1 max]  
*Do not accept greenhouse effect.*
- (b) (i) any trough, clearly labelled at the bottom; [1]
- (ii) CO<sub>2</sub> is a raw material for photosynthesis;  
there is an increase in the rate of photosynthesis in the summer;  
therefore less CO<sub>2</sub> in the air during the summer as it is being used for  
photosynthesis;  
increase in CO<sub>2</sub> in winter because less photosynthesis due to trees losing  
leaves in autumn-winter / lower temperatures / shorter days with less light; [2 max]
- (c) CFCs / CH<sub>4</sub> / N<sub>2</sub>O; [1]  
*Names are acceptable e.g. methane, nitrous oxide. Do not accept SO<sub>2</sub>.*
3. (a) as a cell grows, volume increases faster than surface area / surface area : volume  
ratio decreases;  
the rate of consumption of resources / nutrients / oxygen is a function of volume;  
the rate of production of wastes is a function of volume;  
the rate of exchange of wastes / nutrients is a function of surface area;  
the rates of diffusion are too low relative to cell needs for larger cells; [2 max]
- (b) absorption is taking up of a substance by the skin / mucous membranes / digestive  
tract / cell membranes / layers of cells / the bloodstream; [1]
- (c) large total surface area / many alveoli;  
a wall consisting of a single layer of (flattened) cells;  
moist lining;  
dense network of capillaries; [1 max]
- (d) villus intestinal wall has many folds to increase surface area ( : volume ratio);  
surface of villus close to blood vessels so materials can easily diffuse;  
surface of villus close to lymph vessels so lipids can be easily absorbed;  
greater surface area related to greater rate of diffusion;  
villus wall consists of single layer of cells; [3 max]  
*Do not accept microvilli – not visible in diagrams.*

4. (a) a group of individuals that could interbreed;  
to produce fertile offspring;  
individuals that share a common gene pool; *[2 max]*
- (b) *Any three of the following.*  
animalia / animals;  
plantae / plants;  
prokaryotae/monera;  
protocista;  
fungi; *[1 max]*
- (c) genus and species; *[1]*  
*Both are needed for [1].*

**SECTION B**

*(Remember, up to TWO 'quality of construction' marks per essay)*

5. (a) prophase showing spindle fibres;  
prophase showing condensed chromatin;  
prophase showing replicated chromosomes;  
metaphase showing replicated chromosomes lining up at the equator;  
anaphase showing chromatids moving to opposite poles;  
telophase showing nucleus reforming;  
telophase showing cytokinesis occurring; **[5 max]**  
*The four diagrams must have the name of the phase, otherwise award [3 max]. The four stages must be included to receive [5]. If correct number of chromosomes is not shown award [4 max].*
- (b) two divisions in meiosis, only one in mitosis;  
meiosis results in haploid cells, mitosis in diploid cells;  
crossing over only occurs in meiosis;  
no S phase precedes meiosis II;  
chromosome behaviour in meiosis II and mitosis is similar / chromosome behaviour in meiosis I and mitosis is different;  
chiasmata only form during meiosis;  
homologous chromosomes move to the equator in pairs only in meiosis; **[5 max]**  
*Do not accept number of cells produced - it is a result not a behaviour.*
- (c) *Arguments against (IVF):*  
fertilized egg has potential to become a person / some view a fertilized egg as having special status;  
IVF requires the production of multiple embryos;  
fate of extra embryos is ethical concern;  
ethics of long-term storage;  
stem-cell research is blurring issue as other cells now have the possibility of becoming a person;  
procedure may result in multi-embryo pregnancy which places stress on the family resources / unwanted children;  
issues of equity of access / expensive;  
high rates of failure;  
ownership / responsibility for stored embryos an issue;  
religious opposition / playing God;
- Arguments favouring (IVF):*  
only way some couples can have children / helps infertile couples;  
allows for genetic screening;  
allows for surrogate mothers; **[8 max]**  
*For full marks at least two of the points should include the counter-argument, otherwise [6 max].*

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

*(Remember, up to TWO ‘quality of construction’ marks per essay)*

6. (a) two polymers shown;  
 arranged in a double helix;  
 sugar shown connected to base;  
 sugar-phosphate backbone shown;  
*If only one nucleotide is drawn, award [2 max]*  
 sugar identified as deoxyribose;  
 hydrogen bonding between bases shown;  
 diagram shows complementary base pairing / A bonded to T, C with G;  
*Award previous mark if bases (unlabelled) are shown in the diagram but the complementary base pairing is explained in the annotation.*  
 covalent bonding between phosphate and sugar; **[5 max]**
- (b) mRNA is used as a template / guide;  
 mRNA “read” in base triplets / codon;  
 each codon specifying addition of a particular amino acid to the growing polypeptide;  
 ribosomes bind to mRNA / initiation  
 ribosomes move along mRNA facilitating addition of amino acids / elongation  
 tRNA bring amino acids (to mRNA-ribosome complex);  
 tRNA has a complementary anti-codon;  
 that binds to a specific codon;  
 stop codon causes release of polypeptide / termination; **[5 max]**
- (c) enzymes have an active site;  
 that fits the substrate precisely;  
 changes in the chemical environment of the enzyme can lead to a shape/conformational change in the protein;  
 leading to a change in the shape of the active site;  
 may interfere with the binding of the substrate with the active site;  
 altering pH can alter intermolecular interactions within the protein;  
 or within the active site;  
 enzymes have an optimum pH;  
 increase in temperature can increase molecular motion leading to disruption of intermolecular interactions;  
 increases chance of enzyme substrate collisions so enzyme activity increases;  
 optimal temperature;  
 temperature changes / pH changes can denature the protein;  
 the more substrate, the more product / more enzyme-substrate complex forms;  
 after a point, all active sites are bound to substrate / all active sites occupied;  
 additional substrate will not lead to a greater rate of product formation at this point; **[8 max]**  
*For full marks all three conditions must be included, otherwise award [6 max].*

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



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

7. (a) hormone binding sites;  
enzymes;  
electron carriers;  
channels for (passive) transport;  
(pumps) for active transport;  
cell to cell recognition;  
receptors for neurotransmitters; **[4 max]**
- (b) full name of micro-organism *i.e.* genus species;  
description of life cycle / habitat of disease;  
organ / system affected;  
symptoms of infection (short-term);  
method of infection;  
types of people affected;  
description of treatment;  
description of prevention of infection;  
description of long-term effects; **[6 max]**  
*If virus given award [3 max].*
- (c) variety in population;  
*e.g.* antibiotic resistance;  
other named examples (*e.g.* peppered moth);  
*Award [1] for each of the two examples.*
- For maximum marks, any of the following ideas must be referenced to one or both of the examples, otherwise award [6 max].*
- environmental changes (*e.g.* application of antibiotics);  
affects some varieties more than others;  
best adapted survive;  
to reach reproductive age / breed to pass on alleles;  
result is alleles found in best adapted / become more frequent in population;  
this is referred to as natural selection;  
results in change in species with time / change in allele frequency;  
this is termed evolution;  
discussion of punctuated equilibrium / gradualism; **[8 max]**

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

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