



MARKSCHEME

May 2013

BIOLOGY

Standard Level

Paper 2

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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.).*

- ♦ 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) positive/direct relationship / correlation (in all four groups) / (all four groups) accumulated fat over time [1]
- (b) body fat accumulation increased over time for all four groups;
fructose caused the (significantly) greatest accumulation of fat and } (both
water the least; } needed)
sucrose and artificial sweetener/diet soft drink had the same increase;
sucrose, artificial sweetener and water did not start accumulating fat until after 20
days while fructose increased from the beginning; [2 max]
- (c) glucose-fed group has no/little increase in triglycerides while fructose-fed group
has a (large) increase;
glucose-fed group has smaller variability than the fructose-fed group;
more triglycerides in fructose-fed group than glucose-fed group (from week 2 to
week 10); [2 max]
- (d) diabetes type II / late/adult-onset diabetes [1]
Do not award mark for type I diabetes.
- (e) glucose has a much greater range of uptake / *vice versa*;
but a (much) lower mean/uptake / *vice versa*;
there is no overlap (so there is clear evidence); [2 max]
- (f) fructose [1]
- (g) cancer is uncontrolled mitosis/cell division;
sugar is an energy source/nutrient needed for mitosis/cell division;
ribose is used to produce nucleic acids/DNA/RNA;
production of nucleic acid is necessary for mitosis; [2 max]
- (h) evidence that fructose causes (body) fat accumulation/obesity;
evidence that fructose is related to increased (blood) triglycerides which are
correlated with obesity/coronary heart disease;
evidence that fructose is related to reduced insulin sensitivity/diabetes;
evidence that fructose is used in ribose synthesis but no clear evidence that fructose
causes pancreatic cancer; [3 max]

2. (a) (i)

	<i>recessive allele</i>	<i>dominant allele</i>	<i>codominant allele</i>
<i>heterozygous genotype</i>	no	yes	both/yes;
<i>homozygous genotype</i>	yes	yes	yes;

[2]

Award [1] for each correct row.

(ii) (alleles for blood groups) A and B / I^A and I^B [1]

(b) a correct representation of the alleles eg X^N normal, Xⁿ dark and Y;
 Punnett grid including four cubs' correct genotypes, showing sex linkage;
 female genotype X^N Xⁿ; [3]
 Do not allow ECF.
 Accept other suitable alternatives for ^{Nn} on the X.

3. (a) natality / increased birth rate;
 immigration;
 extra food/water / breeding sites;
 expanding habitat;
 lack of predators/disease/parasites / reduced death rate; [2 max]

(b) more are born than can survive;
 there is variety/variability in the offspring;
 competition for resources / struggle for survival / selection pressure;
 only the most able/adapted survive / survival of the fittest;
 the survivors reproduce and pass on genes;
 genes of less able/adapted are eliminated / change in the gene pool;
 natural selection occurs; [4 max]

4. (a) magnification = measured length of bar ÷ actual size bar represents / 4 mm ÷ 1 μm /
 spore micrograph size ÷ real size / *OWTTE*;
 × 4000; [2]

(b) rate of exchange of materials/gas/energy is a function of its surface area;
 rate of production of heat/waste/resource consumption is a function of its volume;
 surface area to volume ratio decreases with increase in size / *OWTTE*;
 at low surface area to volume ratios, exchange of materials takes longer/reduced
 efficiency of exchange / *vice versa*; [2 max]

SECTION B

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

5. (a) *eg source: pancreas;
substrate: triglycerides / lipids / fats / oils;
product: glycerol and (three) fatty acids; (both needed)
optimal pH:8; (accept answers in the range of 7 to 8) [4]
Accept other correct examples.*
- (b) plasmids are removed/obtained from bacteria;
endonuclease/restriction enzymes cut the plasmids at target sequences;
DNA fragments of other organism are cut with the same restriction enzymes;
in both DNA and plasmid, complementary sticky ends/staggered cut are produced;
DNA segment added to the opened plasmid;
spliced together by ligase;
reverse transcriptase makes DNA copies of mRNA / DNA polymerase to increase the amount of DNA;
recombinant plasmids inserted into new/host cells;
cultured/cloned to produce the new genes/more genetically modified cells; [6 max]
*Award [3 max] if no specific enzyme names are given.
Do not accept the word “enzyme” on its own.*
- (c) *pH:*
enzymes have an optimal pH/work best at a given pH;
activity increases as pH gets closer to optimal pH;
extreme pH denatures enzymes;
by breaking bonds / changing enzyme shape/structure / active site shape/structure;
- substrate:*
as substrate concentration increases, activity increases;
as substrate concentration increases, the collisions between substrate and enzyme increase;
up to a maximal level of action / reaching a plateau;
all active sites are saturated/occupied;
- temperature:*
enzymes have an optimal temperature (where they work most effectively);
activity increases as it gets closer to optimal temperature;
high temperatures stop enzyme activity due to irreversible changes in structure /denaturation;
by breaking bonds / changing enzyme shape/structure / active site shape/structure; [8 max]
- Award any of the above points in an annotated graph.
Award up to [8] if all three addressed and [6 max] if only two addressed.*

(Plus up to [2] for quality)

6. (a) *lysosome*:
(from Golgi apparatus) with digestive enzymes / break down food/organelles/ cell;

Golgi apparatus:

site that processes/modifies/packages and releases proteins;

free ribosomes:

site of synthesis of proteins (released to cytoplasm);

plasma membrane:

controls entry and exit of materials/substances in cell;

rough endoplasmic reticulum:

synthesis and transport of proteins; (*both needed*)

[5]

- (b)

aerobic	anaerobic
requires oxygen	no oxygen;
(in cytoplasm and) mitochondria	in cytoplasm;
Krebs cycle	no Krebs cycle;
large yield of ATP/energy	small yield of ATP;
CO ₂ and water (<i>both needed</i>)	lactate (animals);
	ethanol + CO ₂ (yeast/plants); (<i>both needed</i>)

[4 max]

Award [1] for each contrasting characteristic.

Table format is not necessary for the marks.

- (c) inspiration/inhalation brings air into lungs;
external intercostal muscles contract;
and move rib cage upwards and outwards;
diaphragm flattens/contracts;
increasing thoracic volume;
pressure decreases from atmospheric pressure so air rushes into lungs;
expiration/exhalation forces air out;
internal intercostal muscles contract / external intercostal muscles and diaphragm relax;
abdominal/abdomen wall muscles contract and push diaphragm upwards;
decreasing thoracic volume;
increasing pressure in lungs so air is forced out;
a concentration gradient between air sacs and blood needs to be maintained;

[9 max]

(Plus up to [2] for quality)

7. (a) energy is gained through photosynthesis;
 glucose (from photosynthesis) stored as starch;
 starch stored in chloroplast;
 starch stored as starch granules;
 (starch stored) in seeds/storage roots/stem tubers;
 stored as lipids/oils;
 (lipid/oils storage) in seeds;
 lipids store twice as much energy per gram as starch; [4 max]
- (b) pyramid of energy shows the flow of energy from one trophic level to the next (in a community);
 units of pyramids of energy are energy per unit area per unit time/ $\text{kJ m}^{-2} \text{yr}^{-1}$;
 bar width is proportional to the energy stored (in the biomass) in that trophic level;
 the first/lowest trophic level is producers;
 second level is primary consumers/herbivores;
 third level of secondary consumers/carnivores;
 only a small amount (10 to 20 %) of energy of one level is passed to the next;
 bar width/energy stored in the trophic level decreases (proportionally) as you go up each level;
 pyramid shows that there is a limit to the length of food chains; [6 max]
Award any of the above marking points to a correctly drawn and clearly labelled pyramid.
- (c) normal body core temperature constant/ 36.5 to 37.5 °C; } (accept single values
within this range)
 regulated by negative feedback/homeostatic mechanisms;
 hypothalamus is the centre of thermoregulation;
 hypothalamus sends impulses to the body to increase/decrease temperatures;
 release of sweat (by sweat glands in the skin) if skin temperature rises;
 evaporation of water cools the body; (*concept of evaporation must be mentioned*)
 heat is transferred by blood;
 transfer of heat from body core in blood to surface;
 if temperature rises, increased flow of blood/heat to the skin/vasodilation of skin blood vessels/arterioles; } (do not accept
veins, arteries
or capillaries)
 if temperature drops, decreased flow of blood/heat to the skin/vasoconstriction of skin blood vessels/arterioles; } (do not accept
veins, arteries
or capillaries)
 shivering increases heat production (in muscles);
 example of one behavioural mechanism; } (eg reducing activity (to lower body
temperature) / reducing exposed
surfaces (to reduce heat loss) [8 max]

(Plus up to [2] for quality)