Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2015

Biology

Standard level

Paper 2

12 pages

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.

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.

Section A

1. (a) *autumn 2008*: 175 mm ***to*** 180 mm; *(accept either 175 mm or 180 mm – do not accept in between values)*
winter 2009: 250 mm ***to*** 255 mm; *(accept either 250 mm or 255 mm – do not accept in between values)*
(both needed) **[1]**

(b) a. shorter salmon in autumn 2008 / longer salmon in winter 2009;
b. wider range of length in fish collected during autumn;
c. higher peaks in winter compared to autumn; **[2 max]**
Accept numerical values if clearly stated that one is bigger than the other.

(c) genetics/gender/ food availability/diet/water temperature/predators/age **[1]**

(d) (i) a. both show direct/positive correlation/linear relationship;
b. values for fish collected in winter 2009 are higher than for autumn 2008;
c. many common values in both sets of data;
d. differences between winter and autumn may not be significant because of the overlapping data; **[2 max]**
*Award **[1 max]** if only similarity or difference provided.*

(ii) difficult because of overlap in fork length between juvenile and ocean age one *O. nerka* / total protein depends on fork length/size, not (only) age, so difficult to predict **[1]**

(e) growth is a result of incorporating protein / larger fish have more protein/more muscle/more cells **[1]**

(f) (i) a. <u>average</u>/<u>mean</u> mercury concentration is higher for shark/lower for monkfish;
b. small number of samples for monkfish (so data less reliable) / large number of samples for shark (so data more reliable);
c. minimum for shark is well below minimum for monkfish / maximum for shark is well above maximum for monkfish;
d. range/standard deviation/variation is greater for sharks; **[2]**

(ii) a. age of fish / details of the method used / chemical form of mercury / part of fish analysed / gender / trophic level of fish;
b. statistical calculations *eg:* t-test/mode;
c. exact location of sampling as some areas of environment may have more mercury pollution than others; **[1 max]**

(g) shark (shows the most deviation/variation) **[1]**

2. (a) 45 000(x) ***or*** (x)45 000 *(accept answers in the range of 44 000 to 46 000)* **[1]**

(b) binary fission **[1]**

(c) effective against bacteria, but not viruses **[1]**

(d) (i) an organism that secretes enzymes in dead organic matter and absorbs its nutrients/products of digestion **[1]**

(ii) decomposer / recycle nutrients / break down organic material into inorganic material **[1]**
Do not just accept "recycle" alone.

3. (a) *X*: plateau phase;
Y: exponential growth / log phase; } *(both needed)* **[1]**

(b) a. the sequence in which fossils appear matches the expected sequence of evolution;
b. comparisons with fossils and living organisms (morphology) shows change in characteristics from an ancestral form / *OWTTE*;
Vestigial organs and homologous structures are acceptable answers.
c. fossils of extinct species show that (evolutionary) change has occurred;
d. fossils can be dated with radioisotopes / geological depth/strata indicates (relative) age/date of organism;
e. can yield DNA for molecular clock analysis;
f. example of any of the above can earn one mark (*eg*: reptiles follow amphibians); **[2 max]**

(c) (i) genotype is the genetic make-up/set of alleles (of an organism) while phenotype is the characteristics (expressed/shown in an organism) **[1]**

(ii) chromosome from bacteria has no protein associated/naked DNA / bacteria is circular, *H. sapiens* is linear / (chromosomes of) *H. sapiens* are much bigger/have many more base pairs than bacteria **[1]**
N.B.: *Answer must refer to "chromosomes" not genomes of the two organisms.*

(iii) 20 % **[1]**

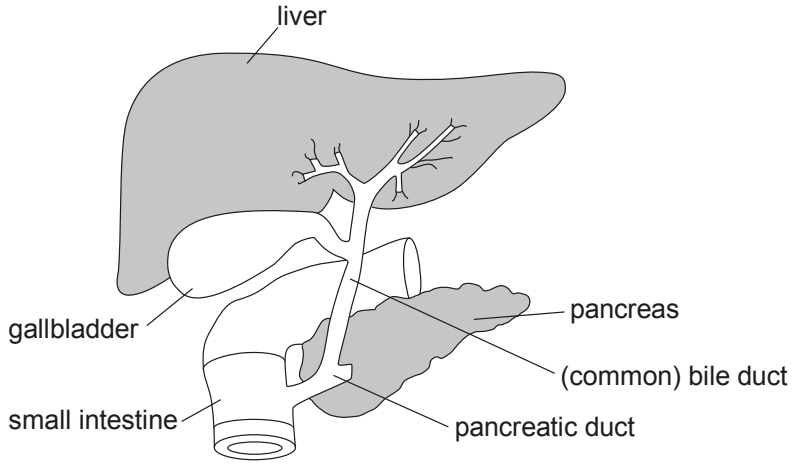
(d) (i) A, B, AB and O **[1]**
All four phenotypes must be shown to award the mark.

(ii) allele I^A and the allele I^B are (co)dominant as they are both expressed in the heterozygote/AB type blood / *OWTTE* **[1]**

4. (a) a. pancreas linked to small intestine by (pancreatic) duct (pancreas and small intestine both must be labelled);
b. gall bladder shown associated with liver and linked to small intestine by (bile) duct, (gall bladder and small intestine must be labelled);
c. showing (bile and pancreatic) ducts joined together before discharging in small intestine; **[2 max]**

Ducts are to be drawn as double line structures.

eg:



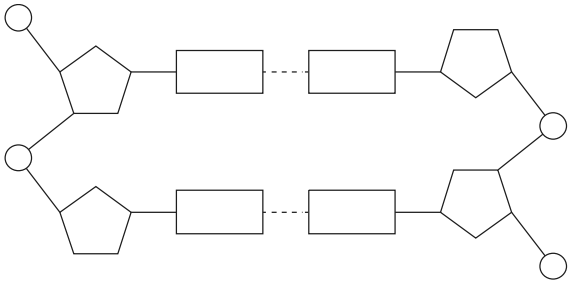
(b) a. (glucagon) released in response to low blood glucose levels;
b. (glucagon) increases blood glucose levels;
c. glucagon leads to conversion of polysaccharides/glycogen (in the liver) to glucose; **[2 max]**
Do not accept implication that glucagon directly converts glycogen to glucose.

(c) starch / glycogen / cellulose **[1]**
*Award **[1]** for any two polysaccharides.*

Section B

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

5. (a) *Award **[1]** for each labelled item shown correctly connected.*



a. phosphate;

b. deoxyribose;

c. (nitrogenous) base / specific name *eg*: adenine/thymine/guanine/ cytosine shown connected to carbon-1;

d. covalent bond / phosphodiester bond;

e. hydrogen bond;
f. nucleotide shown to include phosphate, sugar and base by (shape or label);

g. diagram shows complementary base pairing or A bonded to T, C with G. **[5 max]**

*Award **[3 max]** if the nucleotides are shown in a single strand.*
*Award **[4 max]** if antiparallel structure is not shown.*

(b) a. plasmid used for gene transfer/removed from bacteria;
b. plasmid is a small/extra circle of DNA;
c. restriction enzymes/endonucleases cut/cleave DNA (of plasmid);
d. each restriction enzyme cuts at specific base sequence/creates sticky ends;
e. same (restriction) enzyme used to cut DNA with (desired) gene;
f. DNA/gene can be added to the open plasmid/sticky ends join gene and plasmid;
g. (DNA) ligase used to splice/join together/seal nicks;
h. recombinant DNA/plasmids inserted into host cell/bacterium/yeast; **[5 max]**

(c) a. (genetic) variation in population;
b. (variation is) due to mutation / sexual reproduction;
c. valid example of variation in a specific population;
d. more offspring are produced than can survive / populations over-populate;
e. competition / struggle for resources/survival;
f. example of competition/struggle for resources;
g. survival of fittest/best adapted (to the changed environment)/those with beneficial adaptations / converse;
h. example of changed environment and adaptation to it;
i. favourable genes/alleles passed on / best adapted reproduce (more) / converse;
j. example of reproduction of individuals better adapted to changed environment;
k. alleles for adaptations to the changed environment increase in the population;
l. example of genes/alleles for adaptations increasing in a population;
m. evolution by natural selection;
n. evolution is (cumulative) change in <u>population</u>/<u>species</u> over time / change in allele frequency; **[8 max]**

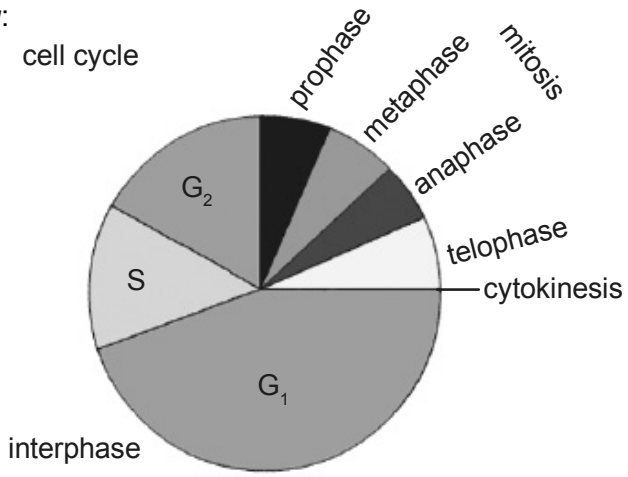
Suitable examples are antibiotic resistance and the peppered moth but any genuine evidence-based example of adaptation to environmental change can be credited.

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

6. (a) a. interphase is the longest phase;
b. interphase includes G_1, S and G_2;
c. in G_1 and G_2 /G phases, cell performs normal functions/protein synthesis/cell grows/organelles are replicated;
d. S/synthesis phase when the DNA replicates;
e. mitosis is when nucleus/genetic material divides;
f. named/described stages of mitosis;
g. cytokinesis: the division of the cytoplasm / formation of two daughter cells; **[5 max]**

*Award **[3 max]** if all three stages (interphase, mitosis and cytokinesis) are not mentioned.*

eg:

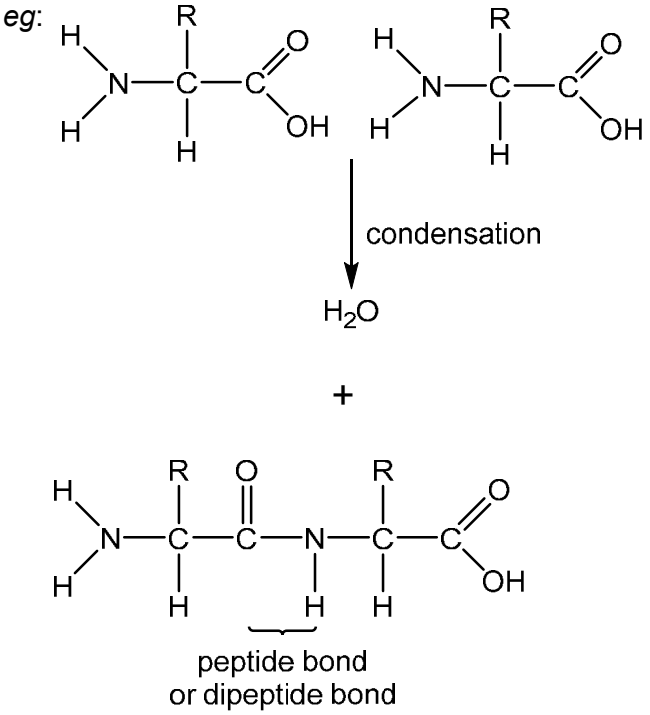


(b) a. translation is the conversion of base sequence on mRNA into an amino acid sequence / *OWTTE*;
b. messenger/mRNA attaches to ribosome (small unit);
c. many ribosome/polyribosomes bind to same mRNA;
d. (mRNA) carries codons/triplet of bases each coding for one amino acid;
e. transfer/tRNA each have specific anticodon;
f. tRNA carries specific amino acid;
g. tRNA anticodon binds to codon in the mRNA;
h. to corresponding triplet base/codon by complementary base pairing / *OWTTE*;
i. a second tRNA (anticodon) binds to next codon;
j. two amino acids bind together / peptide linkage is formed;
k. first tRNA detaches;
l. ribosome moves along mRNA;
m. another tRNA binds to next codon;
n. continues until stop codon is reached;
o. stop codon has no corresponding tRNA (anticodon)/amino acid/causes release of polypeptide; **[8 max]**

(c) a. condensation is joining together two amino acids to form a dipeptide;
b. carboxyl/COOH group of one amino acid reacts with amine/NH_2 group of another / diagrams of two (generalized) amino acids correctly shown;
c. water/H_2O is eliminated;
d. diagram of dipeptide correctly shown;
e. peptide/covalent bond is produced / peptide bond correctly labelled;
f. occurs at the ribosomes;

The above marking points can be award to a clearly annotated diagram.

eg:



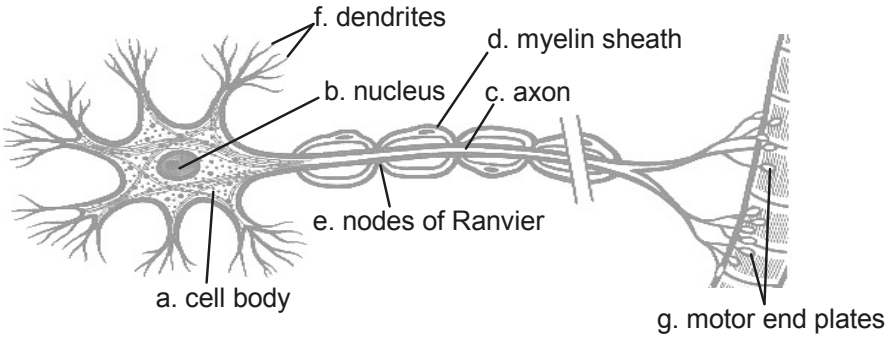
[5]

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

7. (a) *Award **[1]** for each of the following clearly drawn and correctly labelled.*
a. cell body – shown with a nucleus;
b. nucleus correctly labelled;
c. axon – shown as **double line** longer than the longest dendrite;
d. myelin sheath/Schwann cells – surrounding the axon;
e. nodes of Ranvier – shown in axon;
f. dendrites – shown extending from the cell body;
g. motor end plates – not covered by myelin sheath and ending with buttons/dots; **[5 max]**

Award any of the above marking points to clearly drawn annotated diagram.

eg:



(b) a. resting potential is –70 mV / relatively negative inside in comparison to the outside;
b. Na^+/K^+ pumps maintain/re-establish (the resting potential);
c. more sodium ions outside than inside (when at the resting potential);
d. more potassium ions inside than outside (when at the resting potential);
e. nerve impulse is an action potential that stimulates a (wave of) depolarization along the membrane/axon;
f. if neuron is stimulated/threshold potential/–50 mV is reached sodium ion channels open;
g. sodium ions diffuse/move in;
h. (Na^+ move in) causing depolarization;
i. potassium ion channels open / potassium ions diffuse/move out;
j. (K^+ move out) causing repolarization;
k. local currents / description of Na^+ ion diffusion between depolarized region and next region of axon to depolarize; **[8 max]**
Accept any of the above points clearly explained in an annotated diagram.

(c) a. (plasma) membrane encloses/engulfs solid particles/droplets of fluid/molecules;
b. fluidity of the membrane allows endocytosis;
c. (plasma) membrane forms pit/forms indentation/pulled inwards/invaginates;
d. membrane pinches off /seals back on itself/edges fuse;
e. vesicle/vacuole formed;
f. inside of plasma membrane becomes outside of vesicle membrane / converse;
g. vesicle breaks away from plasma membrane/moves into cytoplasm;
h. active process / endocytosis/vesicle formation requires energy; **[5 max]**
Accept any of the above points clearly described in an annotated diagram.

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