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

MARKSCHEME

May 2005

BIOLOGY

Standard Level

Paper 2

10 pages

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.
- 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]*** 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.

- Indicate the award of quality marks by writing **Q2**, **Q1** or **Q0** in **red** at the end of the answer.

SECTION A

1. (a) April ***[1]***

(b) biomass of algae levels vary/fluctuate more than changes in day length;
day length gets longer at the same time as biomass of algae increases / biomass of algae peaks before the day length peaks;
from (late) April biomass of algae drops off, while day length continues to increase;
from January to April day length increases linearly while biomass of algae increase exponentially;
in May, biomass of algae reaches a minimum while day length continues to rise;
mid May to June, biomass of algae starts to increase again while day length rises to its maximum; ***[3 max]***
Only credit answers which include a comparison.

(c) low food (in 7 out of 8/most cases);
day length does not appear to show a clear pattern;
in three of the four groups, low food and short day results in resting egg production;
low food and long day always result in egg production;
high food never results in resting egg production; ***[3 max]***

(d) in April there is high food which does not result in resting egg production ***[1]***

(e) high food to low food ***[1]***
Do not credit "low food" only.

(f) *Advantages of sexual reproduction*: ***[2 max]***
sexual reproduction produces resting eggs when food conditions worsen / high to low food / weather conditions worsen;
resting eggs remain dormant / survive during bad weather conditions/drought/cold temperatures;
increases chance of population surviving bad weather conditions/drought/cold temperatures;
sexual reproduction increases variety;
variety increases the chances of the population surviving bad weather conditions/ drought/cold temperatures;
day length changes represent seasonal weather changes;

Advantages of asexual reproduction: ***[2 max]***
asexual reproduction faster when weather conditions are good/in warmer temperatures / water is available;
asexual reproduction is faster than sexual reproduction;
asexual reproduction does not require the need to find a mate; ***[3 max]***

2. (a) *Award **[1]** for two of the following.*
skeletal muscles;
fungal hyphae;
cell in telophase; ***[1 max]***

(b) a (discrete) structure within a cell with a specialized function / *OWTTE* ***[1]***

(c) occurs in multicellular organisms;
cells becoming specialized/carrying out different functions;
by expressing some genes and not others; ***[2 max]***

(d) karyotyping used to identify sex/XY chromosomes;
two types of chromosomes – autosomal and sex;
sex chromosomes can be X or Y;
sperm carries an X or Y chromosome (determining gender);
XX is female **and** XY is male; ***[2 max]***

(e) size/number of base pairs/molecular weight/mass/length **and** charge ***[1]***

3. (a) a sample where every member of a population has an equal chance of being selected / sample selected without bias ***[1]***

(b) axes correctly labeled (x = time, y = number of individuals/population size);
carrying capacity/plateau correctly labelled;
transitional/lag phase correctly labelled;
exponential growth phase/stage correctly labelled; ***[3 max]***

(c) (i) 24.6 g / 24.63 g (*units needed*) ***[1]***
*Award **[0]** for 25 g or significant figure errors.*

(ii) standard deviation is a measure of variability / degree of spread around the mean;
a small standard deviation indicates the data is spread closely around the mean value / a large standard deviation indicates a wider spread around the mean;
population 2 has greater variability, therefore, it has a greater standard deviation/ *vice versa*;
. 1 standard deviation from the mean represents 68 % of the data / . 2 standard deviations from the mean represent 95 % of the data; ***[2 max]***

4. (a) *Award **[1]** for two of the following.*
erythrocyte/red blood cell;
leucocyte/white blood cell;
phagocyte;
(B/T) lymphocyte/B cell/T cell;
basophil;
neutrophil;
eosinophil;
monocyte; ***[1 max]***

(b) antibiotics block specific metabolic pathways/cell wall 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]***

SECTION B

5. (a) composed of mRNA base triplets;
called codons;
64 different codons;
each codes for the addition of an amino acid to a growing polypeptide chain;
the genetic code is degenerate;
meaning more than one codon can code for a particular amino acid;
the genetic code is universal;
meaning it is the same in almost all organisms;
(AUG is the) start codon;
some (nonsense) codons code for the end of translation; ***[6 max]***

(b) fertilized egg called a zygote;
cell divides by mitosis;
early divisions of zygote result in reduction in quantity of cytoplasm per cell / no increase in overall size;
first divisions occur while zygote in fallopian tube/oviduct;
several divisions result in the formation of a bundle of cells called a morula;
further divisions result in a hollow ball of cells/fluid filled ball of cells/blastocyst;
implantation occurs up to seven days after fertilization; ***[4 max]***

(c) theory put forward by Darwin/Wallace;
overproduction of offspring;
leads to struggle for survival;
variation exists / (random) mutations give rise to variation;
some varieties better adapted than others;
best adapted survive;
best adapted reproduce and pass on characteristics;
evolution is change in species / allele frequency with time;
environmental change can trigger evolution;
evidence that species have evolved include observed evolution/fossil record;
example of evidence;
competing idea is that characteristics acquired during lifetime are passed on to next generation;
competing theory is that organisms have not changed since they were created by God; ***[8 max]***

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

6. (a) large food molecules must be broken down;
such as carbohydrates / proteins, *etc*.;
by hydrolysis of bonds / to form monomers;
in preparation for absorption;
rate of reaction at body temperature too slow;
enzymes increase the rate of breakdown / act as catalysts;
first enzyme example – name, substrate and product;
second enzyme example – name, substrate and product; ***[5 max]***
*Award **[3 max]** if no examples given.*

(b) the name of the enzyme and the substrate;
the name(s) of the product(s);
a statement as to why the application is useful commercially;

*Award **[3 max]** per example.*
e.g. pectinase acts on (soluble) pectin;
produces smaller, more soluble carbohydrates;
used in fruit juice clarification/to increase yield;

e.g. endonuclease DNA acts on DNA;
produces DNA fragments;
used in genetic engineering;

e.g. protease acts on (insoluble) proteins;
produces amino acids;
washing powders – stain removal; ***[6 max]***
Accept any other suitable examples.

(c) named example of desired outcome *e.g.* herbicide resistance;

*Award **[6 max]** if no named example given. Award **[5 max]** if both possible benefits and possible harmful effects are not addressed.*

Possible benefits: ***[4 max]***
benefits include more specific (less random) breeding than with traditional methods;
faster than traditional methods;
some characteristics from other species are unlikely in the gene pool / selective breeding cannot produce desired phenotype;
increased productivity of food production / less land required for production;
less use of chemicals (*e.g.* pesticides);
food production possible in extreme conditions;
less expensive drug preparation;
e.g. pharmaceuticals in milk;
human insulin engineered so no allergic reactions;
may cure genetic diseases;

Possible harmful effects: ***[4 max]***
some gene transfers are regarded as potentially harmful to organism (especially animals);
release of genetically engineered organisms in the environment;
can spread and compete with the naturally occurring varieties;
some of the engineered genes could also cross species barriers;
technological solution when less invasive methods may bring similar benefits;
reduces genetic variation/biodiversity; ***[7 max]***

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

7. (a) *Award **[1]** for each element and its role.*

e.g. C/carbon in forming organic molecules / carbohydrates / fats / proteins / nucleic acids;
e.g. H/hydrogen in forming organic molecules / carbohydrates / fats / proteins / nucleic acids / reducing/fixing CO_2 in photosynthesis;
e.g. O/oxygen in aerobic respiration;
e.g. N/nitrogen in formation of amino acids / proteins / nucleotides / ATP / nucleic acids / DNA / RNA;
e.g. P/phosphorus in formation of nucleotides / ATP / nucleic acids / DNA / RNA;
e.g. Ca/ Ca^{2+} /calcium in muscle contraction / nerve transmission / formation of bones / teeth;
e.g. Fe/ Fe^{2+} /iron in formation of hemoglobin / catalase;
e.g. Na/ Na^{+} /sodium in nerve transmission / osmoregulation;
e.g. K/ K^{+} /potassium in stomatal opening *etc.*; ***[4 max]***

(b) homeostasis is maintaining internal environment at constant levels/within narrow limits;
homeostasis involves both nervous and endocrine systems;
low blood glucose triggers glucagon release;
glucagon is produced by α-islet cells in pancreas;
glycogen is converted to glucose;
high blood glucose concentration triggers insulin release;
insulin produced by β-islet cells in pancreas;
glucose taken up by (liver/muscle) cells;
glucose converted to glycogen;
blood glucose levels controlled by negative feedback;
correct reference to lowering or raising blood glucose levels; ***[6 max]***

(c) through endocytosis large particles are brought into cells across membranes;
through exocytosis large particles are removed from cells;
by the formation of vesicles;
active transport requiring ATP;
uses protein pumps;
to move materials against concentration gradients;
protein channels enable facilitated diffusion of molecules down concentration gradient;
the molecules are too large or too charged to diffuse directly through the membrane;
small polar and non-polar molecules / gases;
can diffuse directly through the membrane;
from an area of high concentration to an area of low concentration/down the concentration gradient (until equilibrium is reached);
osmosis is the passive movement of water molecules;
across a partially/selectively permeable membrane;
from a region of lower solute concentration to a region of higher solute concentration; ***[8 max]***

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