

MARKSCHEME

May 2004

BIOLOGY

Standard Level

Paper 2

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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 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 credit for what they have achieved, and for what they have got correct, rather than penalizing 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. 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 the **[2]** marks for the quality of construction (and vice versa).
- ♦ The important point is to be consistent in the awarding of the quality points.

SECTION A

1. (a) (i) potassium/K [1]
- (ii) sub-arctic forest [1]
- (b) K and Ca has greater MRT in chaparral (than temperate forest);
K has the shortest MRT of all nutrients in both biomes;
C, N, P and Mg greater MRT in temperate forest than chaparral;
MRT values for K and C show little variation between these areas (chaparral and temperate);
P shows the greatest range/difference in MRT;
temperate forest has higher MRT for all nutrients except K and Ca;
average MRT for all nutrients in the temperate forest is 3.8 and for the chaparral is 3.5;
temperate forest and chaparral have similar values for all nutrients compared to the other biomes; [2 max]
- (c) generally plant productivity increases while MRT decreases / negative correlation;
tropical rainforest biome with shortest MRT (for nutrients) has highest plant productivity / sub-arctic has low plant productivity and long MRT;
(but) chaparral has lower plant productivity than sub-arctic forest but shorter MRT for nutrients / there are exceptions to the relationship;
there is no relationship that holds true for all four biomes; [2 max]
Do not accept no correlation.
- (d) higher temperatures in tropical rainforest / lower temperatures in sub-arctic forest;
greater decomposition in tropical rainforest / more saprophytes;
water availability; [1 max]
- (e) a community (biotic) and its abiotic environment / interacting populations and their physical environment [1]
- (f) (relatively) constant/slight increase until June 1963;
peaks in June 1964;
decreases until December 1964;
rise and fall of Cs-137 happens within a year (1964);
increases again until June 1965; [2 max]
- (g) (i) *lichens*: producers/autotrophs/first trophic level;
(ii) *Inuit*: secondary consumer/third trophic level; [2]
- (h) caribou eat lichens and accumulate Cs-137;
Inuit eat caribou and accumulate (more) Cs-137;
toxins build up in food chain/bioaccumulation/magnification (other concepts of additive nature); [1 max]

2. (a) *Award [1] for each two correct.*
- I. plasma / cell membrane;
 - II. cell wall;
 - III. nucleoid (region) / DNA/genetic material;
 - IV. cytoplasm/cytosol/protoplasm;
- [2 max]**
- (b) $26000\times (\pm 1500)$;
- Do not need to show working.*
- [1]**
- (c) colour images instead of black and white / pigments can be observed;
can view living material;
larger field of view / whole cells can be seen;
easier sample preparation / cheaper/easier transport/portable;
- [2 max]**

3. (a) pair of alleles that both affect the phenotype (when present in a heterozygote) / both alleles are expressed and recognized in the phenotype [1]

(b) *Answers can use Punnett square showing the following.*

Parents' genotypes	AB	BO		
Parents' gametes	$I^A I^A$	I^B	I^B	i
F ₁ genotypes	$I^A I^B$	$I^A i$	$I^B I^B$	$I^B i$
F ₁ phenotypes	AB	A	B	B

[4 max]

For genotypes accept format $I^A / I^B / i$ or $A / B / O$ (mixing formats is acceptable). Award [1] for each correct line.

4. (a) chlorophyll (a) [1]

(b) ATP;
 NADPH / hydrogen;
 water;
 RuBP;
 Rubisco; [2 max]

(c) *Answer **must** included two explanations for full marks. Award [2 max] for one explanation.*

production of oxygen;
 (because) oxygen is a by product of the reaction;
 count bubbles of oxygen (from pondweed);
 measure the volume of oxygen;
 use of oxygen probe find oxygen concentration;
or:
 measure carbon dioxide uptake;
 (because) carbon dioxide is a raw material of the reaction;
 measure colour change of pH indicator / other method;
 use of carbon dioxide probe to find carbon dioxide concentration;
or:
 measure increase in biomass;
 (because products) used in production of cell walls and new tissue;
 harvest replicate samples at time intervals for biomass determination; [4 max]

SECTION B

5. (a) *Award [1] for each two of the following structures clearly drawn and correctly labelled. Connections between organs must be correct for full marks.*

penis;
scrotum;
prostate gland;
sperm duct;
urethra/urinary tract;
seminal vesicle;
bladder;
testes;
epididymis;
sperm duct / Vas deferens;
Cowper's gland;
seminiferous tubules;
erectile tissue;

[4 max]

- (b) (IVF) is fertilization outside body / “in glass”;
(drug) stops normal menstrual cycle;
(inject FSH) to stimulate ovaries/stimulate production of eggs;
(HCG) matures the follicles;
eggs are removed from follicles/ovaries/mother;
male provides sperm/sperm donor;
washing / capacitation of sperm;
eggs are mixed with sperm;
2-3 embryos are implanted into uterus;
pregnancy test is done to see if implantation/pregnancy has occurred;

[6 max]

(c) *Answers must have two advantages and two disadvantages for full marks.*

genetic screening is testing an individual for the presence or absence of a gene/allele;

advantages: [4 max]

test parents to see if they are carriers of genetic diseases (before they have children);

fewer children born with genetic disease;

(parents) can use *in vitro* fertilization to produce embryos;

embryos can be screened for disease/other traits (*i.e.* sex of child) and desirable

embryos can be implanted;

genetic diseases can be found and treated early;

plant/animal breeders can screen plants/animals for desirable traits;

financial planning for prospective parents;

emotional preparation for prospective parents;

parents can decide to terminate pregnancy;

disadvantages: [4 max]

frequency of *abortion* can be increased (because of the diagnosis of a genetic disease);

this may be against religious beliefs / unlawful / going against nature;

unacceptable selection of “desirable traits”;

can have psychological effects on people if they know they may have genetic disease that develops later in life;

people may be refused (health/life) insurance based on their genetic profile;

people may not be allowed to reproduce due to their genetic makeup;

intrusive / invasion of privacy;

possibilities of eugenics;

discrimination/bias in hiring;

people may choose not to reproduce (even though they have a high probability of having a normal child);

[8 max]

(Plus up to [2] for quality)

6. (a) Award [1] for each two of the following structures clearly drawn and correctly labelled. Connections between organs must be correct for full marks.

mouth/teeth/tongue;
esophagus;
stomach;
small intestine;
large intestine / colon;
anus;
pancreas;
liver;
gall bladder;
rectum;
salivary glands;
sphincters;

[5 max]

- (b) *source*: salivary glands;
pancreas;
substrate: starch/glycogen; (do not accept carbohydrate)
product: maltose/disaccharide;
optimum pH: 7-8 / neutral - slightly alkaline;

[4 max]

- (c) To receive full marks responses must explain about insulin **and** glucagon.
homeostasis maintains the internal blood glucose levels between narrow limits
(70-110 mg glucose 100 cm⁻³);
blood glucose level is maintained by negative feedback;
islets in pancreas monitor blood glucose levels;
after meal blood glucose increases;
high blood glucose stimulates release of insulin;
(release of insulin) by pancreatic islets/by β -cells ;
causes muscles/adipose tissue and liver to store glucose;
glucose stored in the form of glycogen (in muscle/liver);
storage lowers blood glucose levels;
if blood glucose levels drops glucagon secreted;
secrete glucagon by pancreatic islets/by α -cells ;
this causes liver to break down glycogen (to glucose);
glycogen breakdown causes blood glucose level increase;

[9 max]

(Plus up to [2] for quality)

7. (a) *lysosome*: hydrolysis/digestion / break down of materials (macromolecules);
Golgi Apparatus: synthesis/sorting/transporting/secretion of cell products;
rough endoplasmic reticulum: site of synthesis of proteins (to be secreted) / intracellular transport of polypeptides to Golgi Apparatus;
nucleus: controls cell activities/mitosis/replication of DNA/transcription of DNA (to RNA)/directs protein synthesis;
mitochondrion: (aerobic) respiration/generates ATP;

[5 max]

- (b) *Answers must include both similarities and differences to receive full marks.*
aerobic requires oxygen and anaerobic does not utilize oxygen;

similarities: [3 max]

both can start with glucose;

both use glycolysis;

both produce ATP/energy(heat);

both produce pyruvate;

carbon dioxide is produced;

(both start with glycolysis) aerobic leads to Krebs' cycle and anaerobic leads to fermentation;

differences: [5 max]

anaerobic:

(fermentation) produces lactic acid in humans;

(fermentation) produces ethanol and CO₂ in yeast;

occurs in cytoplasm of the cell;

recycles NADH (NAD⁺);

aerobic cellular respiration:

pyruvate transported to mitochondria;

further oxidized to CO₂ and water (in Krebs' cycle);

produce a larger amount of ATP (36-38 ATP)/anaerobic produces less ATP (2);

can use other compounds / lipids / amino acids for energy;

[8 max]

- (c) *Answers must discuss both carbohydrates and lipids to receive full marks.*

carbohydrates: [3 max]

stored as glycogen (in liver);

short-term energy storage;

more easily digested than lipids so energy can be released more quickly;

more soluble in water for easier transport;

lipids: [3 max]

stored as fat in animals;

long-term energy storage;

more energy per gram than carbohydrates;

lipids are insoluble in water less osmotic effect;

[5 max]

(Plus up to [2] for quality)
