M15/4/BIOLO/SP2/ENG/TZ2/XX/M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2015

Biology

Standard level

Paper 2

9 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*).

Section A

1. (a) Toledo **[1]**

(b)
a. in Cayo and/or Toledo the high incidence seems to be associated with rivers;
b. however, along one river in Toledo there is no high incidence;
c. in Belize District there is low incidence along the river / high incidence away from the river;
d. Orange Walk/ Stan Creek there is no clear association;
e. (consequently) association of rivers with high incidence of malaria is inconclusive OWTTE; **[2 max]**

(c)
a. both are stable from 1989 to 1992;
b. both see upward spike in 1992
c. Corozal reaches its peak (one year) earlier / *vice versa*;
d. Toledo rises after 1998 but Corozal continues to decline / Corozal at the end decreases almost to 0, while Toledo still have incidence at the end of the decade;
e. Toledo has a higher incidence (throughout the decade) / *vice versa*;
f. Toledo changes more rapidly than Corozal / *vice versa*; **[3 max]**

Do not award numerical comparisons.

(d) (i) insecticides used to kill <u>mosquitoes</u> / more anti malarial drugs / drought/less water for mosquito breeding / increased drainage / improved education / more mosquito nets / other reasonable change in conditions **[1]**
Do not accept vaccines as they do not exist.

(ii) drier climate/less rainfall / more predators / vegetation/ecology not favourable to mosquitoes / higher rainfall so faster flowing rivers/more educated inhabitants so more aware of dangers **[1]**

(e) lowland broadleaf forest and broadleaf hill forests *(both required)* **[1]**

(f) Toledo because it has the highest incidence of malaria in map/graph (and farmland has highest correlation to incidence of malaria in the table) **[1]**

(g)
a. if farming provides habitat for mosquitoes, then reducing it could reduce malaria / *OWTTE*;
b. natural habitats provide predators, but farmland does not;
c. changing native vegetation is not practical since plants are adapted to their environment/organisms have specific adaptations to their environments;
d. might work to change broadleaf forest into mixed hill forest as much of broadleaf forest has high incidence of malaria and no part of mixed hill forest has high incidence of malaria / OWTTE;
e. loss of habitat/loss of biodiversity results in less stable environment;
f. the value of maintaining natural habitat must be balanced with the value of reduced malaria;
g. farmland feeds the population, so cannot be replaced / *OWTTE* **[4 max]**

2. (a) a. living things are composed of cells;
b. cells are the basic/smallest unit of life;
c. cells come from pre-existing cells; **[2 max]**
Do not accept cells are the "smallest organisms".
Do not accept "cells are the building blocks" of life on its own.

(b) (i) a. *I*: locomotion;
b. *II*: attachment to surfaces / holds bacteria together / conjugation; **[2]**
Do not accept "exchange material" on its own.
If more than one function is given, mark the first answer only.

(ii) ×15 000 *(accept answers in the range of ×14 000 to ×16 000)* **[1]**

3. (a) a. food chain shows feeding/trophic relationships;
b. showing which organism/animal eats which organism;
c. showing the flow of energy from producer/autotroph to top consumer/top carnivore / through trophic levels; **[2 max]**

(b) (i) example from the food web with four or more organisms, given in proper sequence with arrows showing flow of energy in the correct direction and starting with a producer. **[1]**
*Award **[0]** if any organism in the food chain is not in the web diagram.*

(ii) correct trophic levels **[1]**
eg: raspberry bush ⟶ chickadee ⟶ bull snake ⟶ mountain lion
producer — primary consumer — secondary consumer — tertiary consumer
Accept ECF for mistakes in previous part. Do not accept "trophic level 1" etc.

(c) mountain lions/highest trophic level receives less energy as energy is lost at each level / mountain lions are larger than other animals and require more (smaller) individuals for food **[1]**

4. (a) organism (or virus) that causes a disease **[1]**

(b) a. many types of lymphocytes (B and T) exist;
b. produced/ stored in the lymph nodes;
c. each type recognizes one specific antigen/pathogen;
d. each type responds by dividing to form a clone;
e. (a clone) (B) lymphocyte secretes (specific) antibody against the antigen;
f. antibodies are produced as part of a specific immune response;
g. some reference to plasma/memory cells; **[3 max]**

(c) a. antibiotics block metabolic pathways of bacteria / reference to a specific pathway;
b. viruses have no metabolic pathways / viruses reproduce using the host cell's metabolic pathways;
c. (host cell's) metabolic pathways are not affected by antibiotics / (antibiotics) do not affect host cells because they are metabolically different from bacteria; **[2 max]**

Section B

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

5. (a)
a. (the genetic code is based on) sets of three nucleotides/triplets of bases called codons;
b. bases include adenine, guanine, cytosine and thymine in DNA / adenine, guanine, cytosine and uracil in RNA; *(do not accept ATCG)*
c. each codon is code for one amino acid;
d. some codons are (start or) stop codons;
e. DNA is transcribed into mRNA by base-pair matching/complementary base pairing;
f. mRNA is translated into a sequence of amino acids/polypeptide;
g. each gene codes for a polypeptide;
h. polypeptides may be joined/modified to form proteins; **[5 max]**

(b)
a. channel proteins allow diffusion/osmosis/passive transport;
b. large/polar molecules cannot cross the (hydrophobic) membrane freely;
c. facilitated diffusion involves moving molecules through proteins down their concentration gradient/without requiring ATP;
d. aquaporins (specific integral membrane proteins) facilitate the movement of water molecules/osmosis;
e. some proteins (for facilitated diffusion) are specific to molecule/ions;
f. active transport involves moving molecules through proteins against their concentration gradient/requiring ATP;
g. (some) proteins in the membrane are pumps / pumps perform active transport / sodium potassium pump; **[5 max]**

(c)
a. ATP is a form of energy currency/immediately available for use;
b. ATP is generated in cells by cell respiration (from organic compounds);
c. aerobic (cell respiration) requires oxygen;
d. anaerobic (cell respiration) does not require oxygen;
e. glycolysis breaks down glucose into pyruvate;
f. glycolysis occurs in cytoplasm;
g. (by glycolysis) a small amount of ATP is released;
h. ADP changes into ATP with the addition of a phosphate group/phosphoric acid / accept as chemical equation;
i. in mitochondria/aerobic respiration produces large amount of ATP / 38 mols (for the cell, per glucose molecule);
j. oxygen/aerobic respiration is required for mitochondrial production of ATP;
k. in mitochondria/aerobic respiration pyruvate is broken down into carbon dioxide and water; **[8 max]**

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

6. (a)
a. meiosis reduces a diploid cell into (four) haploid cell(s);
b. (during prophase I) homologous chromosomes pair up/synapsis;
c. chromatids (break and) recombine / crossing over
d. (metaphase I) (homologous chromosomes) at the equator of the spindle / middle of cell;
e. (anaphase I) (homologous) chromosomes separate and move to opposite poles;
f. (telophase I) chromosomes reach poles and unwind *WTTE*;
g. (prophase II) chromosomes (condense and) become visible, new spindles form;
h. (metaphase II) chromosomes line up at the centre of the cells/equator;
i. (anaphase II) sister chromatids separate;
j. (telophase II) chromatids reach the poles and unwind; **[5 max]**

(b)
a. differentiated/somatic/diploid cells taken from donor animal/sheep udder;
b. (diploid) nucleus from donor cells removed;
c. ova/eggs cells removed from (donor) animal/female sheep;
d. (haploid) nucleus removed from eggs/ova;
e. (diploid/donor's) nucleus is fused with/inserted into egg/ovum (to form zygote);
f. embryo (from cell with donor nucleus and egg from surrogate) implanted in uterus of surrogate mother;
g. normal pregnancy and birth is completed;
h. offspring is a genetic copy/clone of the donor mother/diploid nucleus *WTTE*; **[5 max]**

(c)
a. therapeutic cloning involves producing embryos from which embryonic stem cells can be harvested for medical use;

argument in favour:
b. (to many people) any procedure that reduces pain and suffering is ethically/ morally justified;
c. stem cells can be used to replace organs/tissues that have been lost/damaged in a patient;
d. (thus) pain and suffering can be reduced/lives can be saved/life quality improved;
e. cells can be removed from embryos that have stopped developing and would have died anyway;
f. cells are removed at a stage when no pain can be felt by the embryo;
g. use embryos from IVF that would otherwise be destroyed;
Accept up to one additional reasonable argument in favour.

argument against:
h. embryonic stem cells are no longer needed as adult stem cells can be used without causing loss of life;
i. there is danger of embryonic stem cells developing into tumour cells/harmful effects are not yet known;
j. every human embryo is a potential human with the right to development;
k. more embryos may be produced than can be used and so some would be killed;
l. (to many people) any procedure that harms a life/kills is unethical/morally wrong; **[8 max]**
Accept up to one additional reasonable argument against.

*To award **[8]** at least one pro and one con must be addressed.*

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

7. (a) ***NB**: Drawings must be correctly proportioned and clearly drawn showing connections between structures. The drawing may show the heart without contraction or in any stage of contraction. Award **[1]** for any correctly labelled part that has been drawn to the stated standards.*

a. atria/right atrium/left atrium – *shown above the ventricles and must not be bigger than ventricles*;
b. ventricle/left ventricle/right ventricle – *shown below the atria, must have thicker walls than atria*;
c. vena cava/superior vena cave/inferior vena cava – *connected to right atrium*;
d. pulmonary artery – *shown from right ventricle (to lungs)*;
e. pulmonary vein(s) – *shown (from lungs) to left atrium*;
f. aorta – *shown as large artery from left ventricle out of heart*;
g. AV valves/atrioventricular valves / mitral/bicuspid and tricuspid – *named correctly and shown between both atria and ventricles and labelled at least on one side;*
h. semilunar valves – *shown in aorta/pulmonary artery*; **[6 max]**

V*alves need to open in correct direction.*

(b) a. (both) atria collect blood (from veins);
b. sinoatrial/SA node sends impulses to muscle/fibres initiating contraction;
c. blood is pushed to ventricles by contraction of atria/atrial systole;
d. AV (atrioventricular) valves are open (as atria contract);
e. semilunar valves are closed so that ventricles fill with blood;
f. ventricles contract / ventricular systole;
g. AV (atrioventricular) valves close (and preventing backflow);
h. blood is pushed out through the semilunar valves/into pulmonary artery and aorta;
i. when ventricles relax/diastole, semilunar valves close preventing backflow of blood; **[5 max]**

Do not accept the description of blood flow without a clear action.
Do not accept general statements such as systole=heart contraction and diastole = heart relaxation.
***[4 max]** if suggests that left and right sides are contracting at different times or simultaneous contraction not indicated.*

(c) a. nerve impulse reaches the end of the presynaptic neuron;
b. (depolarization causes) calcium channels in membrane (to) open;
c. calcium diffuses into the presynaptic neuron;
d. vesicles of/containing neurotransmitter move to and fuse with presynaptic membrane;
e. (neurotransmitter) released (by exocytosis) into synaptic space/cleft;
f. (neurotransmitter) diffuses across the space/synapse;
g. (neurotransmitter) attaches to receptors on postsynaptic neuron;
h. receptors cause ion channels to open and sodium diffuses into the postsynaptic neuron;
i. the postsynaptic neuron membrane is depolarized;
j. (depolarization) causes a new action potential;
k. (neurotransmitter) on postsynaptic membrane is broken down;
l. (neurotransmitter) is reabsorbed into the presynaptic neuron; **[7 max]**

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