M13/4/BIOLO/HP2/ENG/TZ1/XX/M

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

May 2013

BIOLOGY

Higher Level

Paper 2

10 pages

Subject Details: Biology HL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A **[32 marks]** and **TWO** questions in Section B **[2 % 20 marks]**. Maximum total = **[72 marks]**

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are <u>underlined</u> are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

Section B

Extended response questions - quality of construction

- Extended response questions for HL 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 <u>relevant</u> 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.

<u>Clarity of expression</u>:
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.

<u>Structure of answer</u>:
The candidate has linked relevant ideas to form a logical sequence ***within*** *at least two parts of the* ***same question*** *(eg within part a and within part b, or within part a and within part c etc. but* ***not between*** *part a and part b or between part a and part c etc.).*

- 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 marks.

- Indicate the award of quality marks by stamping **Qcl** or **Qst,** or both in **red** at the end of the answer and enter a quality mark of 0, 1 or 2 in the mark panel.

SECTION A

1. (a) oxygen production/release; (*not count bubbles)*
production/increase/change/ measurement of biomass; ***[1 max]***

(b) high/higher than optimum temperatures denature enzymes (of Calvin cycle);
ribulose bisphosphate carboxylase/rubisco stops working/does not bind substrate;
wilting / withering / loss of water / decrease in turgor / increased transpiration;
closure/reduced aperture of stomata;
lower CO_2 level inside leaf / reduced CO_2 diffusion/uptake into leaf; ***[2 max]***

(c) rate decreases/drops (to zero) with drought and increases when re-watered/ recovering ***[1]***

(d) slight decrease/constant initially then falls / falls increasingly rapidly /decreases exponentially (in drought/up to Day 35);
increases almost to original level/ but doesn't reach original level / rapidly at first then less rapidly / increases then reaches plateau (during recovery/after Day 35); ***[2 max]***

(e) higher/greater (emission) at 35°C than 25°C during both drought and recovery;
both at (approximately) same level at end of drought period/at 35 days;
both increase during recovery but not to original level;
less/little difference in emission between temperatures during recovery/after watering / converse; ***[2 max]***

(f) decreases (rate of photosynthesis); ***[1]***

(g) no effect before (the first) heat treatment;
lower rate/greater reduction in rate during heat treatments with fosmidomycin;
lower photosynthesis/fosmidomycin reduces recovery after heat treatments; ***[2 max]***
Ignore statements that fosmidomycin reduces the rate of photosynthesis if this is not related to heat treatments.

(h) high temperature/heat stress/treatment reduces rate of photosynthesis;
repeated heat treatments cause greater reduction in photosynthesis;
isoprene causes less change/less reduction in photosynthesis due to heat/46°C /higher rate of photosynthesis during heat treatment with isoprene (than without);
isoprene helps photosynthesis to rise again after heat (treatments); ***[2 max]***

(i) 26 (%) *(Allow a range of 25 % to 27 %)* ***[1]***

(j) faster recovery with isoprene than without/than with water treatment;
recovery faster/better/improved with higher isoprene concentration (than lower);
after both time periods / after 24 hours and 1 hour; ***[2 max]***

(k) different plants live in/evolved in/are adapted to different temperature regimes;
(selective) advantage for plants that produce isoprene in high temperature regions;
isoprene synthesis uses energy/materials/only beneficial at high temperatures;
some plants do not have the enzymes/genes for making isoprene; ***[2]***

2. (a) (i) Golgi apparatus/complex/body
Reject Golgi vesicle and Golgi unqualified. ***[1]***

(ii) endocytosis/phagocytosis/pinocytosis
Reject exocytosis. ***[1]***

(b) fluidity of membrane allows change of shape/invagination/formation of vesicles;
phospholipids can move / phospholipid bilayer makes membrane fluid/flexible;
weak bonding between phospholipid tails;
bends/kinks in the phospholipid tails prevent close packing;
cholesterol affects membrane fluidity; ***[2 max]***

3. (a) end-product/non-competitive/(negative) feedback inhibition ***[1]***

(b) amino acid/end product produced if used up/not enough present;
production stops if amino acid/end product unused/accumulates/in excess;
amino acid/end product changes active site of (first) enzyme of pathway;
(this is an example of) negative feedback; ***[2 max]***

(c) lock-and-key where substrate (exactly) fits the active site of the enzyme/where substrate is complementary to the active site;
induced fit where active site/substrate changes shape so substrate can bind/fit; ***[2]***

4. (a) autotrophs make their own food/organic molecules/organic matter and heterotrophs feed on/obtain their food/organic molecules from other organisms;
autotrophs use/require inorganic molecules/CO_2 and heterotrophs require (complex) organic molecules; ***[2]***

(b) an organism that lives on/in non-living/dead (organic) matter and secretes digestive enzymes/digestive juices into it / *OWTTE* ***[1]***

(c) (i) Cnidaria have radial symmetry while Mollusca have bilateral symmetry;
Cnidaria have tentacles/nematocysts/stinging cells while Mollusca do not;
Mollusca (may) have a (hard) shell while Cnidaria do not;
Mollusca have a mouth and anus while Cnidaria have only one opening;
Mollusca have a muscular/large foot while Cnidaria do not;
other valid external difference; ***[1 max]***

(ii) Annelida are segmented while Mollusca are not (visibly segmented);
Annelida may have bristles/chetae/chaetae while Mollusca do not;
Mollusca (may) have a (hard) shell while Annelida do not;
Mollusca have a muscular/large foot while Annelida do not;
other valid external difference; ***[1 max]***

SECTION B

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

5. (a) *Award* ***[1]*** *for each of the following properly drawn, positioned according to adjacent structures and labelled. Also accept diagrams showing cell structures.*
upper epidermis;
palisade mesophyll;
spongy mesophyll/layer;
vascular bundle/vein;
xylem (above) and phloem (below);
lower epidermis (with stomata included in drawing); ***[4 max]***
Reject drawings of stem or root.

(b) water absorbed by the seed / seed rehydrated;
water activates metabolism;
gibberellin synthesized/produced/secreted;
gibberellin stimulates the production of amylase;
amylase digests/hydrolyses starch to maltose;
maltose converted/hydrolysed to glucose (by maltase);
glucose used in aerobic respiration;
glucose used in synthesis/production of cellulose; ***[6 max]***

(c) occurs in stroma (of chloroplast);
energy/ATP and NADPH provided by the light-dependent reactions;
Calvin cycle;
carbon dioxide fixed to RuBP / carboxylation of RuBP/ribulose bisphosphate;
by RuBP carboxylase/rubisco;
forms unstable 6C compound / forms 6C compound which splits;
glycerate 3-phosphate (is produced by carbon fixation);
(glycerate phosphate) to triose phosphate/3C sugar by reduction/adding hydrogen;
using NADPH/reduced NADP;
triose phosphate/3C sugar converted to form hexose/glucose (phosphate);
most/$^5/_6$ of triose phosphate used for regeneration of RuBP;
ATP used to regenerate RUBP/convert glycerate 3-phosphate to triose phosphate; ***[8 max]***

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

6. (a) clotting factor released by platelets/damaged tissue/cells;
cascade/series of reactions;
prothrombin (activated) to thrombin;
soluble fibrinogen to insoluble fibrin / thrombin converts fibrinogen to fibrin;
mesh of fibrin/fibres seals wound/traps platelets/red blood cells; ***[4 max]***

(b) mRNA/gene coding for factor IX extracted from human cell/tissue;
mRNA copied to DNA/cDNA (using reverse transcriptase);
plasmids used (for gene transfer);
restriction enzyme/endonuclease used to open plasmid/cut DNA;
complementary bases/sticky ends on gene and plasmid/link gene to plasmid;
sealed using ligase;
recombinant plasmid/plasmid containing desired gene taken up by bacteria;
isolate/clone the recombinant/transformed bacteria;
bacteria cultured/grown in fermenter to produce factor IX; ***[6 max]***

(c) hemophilia is due to a recessive allele/is a recessive trait / X^H is normal allele and X^h is hemophilia allele;
hemophilia is sex linked;
allele/gene is on the X chromosome;
Reject disease/hemophilia carried on X chromosome.
(sex chromosomes in) females are XX while males are XY;

Y chromosomes do not have the allele/hemophiliac males are X^hY;
males inherit their X chromosome from their mother/do not pass the allele to sons;
males have only one copy so recessive trait/allele is not masked;
males have a 50 % chance of hemophilia/receiving the allele if mother is a carrier;

carrier is heterozygous for the gene/is X^HX^h;
dominant/normal allele masks the recessive allele (so clotting is normal);
females inherit one X chromosome from father and one from mother;
affected/hemophiliac males have carrier daughters;
hemophilia allele could have been inherited from either parent; ***[8 max]***

Accept the points above explained either in text or clearly using a Punnett grid or genetic diagram, but not for simply reproducing an unlabeled Punnett grid or diagram without explanation.

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

7. (a) fossils (give evidence of evolution);
fossils show different species existed in the past/species changed over time;

selective breeding of (domesticated) animals/crop plants;
selective breeding shows that (artificial) selection can cause rapid change;

homologous (anatomical) structures/vestigial organs (give evidence of evolution);
homologous structures/pentadactyl limbs/other example show common ancestry;

DNA/base/amino acid sequences show (common) ancestry/species diverged; ***[4 max]***

Do not award marks for examples of evolution in response to environmental change such as melanism as this is tested in part (c) of this question.

(b) independent assortment of unlinked genes/pairs of genes;
genes/alleles/traits are inherited independently;
(unlinked) genes are on different chromosomes;
presence of one allele does not influence presence of other allele (in gametes);
(evidence from/seen in) dihybrid crosses;
all allele combinations / AB, Ab, aB and ab from AaBb / other example;
in gametes;
(phenotypic) ratio of 9:3:3:1 (in double heterozygote cross);
9:3:3:1 ratio shows equal probability of all gametes;
orientation of bivalents/tetrads/homologous chromosomes is random;
orientation of one bivalent does not affect orientation of others;
in metaphase I; ***[6 max]***

(c) *For each example:*
a named example of a species that has evolved in this way;
description/clear statement of the change that occurred in the environment;
description/clear statement of different varieties (that existed at the same time);
explanation of/reason for one variant having a selective advantage;
the change in the population/species due to natural selection/evolution;
Do not award the last mark if the change is explained using Lamarckism rather than natural selection.

Example:
Staphylococcus aureus/MRSA/*Clostridium difficile/*other named species;
introduction/use of an antibiotic/named antibiotic;
some bacteria were resistant and others were not;
resistant bacteria survived (and multiplied) while non-resistant were killed;
percentage of the population showing resistance increased; ***[8 max]***

[8] *can be awarded if the candidate scores* ***[5]*** *for one example and* ***[3]*** *for the other.*
Do not accept examples where the evidence of evolution comes from fossils, or where the variation is not heritable.

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

8. (a) *Award **[1]** for each one of the following labelled structures.*
outer membrane and inner membrane shown as two separate lines;
inter-membrane space / space between inner and outer membranes;
cristae (shown as projections of inner membrane);
matrix;
(70S) ribosomes (shown as dots in the matrix); ***[4 max]***

(b) large <u>surface area</u> from having many alveoli;
single/flattened layer of (thin) cells in wall;
Reject one-cell membrane/thin membrane.
(surrounded by) dense network of capillaries/capillary bed;
short distance for gases/oxygen/carbon dioxide to <u>diffuse</u>;
moist lining / film of moisture on inside of alveolus;
moisture allows oxygen/gases to dissolve;
diffusion of <u>oxygen</u> down concentration gradient; ***[6 max]***

(c) *Award these points either for inspiration or expiration but not both:*
ventilation is movement of air into and out of lungs;
<u>volume</u> of thorax/lungs/chest increased/decreased;
<u>pressure</u> in thorax/lungs/chest decreased/increased;
air flows from higher to lower pressure / air flows until the pressures are equal;

During inspiration/inhalation:
<u>external intercostal</u> muscles contract so ribcage moved up/out;
diaphragm contracts so moves down/becomes flatter;
internal intercostal/abdomen (wall) muscles relax;

During expiration/exhalation:
external intercostal muscles relax so ribcage moved down/in;
diaphragm relaxes;
recoil of elastic fibres that stretched during inspiration;
<u>internal intercostal</u> muscles contract (during forced ventilation);
abdomen (wall) muscles contract (during forced ventilation); ***[8 max]***

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