M12/4/BIOLO/SP2/ENG/TZ2/XX/M

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MARKSCHEME

May 2012

BIOLOGY

Standard Level

Paper 2

11 pages

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) through Scoris™, by e-mail or telephone – if through Scoris™ or by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader through Scoris™ or by e-mail at any time if they have any problems/queries regarding marking. For any queries regarding the use of Scoris™, please contact emarking@ibo.org.

If you have any queries on **administration** please contact:

Risha Ali
Subject Operations
IB Assessment Centre
Peterson House
Malthouse Avenue
Cardiff Gate
Cardiff CF23 8GL
GREAT BRITAIN

Tel: +(44) 29 2054 7777

Fax: +(44) 29 2054 7778

E-mail: risha.ali@ibo.org

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.

3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**

4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use Scoris™ annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

5. Personal codes/notations are unacceptable.

6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, enter a zero in the mark panel on the right-hand side of the screen. Where an answer to a part question is worth no marks because the candidate has not attempted the part question, enter an "NR" in the mark panel on the right-hand side of the screen.

7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. Scoris™ will only award the highest mark or marks in line with the rubric.

8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp "seen" on any page that contains no other annotation.

9. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

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** (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.).*

- 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. The stamps will **not** automatically award marks.

SECTION A

1. (a) a. both show survival rate decreases with age / negative correlation / inversely proportional;
b. the greatest change in survivorship occurs in early childhood/first 10 years;
c. rate of survivorship changes least between 10 years and 40 years;
d. after 40 years the rate of survivorship changes more rapidly (than from 10 years to 40 years); ***[2 max]***

(b) 80 (%) ***[1]***

(c) a. all three systems decline in their capacity as age increases / negative correlation;
b. fertility stops first at 50 years old whereas other systems decline more slowly;
c. before menopause, breathing capacity drops less rapidly than cardiac capacity / *vice versa*;
d. after menopause, breathing capacity drops more rapidly than cardiac capacity / *vice versa*; ***[3 max]***

(d) 410 min day^{-1} *(accept answers in the range of 400 min day^{-1} to 420 min day^{-1})* ***[1]***

(e) a. post-menopausal/older women do more of the foraging;
b. if women share the food that they forage then the Grandmother Hypothesis would be supported / *vice versa*;
c. difficult to determine as there is an overlap between time spent in different category of groups; ***[2 max]***

(f) a. older/skilled women could provide more food when they no longer reproduce;
b. this could provide more food for offspring/group leading to greater success for the group;
c. (in competition with other groups) this group would survive to pass on the genes for menopause;
d. allows younger women to use time/energy to reproduce and care for offspring; ***[2 max]***

2. (a) (i) osmosis ***[1]***

(ii) active transport ***[1]***

(b) a. movement down the concentration gradient / from high to low concentration;
b. through channel proteins/ion channels;
c. passive transport / it requires no energy from the cell / no ATP;
d. for molecules that cannot pass through the phospholipid bilayer;
e. channel is specific/selective to the ion/molecule being transported; ***[3 max]***

(c) vesicles / vacuoles / endosome ***[1]***

3. (a) $25.8\,kJ\,g^{-1}$ *(units needed)* ***[1]***

(b) a. walnut has the greatest variation in energy content;
b. because the standard deviation/range (much) greater for walnuts than for potato chips;
c. the small standard deviation/range for potato chips indicates that the data are clustered closely around the mean / the large standard deviation/range for walnuts indicates that the data are spread out further from the mean;
d. 68 % of the values will fall within one standard deviation of the mean which is $\pm 2.0\,(kJ\,g^{-1})$ for walnuts but only $\pm 0.1\,(kJ\,g^{-1})$ for the potato chip / *OWTTE*; ***[2 max]***

(c) energy source/storage / insulation / provision of essential fatty acids / hormones / waterproofing / component of membranes / buoyancy / bile salts / protection of internal organs ***[1]***
Only award marks to the first function if candidate gives more than one function.

4. (a) (i) endocrine glands / named endocrine gland *(e.g. pancreas/hypothalamus/ pituitary/ovary/testes)* ***[1]***
Do not accept gland alone.

(ii) cells / tissues / named cells/tissue *(e.g. muscles / muscle tissue / muscle cells / epithelial tissue / other reasonable example)* ***[1]***
Do not accept alveolus or named organ.

(iii) alveoli / lungs ***[1]***

(b) a. high density of capillaries surrounding alveoli;
b. large surface area due to shape / large number of alveoli;
c. thin walls / walls one cell thick; *(do not accept membranes)*
d. moist layer covering the (inner) surface of the alveoli; ***[3 max]***
*Award **[2 max]** for a list of features.*

(c) a. capillaries walls thin/one cell thick for better diffusion; { *(do not accept membranes)*
b. small diameter / narrow lumen to fit into small places/between cells;
c. small diameter for greater surface area for molecular exchange;
d. pores between cells of the walls so plasma can leak out;
e. pores between cells of the walls allow phagocytes/immune components to enter tissues;
f. only one red blood cell allowed to pass at a time for efficient oxygen uptake; ***[3 max]***

SECTION B

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

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

a. phospholipid bilayer – with head and tails;
b. hydrophilic/phosphate/polar heads and hydrophobic/hydrocarbon/fatty acid/ non-polar tails labelled;
c. integral protein – embedded in hydrophobic region of the phospholipid bilayer;
d. channel protein – integral protein showing clear channel/pore;
e. peripheral protein – on the surface (not embedded in hydrophobic region) can be attached to integral protein;
f. glycoprotein – with carbohydrate attached on outside;
g. cholesterol – shown embedded in bilayer; ***[5 max]***

(b)
a. as volume of a cell increases, the ratio of its surface area to volume decreases;
b. food/oxygen enters through the surface of cells;
c. wastes leave through the surface of cells;
d. the rate of substance crossing the membrane depends on surface area;
e. more metabolic activity in a larger cell means more food and oxygen required;
f. large volume means longer diffusion time;
g. (large volume) means more wastes produced;
h. excess heat generated will not be lost efficiently (with low surface area to volume ratio);
i. eventually surface area can no longer serve the requirements of the cell;
j. this critical ratio stimulates mitosis;
k. (thus) the size of the cell is reduced and kept within size limits; ***[7 max]***

(c)
a. large molecules (proteins) must be digested into small molecules;
b. a protease/pepsin digests proteins into polypeptides;
c. pepsin works in the stomach / requires an acid/low pH/pH 2 to work;
d. polypeptides are digested by a protease/trypsin into amino acids;
e. trypsin acts in the small intestine / requires a basic pH/pH 8/high pH;
f. amino acids absorbed by diffusion/active transport;
g. absorption occurs in the villus/microvilli of the small intestine;
h. (amino acids absorbed) into capillaries;
i. blood carries amino acids throughout the body;
j. amino acids diffuse into cells/are absorbed by active transport;
k. cells use amino acids to build proteins;
l. assimilation is when amino acids become part of a cell;
m. proteins are synthesized at the ribosomes/ER of the cell; ***[6 max]***

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

6. (a) *The diagram must show four nucleotides shown with two on each side showing phosphate-sugar backbones and nitrogen base pairs bonded between them.*

*Award **[1]** for each of the following clearly drawn and correctly labelled.*

a. phosphate – shown connected to deoxyribose;
b. deoxyribose – shown connected to phosphate;
c. (nitrogenous) bases – shown bonded to deoxyribose;
d. base pairs – shown with labels adenine/A bonded to thymine/T and cytosine/C bonded to guanine/G;
e. hydrogen bonds – shown connecting bases;
f. covalent bonds – shown connecting deoxyribose to phosphates;
g. nucleotide – clearly identified by the candidate; ***[5 max]***

*Award **[4 max]** if diagram is not shown double stranded.*

(b) a. DNA samples are taken from crime scene, suspects and victims;
b. polymerase chain reaction/PCR used to increase the amount of DNA;
c. restriction enzymes used to cut DNA;
d. electrophoresis involves electric field/placing sample between electrodes;
e. used to separate DNA fragments according to size;
f. creating DNA profiles/unique patterns of bands;
g. comparison is made between the patterns;
h. criminals/victims can be identified in this way;
i. DNA is (quite) stable / DNA can be processed long after the crime; ***[6 max]***

(c) a. DNA codes for a specific sequence of amino acids/polypeptide;
b. the DNA code for one polypeptide is a gene;
c. DNA is transcribed into mRNA;
d. mRNA moves to a ribosome;
e. where mRNA is translated into a polypeptide;
f. originally it was thought that one gene always codes for one polypeptide;
g. some genes do not code for a polypeptide;
h. some genes code for transfer RNA/tRNA/ribosomal RNA/rRNA;
i. some sections of DNA code for regulators that are not polypeptides;
j. antibody production does not follow this pattern (of simple transcription-translation); *(allow other examples)*
k. change in the gene/mutation will affect the primary structure of the polypeptide; ***[7 max]***

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

7. (a)

	bryophyta	***coniferophyta***
a.	(reproduced by) spores	(reproduced by) seeds;
b.	(carried in) capsules	(carried in) cones;
c.	non-woody stems	woody stems;
d.	smaller (less than 2 cm)	larger (meters tall);
e.	rhizoids	roots;
f.	no cuticle on leaves	cuticle on leaves;
g.	no xylem/phloem	have xylem/phloem;

[5 max]

Responses do not need to be shown in a table format.

(b) a. increasing rates of decomposition of detritus previously trapped in permafrost;
b. expansion of the range of habitats available to temperate species;
c. loss of ice habitat;
d. changes in water salinity;
e. changes in distribution of prey species affecting higher trophic levels;
f. increased success of pest species;
g. loss of ice increases absorption of solar radiation increasing warming of atmosphere;
h. extinction of species adapted to arctic/cold conditions;
i. humans can/should take steps to reduce/slow losses in habitat / given example of measure taken;
j. statement applying the precautionary principle to this issue; ***[6 max]***

(c) a. during exponential growth, population has few limitations;
b. plateau phase occurs as limitations decrease growth;
c. maximum (sustainable) size is plateau phase;
d. population has reached carrying capacity;
e. population stability occurs when natality plus immigration equals mortality plus emigration / *vice versa*;
f. further population growth limited by abiotic factors; { *(e.g. temperature/climate/ weather/seasons)*
g. lack of water/food supply;
h. shortage/destruction of breeding habitats;
i. shortage/destruction of shelter;
j. increased numbers of predators/competitors/enemies/diseases; ***[7 max]***

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