



MARKSCHEME

November 2013

BIOLOGY

Standard Level

Paper 2

12 pages

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Subject Details: Biology SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A [**30 marks**] and **ONE** question in Section B [**20 marks**]. Maximum total = [**50 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 underlined 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 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.

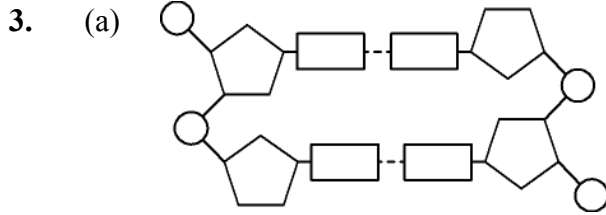
Structure of answer:

*The candidate has linked relevant ideas to form a logical sequence **within** at least two parts of the **same question** (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.).*

SECTION A

1. (a) type I caused by destruction of insulin secreting cells/beta cells (in pancreas) / insufficient insulin produced / genetic disorder resulting in failure to produce insulin;
 type II caused by decreased response of body cells/receptors to insulin (that is produced);
 type I early onset while type II adult onset;
 type I treated with insulin while type II with diet (lifestyle changes); [2]
- (b) negative/inverse relationship/negative correlation / as one variable increases the other decreases / as plasma fatty acid increases, enzyme activity decreases / *vice versa* [1]
- (c) (a decrease of) 45 (%) (*accept answers in the range of 44 (%) to 47 (%)*) [1]
- (d) yes, effect is reversible as activity returns to (approximately) original level (when lipids/fatty acids decrease);
 when lipid/fatty acids washed out enzyme is more active/activity increases;
 difference between starting and final levels of enzyme activity is insignificant because of error bars;
 three hours/experimental time may be insufficient to reverse the effect; [2 max]
- (e) 300 [1]
- (f) increased insulin concentration causes more glucose absorption (up to $10^3 \mu\text{U ml}^{-1}$);
 glucose absorption in muscle bathed in lipid always less than control;
 no further increase/slight decrease in glucose absorption beyond $10^3 (\mu\text{U ml}^{-1})$ insulin; [2 max]
- (g) *Referring to first graph:*
 plasma lipids lower activity of enzyme (needed for glucose absorption);
- Referring to second graph:*
 more/higher glucose uptake with higher insulin levels in muscles without lipids (compared to muscles bathed in lipids);
 lipids reduce glucose absorption (even at raised insulin concentrations);
 isolated muscle used in experiments so results may differ in whole organisms; [2 max]

2. (a) (i) *Award [1] for any two of the following correctly labeled.*
- I. ribosomes
 - II. nucleus (*do not accept nuclear membrane*)
 - III. mitochondrion
 - IV. plasma/cell membrane *[2 max]*
- (ii) ATP production/site of aerobic respiration (*do not accept energy production*) *[1]*
- (b) (protein) material transported by vesicles;
from rER to Golgi apparatus/complex/body/membrane;
vesicles bud off from rER/fuse with Golgi membrane (due to membrane fluidity); *[2 max]*
Do not accept vacuole(s).



correctly shows two antiparallel sugar-phosphate strands/backbones with linkages between phosphates and sugars connected through bases; (*phosphate and simple names such as sugar and base are acceptable labels. They must be given at least once.*)

correctly labeled phosphate and deoxyribose and base;

sugar linked to phosphates through correct pentagon corners/(5'–3') linkages;

shows complementary base pairs of A-T/Adenine–Thymine and G-C/Guanine–Cytosine;

correctly indicates both covalent/phosphodiester and hydrogen bonds;

[3 max]

(b) DNA replication is semi-conservative/daughter DNA molecule contains one parent strand and one new strand;

unwinding of double helix/separation of two strands by helicase;

separated (parent) strands become templates for new strands;

free/single nucleotides join (parent/template) strands through complementary base pairing;

DNA polymerase joins nucleotides in new strands;

[3 max]

Award [3] for the above points clearly shown in an annotated diagram.

4. (a) (i) amniocentesis/sampling amniotic liquid/fluid (via needle)/chorionic villus sampling

[1]

(ii) chromosomes are grouped by pairs according to size and structure/band pattern/location of centromeres

[1]

(iii) metaphase/late prophase of mitosis

[1]

(b) male has (one X and) one Y chromosome / X chromosome is bigger than Y chromosome;

non-disjunction leads to three copies of chromosome 13/trisomy 13;

[2]

(c) (i) Punnett grid shows the gametes (A and a) on one axis and the gametes (A and a) on the other axis and genotypes (AA, Aa, Aa, and aa) of offspring;

AA/homozygous dominant and Aa/heterozygous (show normal pigmentation); *Both needed*

[2]

Do not award marks to any answer suggesting sex linkage.

(ii) $\frac{1}{4}$ /25%/0.25 probability of albinism / 1 in 4 chance

[1]

SECTION B

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

5. (a) CO₂ in atmosphere/air;
plants/producers linked to carbon in air/CO₂ with arrow labeled photosynthesis;
plants/consumers linked to animals/consumers with arrow labeled feeding;
plants/producers and animals/consumers linked to carbon in air/CO₂ with arrow labeled (cell) respiration;
plants/producers and animals/consumers linked to decomposers/bacteria/fungi with arrow labeled death;
decomposers/bacteria/fungi linked to carbon in air/CO₂ with arrow labeled (cell) respiration;
plants/producers connected to carbon in air/CO₂ with arrow labeled combustion/forest fire;
decomposers/bacteria/fungi linked to fossil fuels/coal/oil/natural gas with arrow labeled (partial) decomposition;
fossil fuels/coal/oil/gas linked to carbon in air/CO₂ with arrow labeled combustion;

[5 max]

Award marking points only if arrows point in correct direction).

- (b) correct equation for photosynthesis in words or symbols;
measure production of oxygen;

example of method to measure oxygen production;

(eg count bubbles from water plant/collect oxygen data per unit of time using electronic sensors/probes)

measure uptake of CO₂;

example of method; *(eg method of measuring (aquatic) pH changes/shift per unit time)*

measure increase in biomass;

example of method; *(eg sample (dry) mass of crop before and after timed period)*

not possible to measure water uptake since water is transpired/used in turgidity/many chemical processes;

another valid method if concept of rate (measurements per time) is included;

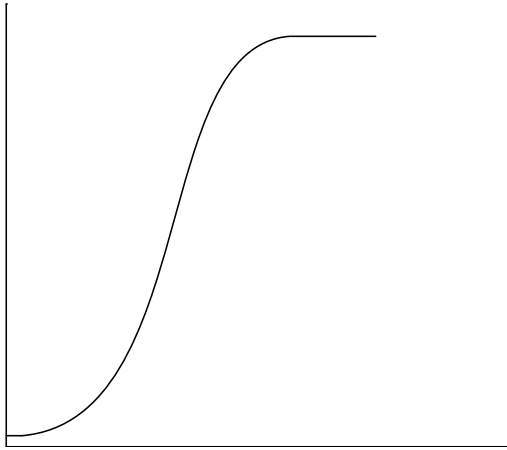
[6 max]

- (c) air enters/exits lungs through trachea, bronchi and bronchioles;
during inspiration/inhalation external intercostal muscles contract;
causing ribs to move upwards/outwards;
during inspiration diaphragm contracts/flattens;
causes increase in volume of thorax/lungs;
decrease in pressure allows air to enter (passively);
during expiration internal intercostal muscles contract/external intercostal muscles relax;
causing ribs to move down/in;
diaphragm relaxes/returns to original domed position;
abdominal muscles contract to push diaphragm up;
causes decrease in volume of thorax/lungs;
increase in pressure forces air out of lungs;
Award [5 max] for inhalation or exhalation only.

[7 max]

(Plus up to [2] for quality)

6. (a)



S-shaped curve correctly drawn; } (eg does not fold back on itself)

y-axis labelled as population/number of individuals and x-axis labeled as time/ years etc; } (both axes must be correctly labelled)

exponential/log growth indicated at point where rate is increasing;

transitional phase indicated at point where rate is decreasing;

plateau phase; *Do not accept carrying capacity*

[4 max]

(b) overpopulation/overproducing (of offspring) leads to competition for limited resources/struggle for survival;

example of limited resource; (eg water/space/food)

not all can survive / less adapted will die/migrate;

some varieties/individuals more suited for environmental conditions;

they are more likely to survive and reproduce;

this is natural selection;

increase chances/spread of disease in population;

waste products of the population may reach toxic levels;

may exceed carrying capacity leading to population crash;

Do not accept references between species.

[6 max]

- (c) FSH (released from pituitary) stimulates follicle growth (in ovary);
oocytes/egg cells mature;
cells of growing follicle produce estrogen;
estrogen signals endometrium/lining of uterus to thicken;
causes final maturation of follicle;
high levels of estrogen stimulate secretion of LH;
LH spike stimulates ovulation/follicle ruptures releasing oocyte/ova/egg cells;
LH stimulates follicle (left behind in ovary) to develop into corpus luteum;
LH stimulates corpus luteum to secrete progesterone/estrogen;
progesterone/estrogen stimulates continued development/maintenance of lining of uterus (in preparation for implantation of embryo);
if no pregnancy then corpus luteum disintegrates;
drop in progesterone/estrogen hormone levels causes breakdown in uterine lining/menstruation;
progesterone/estrogen inhibit FSH/LH release;

[8 max]

(Plus up to [2] for quality)

7. (a) *Award [1] for each of the following clearly drawn and correctly labelled.*
phospholipid bilayer; *(double row of opposing phospholipids, tails to inside)*
hydrophilic/phosphate/polar (heads) and hydrophobic/hydrocarbon/fatty acid/non-polar (tails) labeled;
integral protein; *(embedded in the phospholipid bilayer)*
protein channel/channel protein; *(integral protein showing clear channel/pore)*
peripheral protein; *(shown on surface or slightly embedded on either side)*
glycoprotein; *(with carbohydrate attached on outer side)*
cholesterol; *(shown embedded in bilayer and smaller than the hydrophobic tail)* **[4 max]**
- (b) enzyme shape is specific to (particular) substrate;
lock and key analogy/model;
example of specific enzyme and substrate;
has specific 3-D/tertiary configuration/3-D/tertiary shape essential to functioning;
active site on enzyme binds to substrate;
substrate and active site complementary/fit together;
(substrate and active site) are complementary due to structure/chemical attraction;
enzyme-substrate complex forms;
denaturation changes enzyme's binding ability (to specific substrate); **[6 max]**
Award [6] for the above points clearly shown in an annotated diagram.
- (c) synapse is gap between adjacent neurons;
(arriving) action potential depolarizes pre-synaptic membrane;
opens (voltage-gated) calcium channels in membrane;
causes influx of calcium ions;
causes synaptic vesicles to fuse with pre-synaptic membrane;
vesicles release/exocytose neurotransmitter into the synaptic cleft;
neurotransmitter diffuses/moves across synaptic cleft;
neurotransmitter binds to receptors on post-synaptic membrane;
opens channels allowing sodium ions/potassium ions to diffuse;
initiation of action potential/depolarization in post-synaptic membrane;
removal/breakdown of neurotransmitter stops effect on post-synaptic membrane; **[8 max]**
Award any of the above points for a clearly drawn correctly annotated diagram.

(Plus up to [2] for quality)