INTERNATIONAL BACCALAURÉAT BACHILLERATO
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N02/410/S(2)M+

MARKSCHEME

November 2002

BIOLOGY

Standard Level

Paper 2

11 pages

Subject Details: Biology SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A total ***[20 marks]*** **and ONE** question in Section B ***[20 marks]***. Maximum total = ***[40 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.
- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- 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).

- 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) rate of photosynthesis increases (rapidly) / directly proportional;
rate of photosynthesis levels off / increases slightly after 10000 lumen m^{-2}; ***[2]***

(b) maximum photosynthetic rate is highest with highest CO_2 concentration;
at low light levels, higher CO_2 slightly increases the photosynthetic rate;
at low CO_2 / 280 ppm, the photosynthetic rate reaches its maximum at low light levels / constant over most light intensity / at 280 ppm CO_2 concentration limits photosynthesis;
at 500 and 1300 ppm CO_2 the curve is the same shape but with different maximum rates / each higher light intensity requires a higher CO_2 concentration to reach maximum rate;
maximum rate of photosynthesis from 280 to 500 ppm / increases 5 to 6 times while 500 to 1300 ppm increases 1.5 times; ***[3 max]***

(c) the rate of photosynthesis will increase (over the rate at 370 ppm);
the photosynthetic rate will at least double (but less than 5-6 times);
not linear;
bigger plants / more growth / more grain / greater yield; ***[2 max]***

(d) $= \frac{4.3 - 3.8}{3.8} \times 100 = 13.16\,\%$ *(accept 13.2 %)* ***[1]***

(e) shade leaves receive less light than sun leaves;
to capture sunlight, shade leaves produce more chlorophyll;
to capture sunlight, shade leaves have greater leaf area; ***[2 max]***

2. (a) *Must have both for **[1]**.*
diffusion is the movement of molecules from an area of high concentration to an area of low concentration;
osmosis is the diffusion of water across a partially permeable membrane; ***[1]***

(b) hydrophillic head groups point outward;
hydrophobic tails form a lipid bilayer;
forms a (phospholipid) bilayer;
ions and polar molecules cannot pass through hydrophobic barrier;
helps the cell maintain internal concentration and exclude other molecules; ***[2 max]***

(c) cellulose;
structural support / protection / maintain turgor pressure; ***[2]***

3. (a) *Must have both for **[1]**.*
antigen is a substance / molecule that causes antibody formation;
antibody is a (globular) protein / molecule that recognizes an antigen; ***[1]***

(b) antigen causes an immune response to produce antibodies specific for that antigen;
antibodies produced in B-lymphocytes;
B-lymphocytes produced in bone marrow;
carried in blood;
antigen presenting cell / helper T cell present antigen to B cell; ***[3 max]***

(c) *Must name two for **[1]**.*
CO_2;
O_2;
hormones;
named nutrient;
urea / excess ions;
platelets;
bicarbonate; ***[1 max]***

SECTION B

4. (a) ***[1]*** *for a correct s-shaped curve. Must have correct labelled diagram for full marks.*
[3 max] *for any of the following.*
(exponential) – rapid increase in population;
(transitional) – slowing of growth;
(plateau) – levelling off, birth rate = death rate;

carrying capacity labelled; ***[4 max]***

(b)

Names	Pros	Cons
named birth control devices *(e.g.* condom, pill, IUD);	choose when to get pregnant;	not 100 % effective; against religious principles; promotes promiscuity;
abortion;	women's choices; no unwanted pregnancies;	kill live fetus; partial birth abortions could be harmful to mother; illegal in some places;
abstinence;	100 % effective; no unwanted pregnancies;	difficult marital relations;
sterilization;	100 % effective;	irreversible; cost; forced sterilization of people;
government policy;	keep population under control;	no choice for families; euthanasia of unwanted child / sex;
in vitro fertilization;	promotes fertility;	against religious principles;

[8 max]

(c) *Maximum* ***[3]*** *for causes or maximum* ***[3]*** *for effects, if not linked. To get full credit, must link causes and effects.*
causes:
fossil fuel burning;
deforestation;
cattle ranching / methane production;
use of CFCs;
production of nitrogen oxides;

effects:
increasing CO_2 concentration;
increasing temperature;
increase in photosynthesis;
changing climate;
extinction of species;
glaciers melt / increase in sea level / flooding; ***[6 max]***

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

5. (a) sugar-phosphate backbone;
bases toward centre;
A—T, G—C base pair;
hydrogen bonds labelled;
twisted ladder;
two polynucleotides (two strands shown); ***[4 max]***

(b) mutation is a change in DNA sequence;
changes the mRNA during transcription;
changes the amino acid sequence;
substitution mutation / changes to one codon;
glutamic acid is changed to valine / GAG to GTG;
changes the shape of haemoglobin / haemoglobin becomes less soluble and crystallizes out;
cannot carry oxygen as well;
red blood cells sickle / impairs blood flow;
causes other health problems / anaemia / tiredness;
sickle cell anemia caused by two mutated recessive alleles; ***[7 max]***

(c) species show variation;
variation is inherited;
species have the potential to produce more offspring than can survive;
this leads to a struggle for existence / survival;
resources are limited;
those that are best adapted (on average) survive to reproduce;
this leads to a population adapted to the environment;
as the environment changes those that are best adapted will leave more offspring;
this will cause the species to evolve to a new adaptation / change in gene frequencies; ***[7 max]***

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

6. (a) *Award **[1]** for each of the following structures clearly drawn and labelled.*
mouth / nose;
trachea;
bronchi;
bronchioles;
lungs;
alveoli;
diaphragm;
ribs / rib eye / intercostal muscles; ***[5 max]***

(b) oxygen is becoming limited;
CO_2 concentration builds up in blood;
lactic acid builds up in blood;
lowers blood pH;
chemosensors detect lowered pH;
sensors in carotid artery / aorta;
send impulses to breathing centre / brain stem;
impulse sent to diaphragm;
impulse sent to intercostal muscles;
increases / decreases rate of breathing / contraction / relaxation of muscles;
involuntary control;
breathing rate increases to remove more CO_2 from blood / lungs; ***[9 max]***

(c) name;
Following must be related to named example.
cause;
symptom;
treatment;

Examples could include:

Name	Cause	Symptom	Treatment
artherosclerosis;	high cholesterol;	stroke; heart attack; high blood pressure; shortness of breath;	diet; drugs to reduce cholesterol;
haemophilia;	genetic recessive alleles;	lack of clotting factor / no blood clotting;	injection of clotting factor;
hypertension;	SaH; stress; lack of exercise; smoking;	headaches; asymptomatic;	reduce stress; exercise; diet;

[4 max]

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