N10/4/BIOLO/HP2/ENG/TZ0/XX/M

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MARKSCHEME

November 2010

BIOLOGY

Higher Level

Paper 2

11 pages

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.

4. Unexplained symbols or personal codes/notations are unacceptable.

5. Record marks in the right-hand margin. For Section A this should be against each mark allocation shown in square brackets *e.g.* ***[2]***. The total mark for a question must equal the number of ticks for the question.

6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question.**

7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.

8. Where work for Section A is submitted on additional sheets the marks awarded should be shown as ticks and a note made to show that these marks have been transferred to the appropriate square bracket in the body of the script.

9. Section A: Add together the total for each question and write it in the Examiner column on the cover sheet.
   Section B: Insert the total for each question in the Examiner column on the cover sheet.
   Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.

10. After entering the marks on the cover sheet check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**

11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.

12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **unless the candidate has indicated the question(s) to be marked on the cover sheet**.

13. A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect in the left-hand margin.

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. Do **not** award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified 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 writing ***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. Indicate this with **ECF** (error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover sheet.

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 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 ***within*** *at least two parts of the* ***same question*** *(e.g. 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 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. 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) (i) *gid1-1* ***[1]***

(ii) between 10^{-8} and 10^{-7} mol dm^{-3} *(units required)* ***[1]***

(iii) (breakdown) of starch to maltose ***[1]***

(b) 25% / 1 in 4 / 1:3 seeds produced would be homozygous recessive;
no response to/inhibits gibberellin in homozygous recessives results in less germination;
less growth / dwarf plants produced; *(must be in context)*
would produce plants with infertile flowers that cannot produce rice grains;
would lower rice production/less yield because infertile plants cannot produce seeds (that humans can eat); ***[3 max]***

(c) (i) *Sub1C* ***[1]***

(ii) *Sub1A* is expressed strongly/the most / *Sub1A* produces the most RNA;
Sub1B (always) has the lowest expression/produces least mRNA;
Sub1A expressed/produces mRNA for the longest time/days 1 to 10;
Sub1C expressed/produces mRNA for the shortest time/days 3 to 7; ***[2 max]***

(d) *Sub1A*;
is only expressed in *indica* / *Sub1B* and *SubC* are expressed in both rice varieties;
indica is the variety showing submersion tolerance / *vice versa* for *japonica*; ***[2 max]***

(e) (i) it increases the length of time before flowering ***[1]***

(ii) long-day light exposure increases time before flowering only if (*OsGI*) gene
is not overexpressed/in WT and –/–;
long-day light exposure decreases time before flowering for +/– and/or +/+;
length of day does not make much difference/makes least difference for +/+;
overexpression for +/– reduces time before flowering;
–/– acts as a control / has nearly the same length of time before flowering as WT; ***[2 max]***
Accept numerical answers if they are making a clear comparison.

(iii) is a short-day plant because WT has shortest time/shorter time before flowering in shorter days than longer days / as it takes less time to flower under short day conditions; ***[1]***

(f) codominant alleles show intermediate phenotype when both present;
could be codominant because homozygous +/+ shows longer time before flowering than heterozygous;
–/– ***or*** homozygous not overexpressed has a slightly longer time before flowering than WT so factors other than codominance could be influencing flowering;
dominance shown with short-day light exposure while codominance in long-day light exposure;
because presence causes overwhelming difference compared with absence in short-day light exposure;
OsGI^{+} could be dominant because its presence always causes longer time before flowering; ***[2 max]***

(g) the mutant *gid1-1* would not be useful because it produces sterile plants;
genetically modified rice/rice with *Sub1A* is more tolerant to submersion/can withstand seasonal flooding/torrential rain;
OsGI^{+} varieties adapted to different latitudes / day length could be produced (to overcome food shortages); ***[2 max]***

2. (a) I. sepal;
II. ovary / receptacle;
III. petal; ***[3]***

(b) (i) Angiospermophyta / Angiospermophytes / Angiosperms ***[1]***
Do not accept flowering plants.

(ii) confirms the hypothesis; *must be qualified*
stigma/anther inside the flower/ring of petals so as visiting animal enters it brushes past them;
colourful petals (provide contrast) so that flowers can be seen by animals;
(slightly) cone-shaped flowers so animals come in; ***[2 max]***

(c) first name/*Campanula* for genus / second name/*persicifolia* for species;
(all) members of *Campanula persicifolia* share special/unique features;
two names make a unique combination to designate species / worldwide recognized nomenclature; ***[2 max]***

3. (a) the acquisition of <u>antibodies</u> from another organism ***[1]***

(b) an example { *e.g. detection of (antibodies to) HIV (reject AIDS) / isoenzyme in heart attack / (HCG in) pregnancy test kits / blood and tissue typing / detection of malarial parasites* ***[1]***
Accept any other valid examples.

(c) an <u>organism</u>/<u>virus</u> that causes a <u>disease</u> ***[1]***

(d) antibiotics block/inhibit specific metabolic pathways/cell functions found in bacteria; { *Accept specific examples of inhibition such as cell protein synthesis, cell wall formation.*
viruses must use host/eukaryotic cell metabolism / viruses do not have their own metabolic pathways;
host/eukaryotic cell metabolism/pathways not blocked/inhibited by antibiotics; ***[2 max]***

SECTION B

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

4. (a) structure – collagen;
transport – transthyretin / hemoglobin;
enzyme/catalyst – lysozyme;
movement – actin / tubulin;
hormones – insulin;
antibodies – immunoglobulin;
storage – albumin; ***[4 max]***
Accept any other valid function of proteins with a named example.
For example sodium potassium pump, but do not accept simply "in membranes" without a clear function.
*To award **[4 max]**, responses need a function of protein and a named example.*
Only accept the first four answers.

(b) made of protein;
made of rRNA;
large subunit and small subunit;
three tRNA binding sites;
Aminacyl/A, Peptidyl/P and Exit/E;
mRNA binding site (on small subunit);
70S in prokaryotes / 80S in eukaryotes;
can be free / bound to RER (in eukaryotes); ***[6 max]***

(c) RNA polymerase; *(polymerase number is not required)*
binds to a promoter on the DNA;
unwinding the DNA strands;
binding nucleoside triphosphates;
to the antisense strand of DNA;
as it moves along in a 5'→3' direction;
using complementary pairing/A-U and C-G;
losing two phosphates to gain the required energy;
until a terminator signal is reached (in prokaryotes);
RNA detaches from the template and DNA rewinds;
RNA polymerase detaches from the DNA;
many RNA polymerases can follow each other;
introns have to be removed in eukaryotes to form mature mRNA; ***[8 max]***

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

5. (a) *Award **[1]** for each of the following clearly drawn and correctly labelled.*
head <u>and</u> midpiece/mid-section/body;
tail/flagellum; *(at least four times length of the head and containing fibres)*
acrosome; *(shown as distinct structure near front of head)*
nucleus; *(occupying more than half the width or length of head)*
mitochondria; *(as repetitive structures inside membrane of mid piece)*
centriole; (*between head and midpiece*)
(plasma) membrane; *(shown as single line covering whole cell)*
microtubules; (*in 9 plus 2 array*) ***[4 max]***

(b) FSH promotes development of a new follicle;
also leads to the production of estrogen;
estrogen brings about repair and growth of uterine lining;
estrogen causes negative feedback of FSH;
estrogen brings about LH production;
LH stimulates follicle growth;
LH triggers ovulation;
estrogen contributes to the proliferative phase of the uterine cycle / triggers LH surge;
progesterone contributes to the secretory phase of the uterine cycle/maintains uterus lining;
lowered level of progesterone (due to degeneration of corpus luteum) leads to menstruation; ***[6 max]***

(c) *cause*: ***[4 max]***
AIDS caused by <u>HIV</u>;
penetrates (T) lymphocytes;
(envelope) (glyco)protein and cell receptors involved;
reverse transcriptase enables DNA to be produced from viral RNA; *(reject DNA transformed into RNA)*
number of lymphocytes reduced over years;
results in lower immunity;
other illnesses develop (as result of lower immunity);
AIDS is the observed syndrome when final stages of infection develop / *OWTTE*;

transmission: ***[3max]***
HIV transmitted through blood/sexual contact/body fluids/placenta/childbirth/ breastfeeding;
distribution/transmission uneven around the world;
transmission risk increased depending on society's traditions/beliefs/behaviour;
(rare minority of) individuals do not have cell receptors and do not develop AIDS;
condoms/latex barriers only protection against transmission through sexual contact;

social implications: ***[3max]***
treatment expensive;
discrimination against victims;
moral obligation of wealthy countries to help poorer countries;
economic consequences / loss of wage earners *etc*.;
increase in the number of orphans;
comment on traditions/beliefs/behaviour; *(if not already awarded in transmission)* ***[8 max]***

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

6. (a) x-axis labelled as time/t and y-axis labelled as number/N/population size; *Both labels needed. Do not accept "population" by itself.*

curve clearly showing the shape of the three phases; *oscillations of plateau phase not required*

exponential/rapid growth phase labelled/highlighted properly; *(accept log phase)*
transitional/slowing phase labelled/highlighted properly;
plateau/no growth phase labelled/highlighted properly; *(accept stationary phase)*
carrying capacity/K drawn and labelled as a parallel line to x-axis at plateau level; ***[4 max]***

(b) *Accept examples of the points below, provided that the terms underlined are clearly identified. Accept only named examples (latin or common names) from natural ecosystems only. Do not award marks for general names such as "fish" or "tree".*
food chain shows transfer of nutrients/energy in an ecosystem / arrows from one trophic level to the next in examples;
between different trophic levels / shown in a correct chain or web;
starting with a producer;
followed by at least two levels of consumers / shown in a correct chain or web;
food web is the (branched) interaction of multiple food chains / cross arrows in examples;
using (multiple) producers as a source;
transferring nutrients/energy to consumers from different food chains;
same consumer could be at different trophic levels in a food web; ***[6 max]***

(c) *Award **[2 max]** from the following list of greenhouse gases*:
water vapour;
carbon dioxide;
methane;
oxides of nitrogen;

all (of these gases) occur naturally;
and human activity has increased the normal level of these gases in recent years;
incoming shorter wave radiation from the Sun;
is re-radiated as longer wave radiation/infrared;
(mainly) in the form of heat;
captured by greenhouse gases;
which increases the atmospheric/ocean temperature;
at a higher rate than normal / creating a positive imbalance;
which threatens ecosystems/climatic patterns/ocean patterns;
Earth's history had many fluctuations in gas levels/global temperature / some scientists are skeptical about enhanced greenhouse effect; ***[8 max]***

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

7. (a) *Award **[1]** for each structure clearly drawn and correctly labelled.*
cell wall; *(with some thickness)*
plasma membrane; *(shown as single line or very thin)*
cytoplasm;
pilus/pili; *(shown as single lines)*
flagellum/flagella; *(shown as thicker and longer structures than pili and embedded in cell wall)*
70S ribosomes;
nucleoid / naked DNA;
approximate width 0.5 µm / approximate length 2.0 µm; ***[4 max]***
*Award **[3 max]** if the bacterium drawn does not have the shape of a bacillum (rounded-corner rectangle with length approximately twice its width).*
*Award **[3 max]** if any eukaryotic structures included.*

(b) *Accept the following points as a diagram if clearly drawn and correctly labelled.*
supercoiling of chromosomes in prophase;
chromosomes consist of sister chromatids in prophase;
formation of mitotic spindle / centrosomes/centrioles move away in prophase;
nuclear membrane breaks down in (late) prophase/(early) metaphase;
attachment of spindle microtubules to centromeres;
chromosomes on metaphase plate/equator/centre of cell in metaphase;
parting of (sister) chromatids at onset of anaphase;
movement of sister chromosomes *(accept chromatids)* to opposite poles in anaphase;
re-formation of nuclear membranes in telophase; ***[6 max]***
*Award **[5 max]** if response does not mention all four phases of mitosis.*

(c) pyruvate produced by glycolysis;
pyruvate enters mitochondrion/mitochondria;
pyruvate loses CO_2 in link reaction;
and $NADH+H^+$;
with formation of acetyl CoA;
to take part in Krebs cycle;
where two CO_2 are produced (per molecule of pyruvate);
one ATP from ADP + Pi;
along with (three) $NADH+H^+$ (and one $FADH_2$);
$NADH+H^+$ provide electrons circulating in the electron transport chain on the inner mitochondrial membrane;
allowing H^+ to accumulate in the intermembrane space;
and come back to the matrix through ATP synthase/synthetase to produce ATP (by chemiosmosis);
presence of O_2 required as the final electron acceptor for the electron transport chain;
producing water with H^+; ***[8 max]***

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