

MARKSCHEME

May 2005

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 markscheme 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).
- ♦ 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.

SECTION A

1. (a) GNA varieties have a higher content than Con A varieties [1]
- (b) Con A4 is the most promising;
(relatively) high control of aphids and (relatively) high control of nematodes / has highest combined control of both aphids and nematodes; [2]
- (c) similar levels of control are achieved with much lower lectin content in Con A than GNA;
no clear relationship between lectin content and level of control;
use of two or more figures from the table to illustrate the lack of correlation; [2 max]
- (d) *either*: $\text{percentage} = \frac{\text{mean mass of control} - \text{mean mass of GNA 2\#28}}{\text{mean mass of control}} \times 100\%$
- or*: $\text{percentage} = \frac{5500 (\pm 50) - 3700 (\pm 50)}{5500 (\pm 50)} \times 100\%$;
- either*: $1 - \frac{\text{mean mass GNA 2\#28}}{\text{mean mass mass of control}} \times 100\%$ *or*: $1 - \frac{3700 (\pm 50)}{5500 (\pm 50)} \times 100\%$;
- 32 % (± 2.5 %); [2 max]
- (d) absolute reductions/differences using raw numbers are greatest with nematodes;
percentage reductions are greatest with protozoa;
(percentage) effect on protozoa is more significant;
other GM varieties might have more/different effects;
effects on other protozoa might be different;
soil organisms do not usually make contact with leaves; [3 max]
2. (a) compounds containing carbon (found in living organisms) [1]
- (b) carbon, hydrogen and oxygen [1]
- (c) (i) proteins / named protein / DNA / RNA / chlorophyll / amino acid / other compound containing nitrogen [1]
- (ii) DNA / RNA / nucleotides / ATP / phospholipids / GP (glycerate 3 phosphate) / other compound containing phosphorus [1]

3. (a) I: protein coat / capsid / capsomere;
II: DNA/nucleic acid / RNA / genetic material; [2]
- (b) $\text{size} = \frac{\text{diameter of drawing}}{\text{length of size bar}} \times 10 \text{ nm}$ / equivalent working shown;
52 nm (± 5 nm); (*units required*) [2]
- (c) antibiotics block specific metabolic pathways / cell production in bacteria;
viruses reproduce using the host cell metabolic pathways;
(host cell) pathways are not affected by antibiotics;
viruses do not have metabolic pathways; [3 max]
- (d) some bacteria are resistant to an antibiotic / variation within bacterial populations includes antibiotic resistance;
genes for antibiotic resistance originate as mutations (not caused by antibiotics);
transfer of resistance genes (can occur) from strain to strain / species to species;
bacteria that are resistant survive when an antibiotic is used and others die;
resistant bacteria pass on their genes for resistance to offspring;
proportion of resistant bacteria increases in each generation in the population/species;
natural selection for bacteria that are resistant; [3 max]
4. (a) I: the prostate gland;
II: the urethra; [2]
- (b) *ethical arguments against:* [3 max]
not natural;
against religious teaching;
allows casual sex / multiple partners / promotes promiscuity;
zygotes/embryos killed (by IUDs) / (some) contraceptive pills;
contraceptive pill / methods other than condoms encourage spread of STDs;
IUD / contraceptive pills have side effects / named side effect;
- ethical arguments for:* [3 max]
helps to control the human population;
prevents birth of unwanted children / reduces abortion / reduces number of single parent families;
freedom of choice / women can pursue careers;
condoms prevent spread of STDs / HIV / AIDS;
economic reasons / cannot afford children / cost to society; [4 max]

SECTION B

5. (a) *ventilation (is): [2 max]*
movement of air;
movement in and out of the lungs;
caused by muscles;
an active process;
involves mass flow / involves flow along air passages;
- gas exchange (is): [2 max]*
movement of carbon dioxide and oxygen;
(occurs when) oxygen moves from lungs / alveoli to red blood cells / carbon dioxide moves to lungs / alveoli from red blood cells;
(occurs when) oxygen moves from red blood cells to tissues / carbon dioxide moves to red blood cells from tissues;
a passive process / diffusion;
takes place across a surface; **[4 max]**
- (b) blood is collected in the atria;
blood is pumped from the atria to the ventricles;
opened atrio-ventricular valves allow flow from the atria to the ventricles;
closed semi-lunar valves prevent backflow from the arteries to the ventricles;
blood is pumped out from the ventricles to the arteries;
open semi-lunar valves allow flow from ventricles to arteries;
closed atrio-ventricular valves prevent backflow to the atria;
pressure generated by the heart causes blood to move around the body;
pacemaker (SAN) initiates each heartbeat; **[6 max]**
- (c) vesicle is made by pinching off a piece of membrane;
fluidity of membrane allows this;
vesicles can be used to transport material around inside cells;
proteins are transported in vesicles;
from the rough endoplasmic reticulum to the Golgi apparatus;
from the Golgi apparatus to the plasma membrane;
formation of vesicle from plasma membrane allows material to be taken in;
endocytosis / pinocytosis / phagocytosis / phagolysosome is absorption of material using a vesicle;
fusion of vesicle with plasma membrane allows material to be secreted/passed out;
exocytosis is secretion of material using a vesicle;
named example of endocytosis or exocytosis; **[8 max]**

(Plus up to [2] for quality)

6. (a) helix is unwound;
two strands are separated;
helicase (is the enzyme that unwinds the helix separating the two strands);
by breaking hydrogen bonds between bases;
new strands formed on each of the two single strands;
nucleotides added to form new strands;
complementary base pairing;
A to T and G to C;
DNA polymerase forms the new complementary strands;
replication is semi-conservative;
each of the DNA molecules formed has one old and one new strand; **[8 max]**
- (b) *DNA profiling: [4 max]*
sample of DNA / blood / saliva / semen is obtained;
reference samples of DNA are obtained;
PCR used to amplify / produce more copies of the DNA;
DNA broken into fragments by restriction enzymes;
DNA fragments are separated by gel electrophoresis;
DNA separated into a series of bands;
bands compared between different DNA samples;
if pattern of bands is the same then DNA is (almost certainly) from same source;
if some bands are similar then individuals are (almost certainly) related;
specific example: [1 max]
testing of paternity / forensics / classification / archeology / another specific example;
- (c) *application of karyotyping: [2 max]*
find gender / test for Down's syndrome / other chromosome abnormality;
identify sex chromosomes / numbers of chromosome 21 / other chromosomes counted;
XX = female and XY = male / third chromosome 21 indicates Down's syndrome / other chromosome abnormality (e.g. Klinefelter's syndrome);
obtaining chromosomes: [3 max]
fetal cells obtained from amniotic fluid/amniocentesis / other named source;
white blood cells obtained;
cells encouraged to divide ;
cells accumulated / blocked in metaphase;
prepare slide / chromosomes examined; **[5 max]**

(Plus up to [2] for quality)

7. (a) population is a group of members / organisms of one species;
that live in the same area / same ecosystem;
at the same time;
community is a group of populations / all of the living organisms;
that live in the same area / same ecosystem;
interacting with each other; [4 max]
- (b) *either:*
capture-mark-release-recapture method;
capture a sample of the population;
example of method of capture;
mark each captured individual and release;
allow to settle back into the environment / wait for at least 24 hours / until randomly dispersed;
recapture as many individuals as possible;
count the marked and unmarked individuals;
calculate $\frac{\text{number marked originally} \times \text{recaptured}}{\text{number marked and recaptured}}$;
Accept this formula using symbols with a key or alternative formula.
or:
choose an appropriate habitat;
can use quadrats to sample the habitat;
count burrows / nests / other sites;
count number of individuals per site / sites per individual;
multiply number per site/quadrats \times number of sites/quadrats;
more repetitions will produce a better mean;
make counts of individuals at different times of day; [6 max]
- (c) energy enters as light / sunlight;
trapped by plants / producers / autotrophs;
converted to chemical energy in photosynthesis;
passed to first consumers when they eat plants;
passed from consumer to consumer / passed along the food chain by feeding;
lost from the community as heat;
lost as a result of cell respiration/metabolism/movement;
approximately 90 % lost / 10 % passed on between trophic levels;
number of trophics levels limited by amount of energy entering into the ecosystem;
energy is lost between trophic levels as defecation/loss of feces/excretion;
passed to decomposers after death of organisms / parts of organisms;
energy is lost between trophic levels due to uneaten parts; [8 max]
Credit may be given to a suitably annotated diagram.

(Plus up to [2] for quality)
