



MARKSCHEME

November 2009

BIOLOGY

Standard Level

Paper 2

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General Marking Instructions

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. 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 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 writing **OWTTE** (or words to that effect).
8. 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.
9. Only consider units at the end of a calculation. Unless directed otherwise in the mark scheme, unit errors should only be penalized once in the paper.

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:

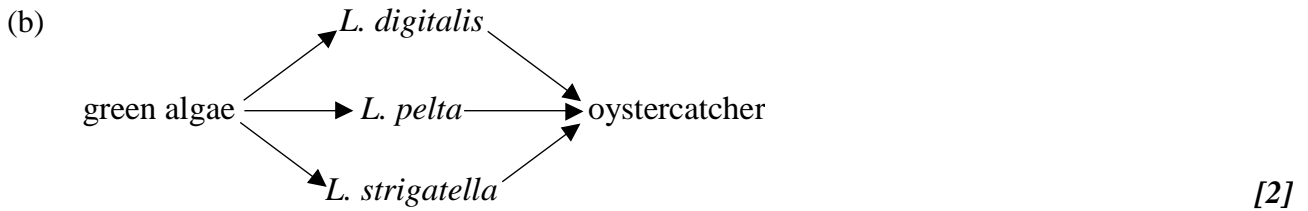
The candidate has made a serious and full attempt to answer all parts of the question and the answers are expressed clearly enough to be understood with little or no re-reading.

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.).*

SECTION A

1. (a) total number of limpets increased [1]



Award [1 max] if arrow direction reversed.

Award [1 max] for a correct food chain from green algae to named species/limpet to oystercatcher.

(c) *L. strigatella* decrease when oystercatchers excluded;
could be due to increase in number of *L. digitalis*;
increased competition/predation (for *L. strigatella*);
less food/green algae (for *L. strigatella*);
less habitat available (for *L. strigatella*); [3 max]

(d) (i) X at 4th location going anticlockwise from top right [1]

(ii) Y at 8th, 9th or 11th location going anticlockwise from top right [1]

(e) (overall) decline in limpet population;
in no location has the population increased;
greatest decrease in numbers at most northern/western locations;
in many/some/quantitative value locations the population has not changed; [2 max]

(f) more predation of the limpets than before;
less food available;
less habitat available;
more competition from other species;
water/air too warm for their metabolic activities/other specific reason;
water pollution / toxins; [2 max]

2. (a) (i) hydrogen [1]

(ii) covalent / phosphodiester linkage [1]

(b) DNA has deoxyribose, RNA has ribose;
DNA has base T/thymine, RNA has base U/uracil; [2]
Do not accept double or single strands as chemical structure.

(c) tRNA attaches to (specific) amino acid;
tRNA (with amino acid) moves to the ribosome;
anticodon of tRNA binds with codon of mRNA; [2 max]

3. (a) stomach [1]
- (b) enzymes speed up the digestive processes;
(chemical) break down of food/food particles/large molecules;
make soluble products/molecules small enough to be absorbed; [2 max]
- (c) to (re)absorb water/vitamins(s) (e.g. K and B12) / temporary storage of feces [1]
- (d) **N.B.** for each marking point, function should accompany structure.
shape of villus has large surface area to improve absorption / microvilli increase surface area to improve absorption;
thin walls/epithelium to allow fast diffusion;
capillaries/rich blood supply (nearby) to absorb digested food products/ maintain concentration gradient;
lacteal in villus to absorb fatty acids/fats (and carry them away from small intestine);
protein pumps in membrane to carry on active transport / channel proteins in membrane to facilitate diffusion;
large number of mitochondria provide ATP for active transport; [3 max]
4. (a) letter U marked/labelled on uterus [1]
Accept in lumen or on wall.
- (b) formation of the corpus luteum [1]
- (c) allows characteristics from both parents to appear in offspring;
crossing over (during prophase 1) changes chromosome composition;
produces gametes which are all different;
random chance of which sperm fertilizes ovum;
greater variation (resulting from sexual reproduction) favours survival of species through natural selection; [3 max]
Accept independent assortment during meiosis from AHL.

SECTION B

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

5. (a) Award [1] for each structure clearly drawn and correctly labelled.

- phospholipid bilayer – with head and tails;
hydrophilic/phosphate/polar heads and hydrophobic/hydrocarbon/fatty acid/
non-polar tails labelled;
- integral protein – embedded in hydrophobic region of the phospholipid bilayer;
- protein channel – integral protein showing clear channel/pore;
- peripheral protein – on the surface;
- glycoprotein with carbohydrate attached on outside;
- cholesterol – shown embedded in bilayer;
- thickness indicated (10 nm); (allow 7 nm to 13 nm)

[5 max]

(b)

passive	active
diffusion / osmosis / facilitated diffusion	active transport / ion pumps / exocytosis / pinocytosis / phagocytosis
a second passive method (from above)	a second active method; (from above)
does not require energy	requires energy/ATP;
down concentration gradient	against concentration gradient;
no pumps needed	requires protein pumps;
oxygen across alveoli / other example	glucose absorption in ileum / other example;

[4 max]

Both the passive and active movements must be contrasted to receive a mark. Award [3 max] if no examples are given. Responses do not need to be shown in a table format.

- (c) water is transparent / light passes through water;
this allows organisms to live below the surface / plants to photosynthesize;
hydrogen bonds between water molecules make water cohesive;
this gives water a high surface tension allowing animals to live on the surface / maintains lung structure (pleural membranes);
helps in water movement through plants/transpiration;
water has a high latent heat of vaporization / OWTE;
evaporation/sweating/transpiration leads to cooling;
water has a high specific heat capacity / OWTE;
this provides a stable environment for water organisms;
water is a universal solvent;
can transport materials around organisms/plants/animals;
can be a solvent for chemical reactions in organisms;
ice is less dense than water / water has a maximum density at 4°C;
surface (pond/lake/ocean) freezes first, allowing organisms to survive in the water below;

[9 max]

Accept hydrogen bonds between water and other substance makes water adhesive from AHL.

(Plus up to [2] for quality)

6. (a) *Award [1] for each structure clearly drawn and correctly labelled.*
trachea;
bronchi;
bronchioles;
lungs;
alveoli – shown enlarged as inset;
diaphragm;
intercostal muscles;
abdominal (wall) muscles; **[4 max]**
Award [3 max] for diagrams that do not show correct connections or proportions.
- (b) anaerobic (cell) respiration in the absence of oxygen;
glycolysis / breakdown of glucose molecules;
leads to the production of pyruvate;
also known as fermentation;
production of small yield/two ATP (molecules per molecule of glucose respired);
produces ethanol;
produces carbon dioxide;
occurs in cytoplasm;
example of anaerobic respiration in plants (*e.g.* waterlogged roots); **[5 max]**
- (c) maintaining the internal environment constant/between narrow limits;
example (other than blood sugar) of blood pH / oxygen and carbon dioxide concentrations / body temperature / water balance;
involves negative feedback;
where a variation from the normal (blood sugar level) triggers the correction mechanisms;
controlled by both nervous and endocrine systems;
blood sugar above normal stimulates insulin release;
insulin secreted by β cells in the (islets of the) pancreas;
insulin lowers blood sugar;
by converting to glycogen/fat / increased respiration;
blood sugar below normal stimulates glucagon release;
glucagon secreted by α cells in the (islets of the) pancreas;
glycogen converted to glucose;
causes increased level of glucose in the blood; **[9 max]**

(Plus up to [2] for quality)

7. (a) cells undergoing mitosis are used for karyotyping;
process of mitosis is stopped at (mitotic) metaphase;
chromosomes (cut from photographs) are arranged in pairs of similar structure/
homologous chromosomes;
allows abnormalities in the chromosome number/appearance to be seen;
any valid example (*e.g. in Down syndrome / gender of fetus*);
detected by identifying unique feature (*e.g. trisomy 21 / one extra chromosome / 47 chromosomes*); **[4 max]**
Award [3 max] for an example with no description of karyotyping.
- (b) restriction enzymes/endonucleases cut a small fragment of DNA from an organism;
same restriction enzymes used to cut DNA of plasmid / *e.g. E. coli*;
sticky ends are the same in both cases;
fragment of DNA is inserted into the plasmid;
spliced together by ligase;
to make recombinant DNA/plasmids;
recombinants can be inserted into host cell and cloned; **[5 max]**
- (c) genetic modification is when the DNA/genotype of an organism is artificially changed;
genetic modification alters some characteristic/phenotype of the organism;
named example with modification (*e.g. salt tolerance in tomato plants*);
benefits: [5 max]
allows crops to be grown where they would not grow naturally;
provides more food;
economic benefits;
expands world's productive farmland;
reduces the need to clear rainforests to grow crops;
lowers cost of production;
less pesticides/fertilizers/chemicals needed so better for environment;
Award marks for any valid benefit consistent with a named example.
harmful effects: [5 max]
may be released into natural environment;
may affect food chains / unintended effects on other organisms;
may affect consumers *e.g. allergies/health risks*;
unfair to smaller farmers who cannot compete;
long-term effects are unknown;
risk of cross-pollination;
risk of long-term contamination of soil; **[9 max]**
Award marks for any harmful effect consistent with the named example.

(Plus up to [2] for quality)
