IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N05/4/BIOLO/SP2/ENG/TZ0/XX/M+

MARKSCHEME

November 2005

BIOLOGY

Standard Level

Paper 2

10 pages

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.
- Units should always be given where appropriate. Omission of units should only be penalized once.
- 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*).

SECTION A

1. (a) line 3 / line III ***[1]***

(b) (i) transgenic have more (%) starch than control;
transgenic have less sugar than control;
transgenic greater total amounts (% fresh weight) of carbohydrates than control;
greater difference between (%) starch and (%) sugar in transgenic than control; ***[2 max]***

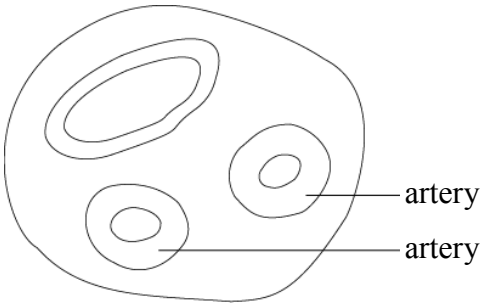
(ii) transgenic contain (gene which produces) enzyme which is active and (produces more starch);
stored sugar is used to produce starch so lower in transgenic; ***[2]***

(c) all transgenic have acceptable fry colour;
control potatoes have acceptable fry colour only after 10 days storage;
transgenic have acceptable fry colour after any length of storage / all values below 2; ***[2 max]***

(d) gene/it delays sprouting;
delay in sprouting increases the length of time the potatoes can be stored; ***[2]***

(e) populations of wild plants might be changed;
can cross species barrier;
allergies;
ethical reasons;
economic reasons (positive or negative); ***[3 max]***

2. (a) (i) one artery labelled ***[1]***



(ii) thick wall (relative to oval structure/vein);
thickness in wall because of fibres (collagen, elastic, muscle);
narrow lumen (relative to oval structure / vein); { *Do not accept "inside is smaller" for narrow lumen.*
umbilical cord has two arteries (and one vein); ***[2 max]***

(b) glucose / carbohydrates;
amino acids; *(do not accept "nutrients")*
antibodies;
water;
fats / fatty acids and glycerol;
oxygen;
minerals / vitamins; ***[2 max]***

(c) oxytocin produces uterine contraction;
regulated by positive feedback;
more contractions produce more oxytocin;
oxytocin stimulates milk ejection (in lactation); ***[2 max]***

3. (a) *Award **[1]** each for any two of the following.*
A: oil beetle;
B: longhorn beetle;
C: Colorado beetle;
D: weevil beetle;
E: ladybird beetle; ***[2 max]***

(b) $\frac{n1 \times n2}{n3}$ ***or*** $\frac{20 \times 10}{5}$;
= 40; ***[2]***

4. *Award **[1]** for every two correctly completed rows.* ***[3]***

	Type of microscope	
Observation of	**Light microscope**	**Electronic Microscope**
Chloroplasts	✓	✓
Large vacuole	✓	✓
Virus	×	✓
Movement of cilia	✓	×
Lysosomes	×	✓
Cell wall	✓	✓

(b) (i) ATP / $NADH + H^+$ / $NADH_2$ / reduced NAD ***[1]***

(ii) substrate binds to active site;
active site is region on surface of enzyme;
active site has a specific shape;
substrate is chemically attracted;
other molecules do not fit / not chemically attracted;
enzyme is the lock and substrate the key;
diagram with annotation of enzyme-substrate complex; ***[3 max]***
Since the action verb is "explain" any answer which is primarily a diagram must be clearly drawn and correctly labelled showing the marking points listed above.

SECTION B

Remember, up to TWO "quality of construction" marks per essay.

5. (a) *Award **[1]** for each of the following structures clearly drawn and labelled correctly.*
trachea;
bronchi;
bronchioles;
lungs;
alveoli;
diaphragm;
ribs and intercostals muscles; ***[4 max]***

(b) (small) animals obtain oxygen (by diffusion) through skin / in humans (large) animals skin is ineffective for ventilation;
humans are large / have a small ratio surface area : volume;
so need ventilation system to increase surface area;
to maintain a concentration gradient in alveoli;
as oxygen is used in respiration (and carbon dioxide is produced);
gaseous exchange occurs between air in alveoli and blood capillaries;
alveoli have high ratio surface area : volume (to facilitate ventilation);
to bring in fresh air (and remove stale air); ***[6 max]***

(c) B-cells / lymphocytes produce antibodies;
antigen recognized;
antigen can be protein in cell wall of pathogen;
macrophage presentation of antigen;
clone formed / division of cells;
T-helper cells assist;
formation of antigen-antibody complex (neutralization/agglutination/precipitation);
phagocytes engulf;
ingest by endocytosis;
pathogen killed;
digested by lysosomes;
formation of memory cells; ***[8 max]***

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

6. (a) *Award **[1]** for each of the following structures clearly shown in the correct relative position. Labels are not required but marking points must be shown clearly and accurately.*
amino group;
acid group;
R group in alpha carbon; (*R groups should appear on both alpha carbons)*
bond between C and N; ***[4 max]***

(b) hydrophilic attracted to water;
hydrophobic attracted to each other / rejects water;
phosphate head hydrophilic;
two carbon tails hydrophobic;
double layer;
hydrophilic heads facing outwards;
hydrophobic tails in the centre;
phospholipids in fluid state;
proteins / cholesterol embedded in layer; ***[6 max]***
Award marks for a clearly drawn and correctly labelled diagram of a membrane.

(c) *active*:
active transport uses energy /ATP;
from a region of lower concentration to a region of higher concentration;
protein pumps in membrane;
each pump only transports one substance;

endocytosis (endocytosis, pinocytosis) is bulk transport;
part of the plasma membrane is pulled inwards;
a droplet of fluid becomes enclosed / vesicle formed;

passive:
by osmosis, diffusion or bulk transport/passive transport;
osmosis is movement of water;
through (transmembrane) proteins/aquaporins;
from lower to higher solute concentration;
diffusion is (passive) movement of particles;
from greater concentration to lower concentration;
facilitated diffusion through (membrane) channels / carrier proteins; ***[8 max]***
*Award **[5 max]** if only active or passive is addressed.*

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

7. (a) *Award **[1]** for each of the following structures clearly drawn and correctly labelled.*
*Award **[0]** for lag phase.*
time on *x*-axis and population size on *y*-axis;
curve increasing rapidly in exponential phase;
curve growing slowly in transitional phase;
curve growing slowly levels off in plateau phase; ***[4]***

(b) *energy*:
energy can enter and leave the ecosystem;
energy is not recycled;
energy is supplied in the form of light / solar energy;
light energy is converted (transformed) into chemical energy/photosynthesis;
energy flows through the food chains/trophic levels;
most is lost as heat;
efficiency of conversion is typically 10-20 % from one trophic level to the next;

nutrients:
nutrients are usually recycled (within ecosystems);
plants absorb nutrients through their roots;
animals obtain nutrients by feeding;
nutrients returned to environment by death / excretion / combustion;
saprotrophs / bacteria / fungi are essential in recycling;
nutrients can be supplied by using fertilizers; ***[8 max]***
*Award **[5 max]** if only energy or nutrient is addressed.*

(c) CO_2 absorption by photosynthesis must be encouraged;
emissions from burning fossil fuels must be reduced;
reforestation;
reduction/stopping of deforestation;
spreading of nutrients in oceans to induce growth of algae;
reducing energy consumption by thermal insulation of homes;
driving less / driving smaller vehicles / hybrid vehicles / motorcycles / walking / using mass transport;
eating local food;
changing to alternate energy sources (solar, wind or nuclear power);
reduce emission of greenhouse gases (CH_4 / CFCs / N_2O / O_3 / SO_2);
e.g. less rice (paddy/padi) fields / feeding cattle with less methane-producing food; ***[6 max]***

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