IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
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N07/4/BIOLO/SP2/ENG/TZ0/XX/M+

MARKSCHEME

November 2007

BIOLOGY

Standard Level

Paper 2

14 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.
- Words that are underlined are essential for 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 penalizing 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 **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 ***[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) (blind) mole rats have a lower oxygen consumption than white rats / numerical comparison *e.g.* white rats consume about twice as much oxygen as (blind) mole rats / *vice versa* ***[1]***

N.B. *A comparison word/term is needed, just quoting numbers from graph is not enough.*

(b) both graphs show greater speed correlated to greater consumption/positive correlation/directly proportional;
(overall) rate of increase is lower in white rats than (blind) mole rats;
(blind) mole rats consume less oxygen at lower speeds than white rats;
but white rats consume less oxygen at higher speeds;
white rat oxygen uptake slows down/stops increasing/reaches plateau as treadmill speed increases but (blind) mole rat oxygen uptake keeps increasing;
(blind) mole rats reach a higher maximum oxygen consumption; ***[3 max]***

(c) lowers oxygen consumption in both types of rats;
less effect on (blind) mole rats than white rats;
plateau reached in white rats at lower speed;
(blind) mole rats have better ventilation systems/are better adapted than white rats; ***[2 max]***

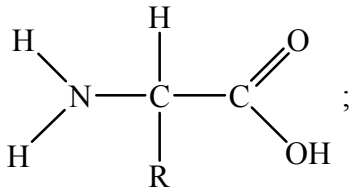
(d) ***N.B.*** *Action verb is "explain" so the adaptation mentioned must be associated with its effect/purpose.*
greater lung volume increases amount of air/oxygen that can be breathed in/contained;
greater alveolar area increases surface area for gaseous exchange/allows more absorption/diffusion of oxygen;
greater capillary area means more contact/more exchange/larger rate of diffusion between capillaries and alveoli;
so more oxygen can be carried away from lungs;
greater capillary area allows more oxygen absorption/gaseous exchange between lungs (alveoli) and blood; ***[3 max]***

(e) rats with adaptations survive better in low oxygen conditions / *vice versa*;
are able to reproduce (more) / *vice versa*;
adaptations are genetically determined / inherited by offspring;
leave more offspring to pass on genes/characteristics/traits;
the frequency of the allele in the genetic pool will tend to increase;
the characteristic of the species gradually changes; ***[3 max]***

2. (a) I: liver;
II: stomach;
III: pancreas;
IV: large intestine/(descending) colon; ***[2 max]***
*Award **[1]** for every two correct, up to **[2 max]**.*

(b) amino group properly drawn;
acid group properly drawn;
C with H and R group attached; *(no labels are required)*

e.g.



;

[2 max]

*Award **[2]** if three are correct, **[1 max]** if two are correct and **[0]** if one is correct.*
N.B. *A condensed formula is acceptable which shows H_2N- and -COOH instead of the expanded amino group and carboxyl group attached to the central carbon atom; N atom of amino group must be joined to central C atom.*

(c) each enzyme has an optimum pH where enzyme functions best / drawing of bell curve with optimal pH labelled;
changes in pH (from optimum pH) decrease activity/effectiveness;
pH slightly changes the shape of the active site / tertiary structure of protein changed / enzyme denatured;
more difficult to form enzyme-substrate complex; ***[2 max]***
N.B. *Accept above marking points if given through a specific example such as pepsinogen conversion to pepsin when pH is lowered.*

(d) microvilli increase surface area of absorption;
epithelium/one layer of cells provides a thin layer to enhance absorption/small distance for diffusion;
protein channels (in membrane of microvilli) allow facilitated diffusion;
mitochondria (for energy) present for active transport;
blood capillaries close to epithelium/surface membrane reduce distance/increase speed for diffusion;
blood capillaries carry away glucose/amino acids/nutrients;
lacteal carry away fats / fatty acids / glycerol; ***[3 max]***
Accept any of the above points in a clearly drawn annotated diagram.

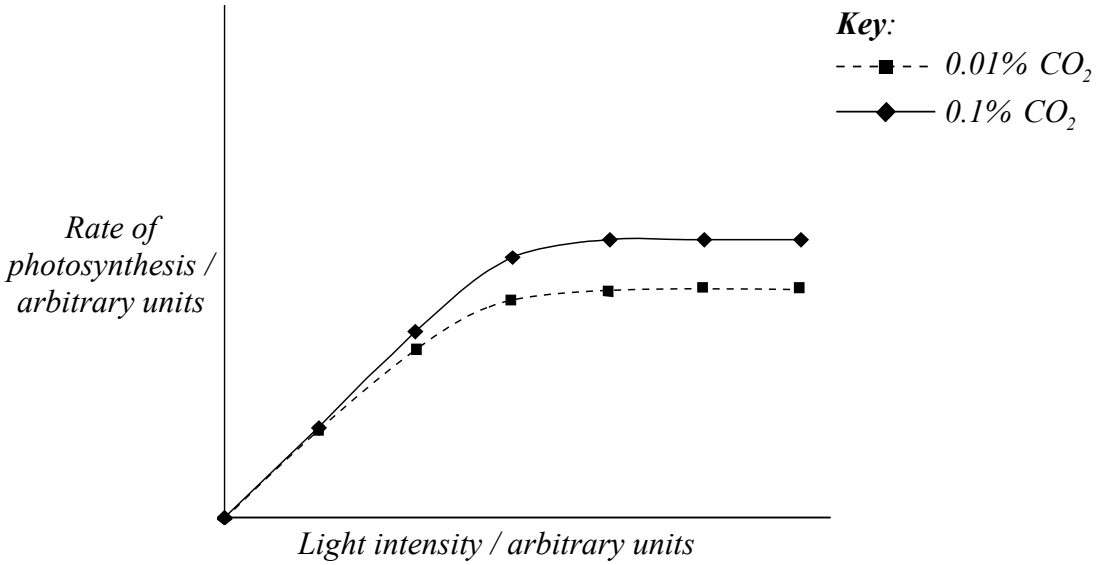
3. (a) charge;
size (smaller move more than large); ***[1]***
*Award **[1]** if both correct.*

(b) *from mother*: B;
from father: E; ***[1]***
*Award **[1]** if both correct.*

(c) son 1 ***[1]***

(d) criminal investigations to confirm suspects / rape cases / tracking individuals in populations ***[1]***
Any other suitable examples.
N.B. *"Criminal investigation" is not enough.*

4. (a)



*Award **[1]** for plot with similar shape but <u>lower plateau</u>.* ***[1]***

(b) *oxygen*:
released / waste product (through stomata) / used in respiration / specific reference to where used in respiration;

hydrogen:
used in production of organic molecules/sugars / to fix/combine with carbon dioxide / specific reference to where used in photosynthesis; ***[2]***

(c) ***N.B.*** *Action verb is "explain" so reasoning must be given for each marking point.*
material not consumed because of death;
material not eaten (*e.g.* bones / hair);
material not assimilated is defecated;
heat loss <u>through respiration</u>;
excretion of <u>organic molecules</u> *e.g.* urea; ***[2 max]***

SECTION B

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

5. (a) cheaper;
easy to carry for field studies / portable;
material is easily prepared / setting up microscope is simple;
images can be in colour;
a larger field of view;
material can be kept alive;
movement can be seen; ***[5 max]***

(b) as size increases both surface area and volume increase, but volume increases more / ratio of surface area to volume decreases as size of cell increases;
rate of metabolism is a function of its mass to volume ratio;
surface area limits/affects the rate at which substances can enter (or leave) the cell;
volume determines the rate at which material is produced/used;
oxygen/nutrients/substances will take too long to diffuse into/out of the centre of the cell if it is too big;
excretory products would take too long to be eliminated;
heat will take too long to be eliminated;
example of cell adaptation to increase the ratio of surface area : volume *e.g.* root hair cell; ***[7 max]***

(c) *organelle*: discrete/individually distinct structure/body <u>within a cell</u>;
some enclosed in their own membrane;
ribosomes: protein synthesis;
golgi apparatus: processing/packaging of proteins/modifying proteins;
lysosomes: digestion/destruction of worn out organelles/foreign bodies/cell suicide;
mitochondrion: production of energy/ATP / aerobic respiration;
rough endoplasmic reticulum: synthesis of proteins (which are secreted); ***[6 max]***

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

6. (a) ovaries;
oviducts/fallopian tubes, if frontal view they must surround but not connect to ovary, but must connect to uterus / if side view only one ovary need be shown with one oviduct/fallopian tube shown as flared/widened at end near ovary;
uterus, which should be larger than ovary and show thickness in walls;
cervix, positioned at base of uterus;
vagina; ***[4 max]***
*Award **[1]** for any of the above if clearly drawn and correctly labelled diagram.*

(b) definition of contraception;
name of contraception;
description of type of method (*e.g.* mechanical, chemical, behavioural or surgical);
description of method/apparatus;
description of use;
effect on body;
advantage;
advantage;
advantage;
disadvantage;
disadvantage;
disadvantage; ***[8 max]***
Answers must have at least one advantage for and one disadvantage against to receive full marks.

e.g.
contraception is having sexual intercourse without getting pregnant;
condom;
a condom is a mechanical method;
it is a strong sheath of rubber/plastic placed on the penis;
it is placed on before intercourse and removed after;
does not allow the sperm to reach the ova / prevents fertilization;
prevents the birth of unwanted children;
prevents transmission of sexually transmitted diseases (*e.g.* gonohorrea);
avoid the birth of children from parents with genetic diseases;
promiscuity might be encouraged;
wrong to intervene in natural processes;
some people are allergic to plastics;
religious reasons;
rate of failure / false sense of security;

(c) level of progesterone falls;
oxytocin is produced;
causing contraction of uterus;
contractions increase by positive feedback;
contractions result in more oxytocin production;
cervix relaxes and becomes wider;
amniotic sac bursts;
baby pushed (head first) through cervix/vagina and is born;
umbilical cord is severed/ruptured;
placenta is expelled / afterbirth; ***[6 max]***
*Award **[4 max]** if no reference to named hormones.*

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

7. (a) both are nucleic acids/long polynucleotides;
both composed of pentose sugars, phosphate groups and nitrogenous bases;
DNA has two strands and RNA one;
DNA contains deoxyribose sugar and RNA has ribose sugar;
DNA contains thymine and RNA contains uracil;
both contain adenine, cytosine, and guanine;
DNA is helical and RNA is not; ***[5 max]***
N.B. *Names, not letters, are required for nitrogenous bases.*

(b) production of new DNA;
semi-conservative;
one old strand and one new strand;
double helix unwound/separated;
by breaking of H-bonds;
by helicase (enzyme);
single strand acts as a template / blueprint;
free bases form H-bonds with complementary bases / A with T, C with G;
nucleotides linked;
by DNA polymerase;
daughter DNA molecules rewind;
daughter strand identical to parent strand; ***[8 max]***
Accept any of the above points in a clearly drawn annotated diagram.

(c) *Award **[3 max]** for description*:
genetic code determines how the base sequence of mRNA is expressed as amino acid sequences;
genetic code is a triplet code;
series of bases on mRNA;
three bases code one amino acid;
a group of three bases is called a codon;
there are 64 codons;

*Award **[2 max]** for definition*:
degenerate: two or more codons code for same amino acids;
universal: all living organisms have this code; ***[5 max]***

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